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Final Environmental Impact Statement

Remedial Actions at the Former Vitro Rare Metals Plant Site,

Canonsburg,
Washington County,
Pennsylvania

United States Department of Energy

July 1983

Volume II Appendices

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Authorizing Official
Date: 2-23-67

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Appendix A

ENGINEERING APPENDICES

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Appendix A.1

**SUMMARY OF CONCEPTUAL DESIGN FOR
STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS,
CANONSBURG, PENNSYLVANIA**

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION
OF RADIOACTIVELY CONTAMINATED MATERIALS,
CANONSBURG, PENNSYLVANIA

U.S. DEPARTMENT OF ENERGY
URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT OFFICE
ALBUQUERQUE OPERATIONS OFFICE
ALBUQUERQUE, NEW MEXICO 87108

July 1983

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1 INTRODUCTION

1.1 PURPOSE

This report provides a summary of the conceptual design and other information necessary to understand the proposed remedial action at the expanded Canonsburg, Pennsylvania site. This design constitutes the current approach to stabilizing the radioactively contaminated materials in place in a manner that would fully protect the public health and environment. This summary is intended to provide sufficient detail for the reader to understand the proposed remedial action and the anticipated environmental impacts.

The site conceptual design has been developed using available data. In some cases, elements of the design have not been developed fully and will be made final during the detailed design process. Additional details and supporting analyses can be found in the remedial action plan (U.S. DOE, 1983).

1.2 DESIGN OBJECTIVES

The purpose of the remedial action is to dispose of the radioactively contaminated materials in a manner that complies with the EPA standards (40 CFR 192) to prevent future health risks. Consistent with these EPA standards (40 CFR 192), and to meet other objectives, the following major design objectives have been established:

1. Reduce the average radon flux from the radioactively contaminated materials to levels less than 20 picocuries per square meter per second.
2. Design controls that would be effective for up to 1000 years with minimum maintenance and a minimum design life of 200 years.
3. Prevent inadvertent human intrusion.
4. Ensure that existing or anticipated beneficial uses of ground and surface water would not be adversely affected.
5. Reduce radioactive contaminant levels on areas released for unrestricted use and areas without additional erosion protection to levels that would not exceed 5 picocuries of radium per gram of soil above background in the top 15 centimeters of soil, and would not exceed 15 picocuries of radium per gram of soil above background in any 15-centimeter layer below that depth (EPA, 40 CFR 192).
6. Include the adjacent vicinity properties (former Georges Pottery and the Wilson Avenue and George Street residential properties) north of the ConRail right-of-way in the expanded Canonsburg site and provide for the disposal of other vicinity property material at the expanded Canonsburg site. Decontaminate the adjacent ConRail right-of-way (a vicinity property) for release for unrestricted use.

7. Protect against releases of radioactively contaminated materials from the expanded Canonsburg site during construction.
8. Provide flood protection, runoff and sediment control, and waste-water treatment.
9. Reconstruct and reopen Strabane Avenue after the remedial action is completed.
10. Minimize the areas that would be disturbed during construction to minimize exposure of the public and the remedial-action workers to radioactively contaminated materials.

1.3 MAJOR ELEMENTS OF THE DESIGN

The principal feature of the concept design is the consolidation of the more radioactively contaminated materials (Figure A.1-1) into a lined encapsulation cell (Figures A.1-2, A.1-3, and A.1-4) on the expanded Canonsburg site to control radon exhalation and to protect the ground water. The remaining radioactively contaminated materials on the expanded Canonsburg site, but not placed in the encapsulation cell, would be stabilized in place using cover systems. The design would require the following major construction activities:

1. Preparation of the expanded Canonsburg site, including construction of a flood control berm and construction of a waste-water sedimentation basin to protect against release of contaminants from the expanded Canonsburg site during construction.
2. Construction of drainage control measures to direct all generated waste- and storm-water runoff to the sedimentation basin during construction activities.
3. Removal and relocation of onsite surface and subsurface utilities to areas that could be serviced without disturbing those parts of the expanded Canonsburg site containing radioactively contaminated materials.
4. Excavation and handling of radioactively contaminated materials during relocation and encapsulation.
5. Dewatering of soils within Area C to facilitate excavation of radioactively contaminated materials from this area.
6. Installation and operation of a waste-water treatment facility to protect against contamination of surface waters during construction.
7. Construction of the encapsulation cell liner for protection of ground water.
8. Emplacement of radioactively contaminated materials into the encapsulation cell to control radon exhalation and protect ground water.

AREA OF RADIOACTIVELY
CONTAMINATED MATERIALS
(DEFINED AS AREA WHERE Ra 226
CONCENTRATION EXCEEDS 100 pCi/gm OF SOIL
AND AT LEAST 300 CU YDS CONTIGUOUS IN SIZE)

AREA TO BE EXCAVATED AND ENCAPSULATED

AREA TO REMAIN IN PLACE (WITH ADDITIONAL
COVERING AFTER FINAL GRADING)

NOTE THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY
BY KURCH HOUSLEY & ASSOC PITTSBURGH PA DATED
MARCH 1983 AND ON MAPS OF THE CHARTIERS CREEK
BASIN PA BY THE US ARMY CORPS OF ENGINEERS
PITTSBURGH PA DATED 6/3/73

**FIGURE A.1-1
AREAS OF RADIOACTIVELY CONTAMINATED MATERIALS
EXPANDED CANONSBURG SITE**

FIGURE A.1-2
CONCEPTUAL DESIGN FOR STABILIZATION
OF RADIOACTIVELY CONTAMINATED MATERIALS
EXPANDED CANONSBURG SITE

9. Decontamination (as necessary), demolition, and disposal of all buildings and railroad spur lines on the expanded Canonsburg site (including the former Georges Pottery property and the residential areas on Wilson Avenue and George Street).
10. Construction of the final cover system over the encapsulation cell to inhibit water infiltration and radon exhalation.
11. Emplacement of soil cover over the remainder of the expanded Canonsburg site (with the exception of the George Street and Wilson Avenue residential areas) with final grading to provide suitable drainage control.
12. Emplacement of topsoil and erosion protection on the encapsulation cell and the remainder of the expanded Canonsburg site.
13. Revegetation of all disturbed areas to mitigate erosion.
14. Installation of temporary and permanent fencing to discourage human intrusion.
15. Reconstruction of Strabane Avenue.

1.4 PROPOSED FINAL CONDITION

The completed encapsulation cell will encompass about 6 acres in Areas A and B. The encapsulation cell will be constructed with a clayey soil liner on the bottom and a low permeability cover over the top. The top of the embankment will be about 20 feet above the elevation of the existing grades with a maximum slope of 1 vertical to 5 horizontal side slopes. The residential areas that are part of the expanded Canonsburg site would require little remedial action except for building demolition. Disturbed areas would be covered with clean soil and revegetated. A small amount of final grading could extend into this area. The buildings in Area A and the former Georges Pottery property would be demolished leaving their foundations in place if there is no interference with construction activities and there is no major radioactive contamination beneath the foundations. The construction of the encapsulation cell would produce an excess of excavated material. The building rubble would be mixed with some of this excess material and placed in Area C. The remainder of the excess excavated material would be spread over the area west of the encapsulation cell (comprising portions of Area A and the former Georges Pottery property).

After completion of the encapsulation cell, the remainder of the expanded Canonsburg site (excluding the George Street and Wilson Avenue residential areas) would be covered with 1 to 3 feet of clean fill and select soil, contoured for drainage, and revegetated. Any surface radioactive contamination on the residences would have been removed and included with other radioactively contaminated materials on the expanded Canonsburg site. Strabane Avenue would be decontaminated and repaved. Chain link fences with warning signs would enclose the expanded Canonsburg site (including Area C) while leaving access to Strabane Avenue available to the public.

2 CONCEPTUAL DESIGN

2.1 GENERAL

2.1.1 Layout

Figure A.1-2 illustrates the expanded Canonsburg site development plan. The encapsulation cell has been sized to contain approximately 85,000 cubic yards of radioactively contaminated materials. The remainder of the expanded Canonsburg site would be graded to allow for excess excavated material and additional clean soil cover, and to provide adequate expanded Canonsburg site drainage.

The encapsulation cell has been located to minimize construction conflicts with demolition activity and with the removal of radioactively contaminated materials. The location would also allow for sequencing construction activities with minimum rehandling of radioactively contaminated materials. Due to emplacement of compacted fill, the bottom of the liner of the cell would be above the 100-year flood level. The slope would be protected to above the 1000-year flood level.

The proposed remedial action construction staging area would be located to have minimum impact on demolition activity and to be centrally located for the encapsulation cell construction activities. This area would also have easy access from the intersection of George Street and Strabane Avenue and is adjacent to existing utilities.

2.1.2 Design criteria

2.1.2.1 Excavation criteria for radon control

The excavation rationale considered the potential for increased levels of radium-226 from decay of thorium-230. Thorium-230 exists on the expanded Canonsburg site in concentrations greater than those found in natural uranium- and radium-bearing ores since radium-226 and thorium-230 were extracted during the recovery operations. Based on decay rates, the increase in radium-226 after 1000 years will result in an activity of approximately 30 percent of the original thorium-230 activity.

Significant quantities of radioactively contaminated materials would be excavated and placed in the encapsulation cell (Figure A.1-1). Areas to be excavated would be delineated using a survey grid. The survey grid (50 feet x 50 feet) would minimize the likelihood that a contiguous volume of soil greater than 300 cubic yards and contaminated with greater than 100 picocuries of radium-226 per gram of soil projected for 1000 years would remain undetected and unexcavated. Smaller contiguous volumes of greater than 15 cubic yards that could have an average concentration of greater than 100 picocuries of radium-226 per gram of soil throughout the design life would be excavated and encapsulated if they were detected as a result of the grid survey or the excavation activities.

After the major portion of the radioactively contaminated materials has been encapsulated, a cover would be placed over the radioactively contaminated materials. The cover would consist of soil compacted at or close to optimum moisture content that would reduce the diffusion of radon and decrease the penetration of water.

To control radon emissions from radioactively contaminated materials having lower level concentrations that would not be encapsulated and to provide long-term stability, the remainder of the expanded Canonsburg site, except for uncontaminated areas, would be covered with a minimum of 2 feet of compacted soil. This is calculated to reduce the current and future radon emission rates to well below the EPA standard (40 CFR 192) and to provide an adequate allowance for erosion to ensure the longevity of the treatment. Additionally, concrete slabs would be left in place and lower-level vicinity property radioactively contaminated materials would be placed on top of the disposal site prior to the placement of the final 2 feet of cover material.

The use of a minimum of 2 feet of additional cover for radon control also considered the increase of radium-226 from the decay of thorium-230. The average radium-226 activity over the nonencapsulated area considering thorium-230 decay is expected to be less than 100 picocuries per gram of soil during the design life of the expanded Canonsburg site.

Radon emissions were calculated using the RAECO model (Rogers et al., 1981) to predict emission rates from the radioactively contaminated materials before and after remedial action. Data on the distribution of radium in the radioactively contaminated materials, the quantities of radioactively contaminated materials to be encapsulated, and the properties of the liner and cover materials would be collected before selecting the final cover and liner thickness.

2.1.2.2 Excavation criteria for water quality protection

After completion of the remedial action, migration through ground water would be the principal exposure pathway. Because of this exposure pathway, excavation criteria were considered that would limit radionuclide concentrations in water to acceptable levels.

Analyses of ground water indicated that uranium and radium-226 are the most radiotoxic or toxic contaminants at the expanded Canonsburg site. Soil and ground-water samples were further evaluated to determine a level of residual radioactive contamination in soil that would maintain onsite ground water at a level that would have a negligible impact on offsite ground and surface waters.

As a first step in the ground-water analysis, average concentrations of radium-226 and uranium in soil and ground water were compared to derive a soil excavation criterion in terms of residual radium-226 concentrations. Empirical and theoretical estimates of ground-water leach rates, contaminant migration rates, and contaminant concentrations of less than 100 picocuries of radium-226 per gram of soil (not encapsulated) would result in levels of less than 5 picocuries of radium-226 per liter, and 10 picocuries of total uranium per liter in Chartiers Creek during the design life of the expanded Canonsburg site. Excavation criteria that would limit the unencapsulated radium-226 concentration, including grow-in from thorium-230 over the long term to 100 picocuries of radium-226 per gram, would therefore limit potential water contamination to below the EPA National Primary Interim Drinking Water standards (40 CFR 141).

It should also be noted that radionuclides other than uranium and radium-226 may affect ground-water quality. In the event that the grid survey reveals high levels of other radionuclides, other excavation criteria would be selected to provide an equivalent degree of protection.

2.1.3 Long-term stability

The remedial action has been designed so the disposal site would withstand the forces of nature for a long period of time (more than 200 years). Several types of natural erosive damage have been investigated and protective systems identified. The results of these investigations are discussed in the subsections that follow.

2.1.3.1 Wind erosion

Due to the ease of establishing a self-perpetuating vegetative cover on the expanded Canonsburg site, wind erosion is not anticipated to have a significant effect on the long-term stability of the expanded Canonsburg site. In the unlikely event that wind erosion would occur, design features incorporated for protection against other erosive forces would ensure long-term stability.

2.1.3.2 Water erosion

To reduce the potential for water erosion, embankment slopes would be limited to a maximum of 1 vertical to 5 horizontal (Figures A.1-3 and A.1-4). The remainder of the expanded Canonsburg site would be gently sloped with two drainage swales located on the north and south sides of the encapsulation cell. The drainage swales would be lined with pit run rock to prevent erosion. Except for those swale areas covered with rock, the encapsulation cell and the remainder of the expanded Canonsburg site would be revegetated for additional erosion protection.

Severe rainfall events have the potential to develop rills and gullies on the steeper (20 percent) side slopes of the embankment. These events could erode away some or all of the topsoil in small, undefinable areas. One such potential rainfall event is commonly referred to as a probable maximum precipitation (PMP). A PMP is defined as the maximum precipitation that could occur from the most severe combination of meteorological conditions that are reasonably possible in a region.

To protect against an unlikely PMP occurring on the expanded Canonsburg site, the encapsulation cell would have a 1.5-foot thick layer of rock as part of the cover system. The rock sizes are designed to remain intact during and following a PMP even if the topsoil is eroded away. Other areas of the expanded Canonsburg site with gentler slopes would not require this added protection.

2.1.3.3 Flood protection

The expanded Canonsburg site is adjacent to Chartiers Creek and is therefore subject to certain flood conditions. Flow conditions and flood levels have been calculated for three flood events: a 100-year flood, a 1000-year flood, and a probable maximum flood (PMF). The results of these calculations are contained in the remedial action plan. A PMF is the flood in Chartiers Creek adjacent to the expanded Canonsburg site that could result from a PMP on the drainage basin upstream from the expanded Canonsburg site.

The bottom of the encapsulation cell would be placed above the 100-year flood plain. This would require some fill with compacted soil in certain areas of lower elevation. The location of the cell would be such that even during a 1000-year flood, the cell would not be subjected to erosive water velocities. However, the cell would have additional rock protection to above the 1000-year flood level. Flood velocities associated with a PMF may erode some topsoil but would not affect the integrity of the encapsulation cell. The rock size selected to protect against PMP-initiated gully erosion would also protect against PMF damage.

2.1.3.4 Geomorphology (stream meander)

The expanded Canonsburg site is located on alluvial fill along Chartiers Creek and therefore has a slight possibility of being subject to stream meander. Based on drill logs and visual inspection, the creek bank adjacent to the expanded Canonsburg site along the western, northwestern, and northern boundaries of the expanded Canonsburg site consists of bedrock and is not likely to erode and allow the creek to encroach on the expanded Canonsburg site in the foreseeable future. Along the northeastern and eastern sides of the expanded Canonsburg site, the stream bank consists of alluvial fill and is subject to a slight potential encroachment into the expanded Canonsburg site

(U.S. DOE, 1983). Those areas of the expanded Canonsburg site subject to stream encroachment would be protected with a rock structure. This rock structure is designed to preclude lateral stream migration that could expose the radioactively contaminated materials (Figure A.1-3).

2.1.4 Ground-water protection

Encapsulation of most (+ 90 percent) of the radioactive contamination in an engineered cell above the ground-water level in Area A would reduce the potential for leaching and contaminant migration. The encapsulation cell would be designed with a relatively impermeable cover and liner that would reduce infiltration of precipitation, retard water flow through the encapsulation cell, and a liner that would retard contaminant migration.

The demolition and abandonment of the existing structures would eliminate the storm sewer recharge to the ground water in Area A and the former Georges Pottery property. Covering the ground surface with a sloping clayey cover would reduce the amount of infiltration from precipitation events. Ground-water modeling indicates that these actions would result in lowering the water levels beneath Area A and the former Georges Pottery property to about 952 feet elevation and beneath Area B to about 942 feet elevation. Since the expanded Canonsburg site ground water is also recharged off the expanded Canonsburg site, ground water would continue to flow beneath the expanded Canonsburg site, but the water levels in Areas A and B and the former Georges Pottery property would be reestablished at a lower elevation. Ground-water levels in Area C would not be significantly affected by the remedial action.

Removal of most of the radioactively contaminated materials below the ground-water level in Area C would greatly reduce the existing source for water-soluble radioactive constituents. The small quantity of radionuclides already in the ground-water system between the radioactively contaminated portion of Area C and Chartiers Creek would continue to move toward the creek. The calculated concentration of uranium that would continue to migrate to the creek is estimated to be less than 0.006 milligram per liter.

Some radioactively contaminated materials would remain in place in all areas of the expanded Canonsburg site; however, lowering the ground-water levels described previously would reduce leaching and contaminant migration toward Chartiers Creek. Water-soluble constituents already in the ground water of other areas of the expanded Canonsburg site would continue to migrate toward the creek. Concentrations of radionuclides as they discharge into the creek would be reduced to levels below detection by standard laboratory techniques.

Since the major portion (+ 90 percent) of the radioactive contamination would be placed in the encapsulation cell, water infiltration into and through the encapsulation cell could be a potential source of future ground-water contamination. Accordingly, the encapsulation cell would be designed to greatly reduce the quantity of water that can infiltrate through the radioactively contaminated materials and into the ground water.

2.2 SITE PREPARATION

2.2.1 Clearing

A significant quantity of vegetation including grasses, shrubs, and small to large trees presently grow on the expanded Canonsburg site. Trees and other vegetation on nonradioactively contaminated areas that do not interfere with construction would remain on the expanded Canonsburg site. Grasses, weeds, shrubs, and trees on radioactively contaminated areas, and radioactively contaminated organic building materials would be shredded, chipped, or otherwise reduced in size and buried on the expanded Canonsburg site outside the encapsulation area. Organic materials would not comprise more than 5 percent by volume per lift in areas with buried radioactively contaminated materials.

2.2.2 Flood-control berm

A flood-control berm would be designed, located, and maintained to protect the expanded Canonsburg site during construction activities from the 100-year flood of Chartiers Creek (Figure A.1-4). As portions of Areas B and C lie within this flood boundary, the berm would be located adjacent to Chartiers Creek and extend from the northeast corner of Area B (abutting the Canonsburg Street Railway berm) to the southeast boundary of Area C.

After the area where the berm is to be placed has been decontaminated, fill suitable for final cover material would be used to construct the berm. The final design of the berm would be dependent on additional radiological surveys.

2.2.3 Storm drainage

All construction activities would be conducted in such a way as to prevent accelerated erosion and sedimentation. Within Areas A, B, C, and the former Georges Pottery property, areas disturbed by construction activities would be graded so that runoff would drain to one or more sedimentation basins. Channels would limit runoff velocity by being grassed or lined with erosion resistant material.

During remedial action, all drainage within Areas A, B, and C would be effectively blocked by the flood-control berm. The drainage within Areas A and B would flow eastward around the northern and southern sides of the encapsulation cell construction area to the sedimentation basin. During initial expanded Canonsburg site construction the low areas on Ward Street and along Strabane Avenue would be filled in to ensure drainage to the basin along the south side of the cell. Due to the geometry of the encapsulation cell, storm runoff waters would collect in the excavated portion during construction. These waters could be trenched or pumped out of the encapsulation cell area and into the sedimentation basin.

Drainage within the former Georges Pottery area flows primarily westward. Prior to earthwork activity, this area would be encircled on three sides (north, west, and south) with a berm and a ditch to direct flows towards the sedimentation basin. Within Area C, drainage would be trapped by dewatering trenches and the excavation process. A berm would be necessary along Strabane Avenue to ensure that drainage along the southern side of the encapsulation cell construction would flow to the basin and not into Area C. Some ditching adjacent to the flood berm within Area C would be necessary to direct drainage across Strabane Avenue to the basin. All waste water generated from runoff and dewatering in Area C would be pumped into this ditch for gravity flow to the sedimentation basin.

Demolition and reclamation activities in the onsite residential area would be conducted independently of other expanded Canonsburg site activities and in such a manner as to minimize localized erosion and sediment production. Control measures that could be employed include vegetation, filters, fabric fences, and channels.

Runoff from land outside the affected areas would be diverted away from the expanded Canonsburg site. Diversions could be by means of ditches or berms.

2.2.4 Sedimentation basin

A sedimentation basin would be the primary means to collect radioactively contaminated waste water prior to treatment. Waste waters would result from the following:

1. Decontamination activities including equipment washing, building washing, and truck washdown.
2. Initial dewatering and maintenance pumping of Area C.
3. Runoff from Areas A, B, C and the former Georges Pottery property.

Because of the limited working area and the numerous construction activities, it would be very difficult to separate clean runoff from contaminated runoff. Therefore, all runoff from Areas A, B, and C and the former Georges Pottery property would be diverted to the sedimentation basin and collected for treatment.

The sedimentation basin would have the capacity to retain 7000 cubic feet per acre for affected areas, plus expected decontamination and dewatering streams. In addition, the sedimentation basin would be designed with sufficient freeboard and a spillway system to allow discharge to Chartiers Creek of effluent quantities from storm events greater than the design capacity. The spillway system would be designed so that any flow would enter Chartiers Creek at a location where the creek flood-water elevation is far enough below the spillway elevation to allow for free drainage.

The proposed location of the sedimentation basin would be the narrow strip of land between the encapsulation cell and the flood control berm within Area B. The bottom of the sedimentation basin could be excavated 2 to 3 feet lower than the existing grade to allow free drainage around the encapsulation cell into both ends of the basin. A level area contiguous with the top of the flood control berm could be filled in at the northeast corner of Area B, for location of a water treatment facility.

The Area C excavation would be conducted to retain rainfall runoff as necessary. Area C water would then be pumped to the sedimentation basin for treatment.

2.2.5 Waste-water treatment

Depending on the effectiveness of the sediment basin in removing contaminants, a secondary means of removing contaminants could be required. This secondary treatment could involve a combination of pH adjustment, metals precipitation, ion exchange, and multimedia filtration. The selection and design of the secondary treatment system can be determined only with additional data on the water-quality characteristics of the expected waste streams and the requirements of the NPDES discharge limitations (40 CFR 124). At the completion of construction, residues removed by the treatment plant and the sedimentation basin would be buried on the expanded Canonsburg site.

2.2.6 Dust control

Dust generated by excavation, earth movement, vehicle use, stockpiling, and similar activities must be controlled and minimized.

Special emphasis would be placed on controlling dust that originated from building decontamination and temporary stockpiling or mixing of radioactively contaminated materials.

It is anticipated that water with a water-based surfactant sprayed under high pressure (from trucks and hoses) would be adequate to control dust. Hoses would be available for each excavation area.

The sources for dust suppression water would include impounded runoff and/or potable water. Recycled water would be used as much as practicable.

To reduce excessive fugitive dust generated by vehicular traffic, a paved exit and entrance road from the site would be supplied for a minimum length of 150 feet. These driveways would be used to remove any radioactively contaminated materials that adhere to the wheels or undercarriage of the vehicles. Driveways would drain to a conveyance, which in turn would drain to the sedimentation basin. This paved area would be kept clean. The head of the driveways would be equipped with a wash area supplied with a hose.

The need for spraying the roads and pile areas would be determined on a day-by-day basis. The frequency of spraying would increase as combinations of low soil moisture and high wind speed conditions were encountered.

2.3 DEMOLITION

Numerous buildings presently located on the expanded Canonsburg sites would be demolished and the rubble added to other materials on the expanded Canonsburg site. The buildings would be decontaminated (if necessary) and/or a contamination fixing agent (i.e., paint) would be applied to the extent necessary to minimize the spread of radioactive contamination during demolition, and demolished. Demolition rubble would be placed in the excavation created in Area C. Organic and other biodegradable rubble would be buried on the expanded Canonsburg site outside the encapsulation area. Building foundation materials that did not interfere with expanded Canonsburg site construction activities would be left in place and covered.

2.4 ENCAPSULATION CELL

The encapsulation cell is designed to contain approximately 85,000 cubic yards of radioactively contaminated material and would be placed in Areas A and B well above the projected post-remedial action ground-water levels. It is estimated that about 62,000 cubic yards of radioactively contaminated materials would be excavated from all areas of the expanded Canonsburg site and placed in the encapsulation cell. This quantity is estimated to contain + 90 percent of the radioactive contamination on the expanded Canonsburg site. The excess design capacity is to allow for overexcavation and revisions in the

radioactively contaminated materials estimate. The encapsulation cell would be covered with a multilayer cover as described below. The remainder of the expanded Canonsburg site (except the residential areas) would be covered with a minimum of 2 feet of clean soil (U.S. DOE, 1983). The major features of the encapsulation cell design consist of the following, from top to bottom.

1. A 1-foot thick layer of select (top) soil with vegetation.
2. A 1-1/2-foot thick layer of pit run rock.
3. A 3-foot thick compacted earthen cover.
4. The encapsulated radioactively contaminated material.
5. A 2-foot thick compacted earthen liner.
6. A 1-foot thick layer of coarse sand.

2.4.1 Select soil layer

The top 1-foot soil layer would be a base for shallow-rooted vegetation.

2.4.2 Pit run rock layer

The 1-1/2-foot thick pit run rock layer would serve several design functions. It would serve as a backup barrier against erosion, as a barrier against plant root penetration, as a barrier against burrowing animal penetration, and as a device to channel the water percolating through the topsoil layer away from the cover. The water would drain into the swales or other engineered drain areas at the low points around the toe of the encapsulation cell.

2.4.3 Encapsulation cell cover

The encapsulated cell cover is designed to inhibit the infiltration of surface water and to retard the release of radon. The cover would consist of a 1-foot layer of bentonite, modified clayey soil, and an additional 2 feet of compacted clayey materials.

2.4.4 Encapsulation cell liner

The 2-foot thick liner would be constructed of locally available borrow materials and would be placed over the capillary break. The liner is designed to be more permeable than the cover and would thus reduce the potential for accumulation of water within the encapsulation cell and also would act to retard radioactively contaminated materials migration.

2.4.5 Capillary break

The coarse sand is designed as a capillary break to preclude upward water migration into the encapsulation cell. The capillary break would consist of a 1-foot layer of coarse sand placed on undisturbed or recompacted onsite materials.

2.5 WATER BALANCE

Water infiltration into and through the encapsulated radioactively contaminated materials and into the ground water is a potential source of ground-water contamination.

Although the liner and capillary break are designed to reduce ground-water contamination, the primary barrier against ground-water contamination would be the encapsulation cell cover. A multilayer cover system would be placed over the encapsulation cell to inhibit water infiltration and radon exhalation. As discussed previously, 3 feet of compacted earthen cover would be required for radon attenuation. This 3-foot-thick radon barrier, in conjunction with the rock erosion barrier and the 1-foot layer of selected soil, is calculated to reduce the net annual infiltration through the cover system to 1.2 inches per year. This is about 3 percent of the average annual rainfall in the Canonsburg area.

2.6 RADON AND WATER INFILTRATION BARRIER

The radon barrier (and the water infiltration barrier) would be constructed of locally available borrow material and bentonite. Radon emissions before and after the remedial action were calculated using the RAECO model (Rogers et al., 1981). Data on the distribution of radium in the radioactively contaminated materials, the quantities of radioactively contaminated materials to be encapsulated, and the properties of the cover materials have been used to develop the estimate of cover thickness. The cover thickness necessary to reduce the radon exhalation rate from the encapsulated radioactively contaminated materials to less than 20 picocuries per square meter per second (EPA, 40 CFR 192) is calculated to be about 2.4 feet. The remainder of the covered expanded Canonsburg site would require a minimum of 6 inches of cover to reduce the radon flux to below 20 picocuries per square meter per second (EPA, 40 CFR 192).

Radon emissions after the completed remedial action, including the erosion barrier and vegetation support layer, are calculated to be about 5 picocuries per square meter per second from the encapsulation cell, and about 9 picocuries per square meter per second for the remainder of the expanded Canonsburg site. The average post-remedial-action radon emission rate for the covered expanded Canonsburg site is calculated to be about 8 picocuries per square meter per second.

2.7 RADIOACTIVELY CONTAMINATED MATERIALS EXCAVATION

Excavation in Area C would require a dewatering scheme. Most of the radioactive contamination at the expanded Canonsburg site lies within Area C and extends to depths of as much as 18 feet. The ground water in this area is quite close to the surface. The remedial-action plan proposes that a drain trench system be constructed within the portion of Area C to be excavated. Pumping of ground water to the sedimentation basin would be required at only one point. Because of uncertainties in the characteristics of the deeper radioactively contaminated materials, excavation by dragline could be required. No major problems are expected in Area A, where a number of smaller volumes of radioactively contaminated materials that are above the ground-water table would be excavated.

2.8 RADIOACTIVELY CONTAMINATED MATERIALS ENCAPSULATION

Even with dewatering, Area C radioactively contaminated materials could be found to have high moisture contents. It is proposed that radioactively contaminated materials be physically mixed with the relatively dry radioactively contaminated materials excavated from Area A and possibly some soil stabilizers. This mixing should take place within the encapsulation cell itself and should result in a compactable material near optimum moisture content. The radioactively contaminated materials would be spread in 12-inch maximum loose lifts and compacted to a dry density of 90 percent of Standard Proctor compaction level.

Some of the radioactively contaminated materials from Area C are acidic in nature. Waste conditioning to neutralize these radioactively contaminated materials could be necessary to prevent damage to the soil liner.

2.9 SURFACE STABILIZATION

Side slopes of the encapsulation cell would be no greater than 1 vertical to 5 horizontal. To promote drainage the top of the encapsulation cell would have a minimum slope of 2 percent. To ensure that the encapsulation cell would withstand erosion during the 200- to 1000-year design life, and to present a natural appearance, the cover for the encapsulation cell and the remainder of the expanded Canonsburg site would be graded and the corners of the expanded Canonsburg site would be rounded to avoid sharp breaks in grade.

In the extremely unlikely event that the top 1-foot thick layer of soil that would support the vegetation would be eroded away, the encapsulation cell would be covered with a 1.5-foot thick layer of pit run rock that would provide additional erosion protection. The drainage swales north and south of the encapsulation cell as they near Chartiers Creek would also be lined with pit run rock. The encapsulation cell and the remainder of the expanded Canonsburg site would be revegetated.

2.10 EXISTING UTILITIES

The final objective of remedial action concerning utilities would be to disconnect and remove, or abandon and leave in place, all utilities within the expanded Canonsburg site. Main utility lines following Strabane Avenue could remain in place.

The water utility has a main running along Strabane Avenue that could remain active and in place. Two lines branch off this main and proceed up George Street and up Ward Street to the residential area along Wilson Avenue. The Ward Street branch would be abandoned; the George Street branch is a subsidiary feeder to the Village of Strabane and would be either relocated or abandoned.

The gas utility has a main line running along Strabane Avenue. At one point this line diverts from Strabane Avenue into Area C. This section of line would be relocated to follow along the boundary of Strabane Avenue. A branch line ties into this gas main at the George Street intersection, loops around the expanded Canonsburg site, and ties into another main located across Chartiers Creek from Area B. This branch would be disconnected at the two tie-in points and left in place.

The main overhead power lines that run along Strabane Avenue would remain active and in place. One of these, however, diverts slightly from Strabane Avenue across the southeastern tip of Area B enroute to the substation across Chartiers Creek. Another branch line runs from the substation across Area B and ties into a branch running up George Street. Both of these branch lines would be disconnected and removed. A final power line runs from the substation along the Washington-Canonsburg Street Railway right-of-way,

extends to a location across Chartiers Creek to the west, and returns across the creek to a terminal near the residence at the end of George Street. This line could be left in service if it services the area across the creek; otherwise, it would be disconnected and removed.

If radioactively contaminated materials that must be excavated are found along and beneath Strabane Avenue, care would be taken during construction not to disrupt the main utility lines running along this road. Temporary utility routing may be required during the remedial action.

A sewer line running along the Washington-Canonsburg Street Railway right-of-way ending near the former Georges Pottery property has been identified. This line is assumed to be used by only the residences along Wilson Avenue. Because of its closeness to the north side of the encapsulation cell it would be removed.

2.11 REVEGETATION

All areas of the 30-acre expanded Canonsburg site disturbed by remedial action, except those to receive riprap, would be prepared and seeded with native grasses.

2.12 FENCING

After remedial action is complete, permanent fencing would be placed around the entire expanded Canonsburg site. Strabane Avenue would be fenced along both sides. The fence would be 6-foot high chain link topped with three strands of barbed wire, and would be secured with a locked gate.

Appendix A.2

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS, BURRELL TOWNSHIP, PENNSYLVANIA

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF
RADIOACTIVELY CONTAMINATED MATERIALS
BURRELL TOWNSHIP, PENNSYLVANIA

U.S. DEPARTMENT OF ENERGY
URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT OFFICE
ALBUQUERQUE OPERATIONS OFFICE
ALBUQUERQUE, NEW MEXICO 87108

July 1983

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1 INTRODUCTION

1.1 PURPOSE

This report provides a summary of the conceptual design and other information necessary to understand the proposed remedial action at the Burrell Township, Pennsylvania site.

This summary is intended to provide sufficient detail for the reader to understand the proposed remedial action and the anticipated environmental impact. In some cases, planning assumptions have been necessary; these will be finalized during the detailed design process. Location, topography, and the extent of the radioactive contamination are shown on Figures A.2-1, A.2-2, and A.2-3, respectively.

1.2 DESIGN OBJECTIVES

The purpose of the remedial action is to stabilize the radioactively contaminated materials at the Burrell Township site in a manner that complies with the EPA standards (40 CFR 192) to prevent future health risks. Consistent with these EPA standards (40 CFR 192), and to meet other objectives, the following major design objectives have been established:

1. Reduce the average radon flux from the radioactively contaminated materials to levels less than 20 picocuries per square meter per second.
2. Design controls to be effective for up to 1000 years with minimum maintenance and a minimum design life of 200 years.
3. Discourage future excavation at the Burrell site.
4. Ensure that existing or anticipated beneficial uses of ground and surface water would not be adversely affected.
5. Reduce radioactive contaminant levels on areas released for unrestricted use to levels that do not exceed 5 picocuries of radium per gram of soil above background in the top 15 centimeters of soil, and do not exceed 15 picocuries of radium per gram of soil above background in any 15-centimeter layer below that depth (EPA, 40 CFR 192).
6. Radioactively decontaminate the adjacent ConRail right-of-way.

7. Minimize releases of radioactive contamination from the Burrell site during construction.
8. Provide for erosion control during construction.
9. Minimize the areas that would be disturbed during construction and minimize the exposure of the remedial-action workers and the public to radioactively contaminated materials.

1.3 MAJOR ELEMENTS OF THE DESIGN

The principal feature of the design concept is capping the surface of the Burrell site to control radon exhalation, inhibit water infiltration, and prevent erosion. This design would require the following major construction activities:

1. Preparation of the Burrell site, including construction of temporary roads, a railroad crossing, and erosion control facilities to protect against release of radioactively contaminated materials from the Burrell site during construction.
2. Construction of the cover system over the radioactively contaminated area to inhibit water infiltration and radon exhalation.
3. Emplacement of topsoil and erosion system on the Burrell site.
4. Seeding all disturbed areas to mitigate erosion.

1.4 PROPOSED FINAL CONDITION

The completed stabilized area would encompass about 4 acres in the northwest portion of the Burrell site. Cover material would be brought from elsewhere on the Burrell site or from the immediate area to form a low permeability cover. The surface would be graded to maximize runoff and vegetated to discourage erosion.

While the Burrell site has been designated a vicinity property, it is the DOE's intent to redesignate the Burrell site as a disposal site, and acquire and maintain title to the radioactively contaminated portion of the Burrell site. Chain-link fences with warning signs would enclose that portion of the Burrell site containing the buried radioactively contaminated materials.

2 CONCEPTUAL DESIGN

2.1 GENERAL

It is estimated that the radioactively contaminated area at the Burrell site is limited to approximately 4 acres and that its stabilization could be accomplished by covering the radioactively contaminated area with 3 feet of locally available soil, a rock or riprap layer on embankment slopes, and a final soil layer for vegetation. Additional onsite monitoring in 1984 would confirm the area involved and provide the data required for the final design of the site cover. The remainder of the Burrell site (once designated) would be graded and vegetated to allow for adequate drainage.

Radioactively contaminated materials on the adjacent ConRail right-of-way would be excavated and moved to the area of the Burrell site that is to be covered.

A soil cover would be placed over the radioactively contaminated materials. The cover would consist of soil compacted at optimum moisture content to reduce diffusion of radon and to minimize the infiltration of precipitation. The cover would be designed to reduce radon exhalation rates to less than 20 picocuries per square meter per second (EPA, 40 CFR 192).

Because of the climatic conditions at the Burrell site and the ease of establishing and maintaining vegetative cover on the Burrell site, wind erosion is not expected to have any significant effect on the long-term stability of the Burrell site. To reduce the potential for water erosion, slopes would be limited to a maximum of 1 vertical to 5 horizontal. Rock covers or riprap would be used where required to control erosion. The remainder of the Burrell site would be gently sloped with drainage swales to the onsite ponds and the Conemaugh River. The existing onsite ponds would be drained by removing the dam and the soil between ponds C and D (see Figures A.2-2 and A.2-3).

Stabilization of the radioactively contaminated materials above the ground-water level would reduce the potential for leaching and radioactive contaminant migration. The Burrell site would be designed with a low permeability cover that would reduce infiltration of precipitation, retard water flow through the Burrell site, and attenuate radioactively contaminated materials. Covering the ground surface with a sloping clayey cover would reduce the amount of infiltration from precipitation.

Radioactively contaminated materials would remain in place; however, lowering the ground-water levels by limiting infiltration would reduce leaching and radioactive contaminant migration toward the Conemaugh River. Water-soluble radioactively contaminated materials already in the ground water would continue to migrate toward the Conemaugh River. The rate of water flow and radioactively contaminated water migration is estimated to be minimal.

Concentrations of radionuclides as they discharge into the Conemaugh River would be diluted to well below the levels discussed in the EPA's hazardous waste management system guidelines (47 FR 32274; July 26, 1982) and in the relevant state (25 PA Code 93) and Federal (40 CFR 141) water quality criteria.

2.2 SITE PREPARATION

A significant quantity of vegetation including grasses, shrubs, and small trees presently grows on the Burrell site. Trees and other vegetation from nonradioactively contaminated areas that would not interfere with construction would remain intact on the Burrell site. Grasses, weeds, shrubs, and trees from radioactively contaminated areas would be reduced in size and buried on the Burrell site; organic materials would comprise no more than 5 to 10 percent by volume per lift. Vegetation from nonradioactively contaminated areas that interferes with remedial-action construction, could be cut and removed from the Burrell site or handled in the same manner as radioactively contaminated organic material.

2.3 FLOOD CONTROL

The 1972 storm resulting from Hurricane Agnes is considered a 1000-year storm. The Conemaugh River level at the Burrell site attained an elevation of 969.45 feet during this storm. The finished Burrell site would be above this level. The only anticipated remedial action below this level would be the removal of the onsite pond dams to allow drainage. All borrow and Burrell site work would be above this elevation.

2.4 EROSION CONTROL

Erosion during construction would be controlled through contouring and erosion control fences. All construction activities would be conducted in such a way as to prevent accelerated erosion and sedimentation. Channels of conveyance would limit runoff velocity by being planted with grass or lined with erosion-resistant material.

Runoff from land outside the affected areas would be diverted away from the Burrell site. Diversions could be by means of ditches or berms.

2.5 DUST CONTROL

Dust generated by excavation, earth movement, vehicle use, stockpiling, and similar activities would be controlled and minimized. It is anticipated that water with a water-based surfactant sprayed under high pressure (from trucks and hoses) would be adequate to control dust.

The sources for dust suppression water would include impounded runoff and/or potable water. Recycled water would be used as much as practicable. Conemaugh River water could be used, if practical.

The need for spraying the roads and pile areas would be determined on a day-by-day basis. The frequency of spraying would increase as combinations of low soil moisture and high wind speed conditions were encountered.

2.6 COVER

A cover system would be designed and constructed over the radioactively contaminated area to inhibit water infiltration and radon exhalation. The compacted earthen cover would reduce water infiltration to less than 10 percent of the annual precipitation at the Burrell site. Preliminary estimates indicate that a 3-foot soil cover would reduce the average radon flux from the radioactively contaminated materials to levels well below the 20 picocuries per square meter per second standard (EPA, 40 CFR 192). The cover system would be constructed of locally available borrow material amended as necessary with sodium bentonite to reduce permeability to less than 1.0×10^{-7} centimeters per second.

The final cover thickness would be determined by the characteristics of borrow materials, additional onsite monitoring, and the results of water-balance calculations.

2.7 SURFACE STABILIZATION

The side slopes of the stabilized area would be no greater than 1 vertical to 5 horizontal. To promote drainage the top would have a minimum slope of 2 percent. Portions of the Burrell site subject to erosive water velocities would be protected with rock. To ensure that the cover would withstand water erosion during the 200- to 1000-year design life, the cover for the stabilized area and the remainder of the Burrell site would be graded and corners would be rounded to avoid sharp breaks in grade. Areas of the Burrell site disturbed during construction would be revegetated.

2.8 EXISTING UTILITIES

There are no known utilities on the Burrell site.

2.9 REVEGETATION

All areas of the Burrell site disturbed by remedial action would be prepared and seeded with native grasses.

2.10 FENCING

After all remedial action is complete, permanent fencing would be placed around the Burrell site. The fence would be 6-foot high chain link topped with three strands of barbed wire, and would be secured with a locked gate.

Appendix A.3

ENERGY AND OTHER RESOURCES CALCULATIONS

The values given in the tables in this appendix are estimates of the amounts of energy and materials necessary for the entire project.

Table A.3-1. Electrical power use by alternative (kilowatt hours)

Alternative	Base	Contingency (25%)	Total
<u>Alternative 2</u>			
Canonsburg site			
Storage trailers (2)	112,000		
Shower/lockerroom trailer	30,250		
Hot water	3,000		
Waste-water treatment plant	7,800		
Yard lighting	<u>24,650</u>		
Subtotal	177,700	44,300	222,000
Burrell site			
Storage trailer	45,300		
Shower/lockerroom trailer	42,300		
Hot water	2,500		
Waste-water treatment plant	2,600		
Yard lighting	<u>20,300</u>		
Subtotal	<u>113,000</u>	<u>27,000</u>	<u>140,000</u>
Total	290,700	71,300	362,000
<u>Alternative 3</u>			
Canonsburg site	177,700	44,300	222,000
Burrell site			
Storage trailer	5,100		
Hot water	800		
Yard lighting	<u>900</u>		
Subtotal	<u>6,800</u>	<u>1,700</u>	<u>8,500</u>
Total	184,500	46,000	230,500

Table A.3-1. Electrical power use by alternative (kilowatt hours)
(continued)

Alternative	Base	Contingency (25%)	Total
<u>Alternative 4</u>			
Canonsburg site			
Storage trailers (2)	112,000		
Shower/lockerroom trailer	60,500		
Hot water	3,600		
Waste-water treatment plant	12,000		
Yard lighting	<u>27,000</u>		
Subtotal	215,100	54,900	270,000
Burrell site	113,000	27,000	140,000
Hanover site			
Storage trailers(s)	115,000		
Shower/lockerroom trailer	64,500		
Hot water	3,900		
Waste-water treatment plant	10,900		
Yard lighting	<u>28,000</u>		
Subtotal	<u>222,300</u>	<u>57,700</u>	<u>280,000</u>
Total	550,400	139,600	690,000
<u>Alternative 5</u>			
Canonsburg site	215,100	54,900	270,000
Burrell site	6,800	1,700	8,500
Hanover site	<u>222,300</u>	<u>57,700</u>	<u>280,000</u>
Total	444,200	114,300	558,500

Table A.3-2. Fuel use by alternative (gallons)

Alternative	Base	Utilization factor		Total
<u>Alternative 2</u>				
Diesel fuel				
Canonsburg site	250,668	x	0.80	200,000
Burrell site	108,605	x	0.80	<u>87,000</u>
Subtotal				287,000
Gasoline				
Canonsburg site	40,300	x	0.80	32,000
Burrell site	48,680	x	0.80	<u>40,000</u>
Subtotal				<u>72,000</u>
Total				359,000
<u>Alternative 3</u>				
Diesel fuel				
Canonsburg site	228,468	x	0.85	195,000
Burrell site	90,232	x	0.85	<u>77,000</u>
Subtotal				272,000
Gasoline				
Canonsburg site	39,160	x	0.85	33,000
Burrell site	6,120	x	0.85	<u>5,000</u>
Subtotal				<u>38,000</u>
Total				310,000

Table A.3-2. Fuel use by alternative (gallons)
(continued)

Alternative	Base	Utilization factor		Total
<u>Alternative 4</u>				
Diesel fuel				
Canonsburg site	663,430	x	0.90	600,000
Burrell site	108,605	x	0.80	87,000
Hanover site	607,317	x	0.80	<u>485,000</u>
Subtotal				1,172,000
Gasoline				
Canonsburg site	48,400	x	0.80	40,000
Burrell site	48,400	x	0.80	40,000
Hanover site	21,840	x	0.80	<u>18,000</u>
Subtotal				<u>98,000</u>
Total				1,270,000
<u>Alternative 5</u>				
Diesel fuel				
Canonsburg site	663,430	x	0.90	600,000
Burrell site	90,232	x	0.85	77,000
Hanover site	431,795	x	0.85	<u>367,000</u>
Subtotal				1,044,000
Gasoline				
Canonsburg site	48,400	x	0.80	40,000
Burrell site	6,120	x	0.85	5,000
Hanover site	20,080	x	0.80	<u>16,000</u>
Subtotal				<u>61,000</u>
Total				1,105,000

Table A.3-3. Concrete use by alternative (cubic yards)

Alternative	Waste-water treatment plants	Pads for truck wash	Stabilization of filter sludge	Total
<u>Alternative 2</u>				
Canonsburg site	70	190	4,850	5,000
Burrell site	<u>70</u>	<u>190</u>	<u>1,000</u>	<u>1,260</u>
Total	140	380	5,850	6,260
<u>Alternative 3</u>				
Canonsburg site	<u>70</u>	<u>190</u>	<u>5,000</u>	<u>5,260</u>
Total	70	190	5,000	5,260
<u>Alternative 4</u>				
Canonsburg site	70	190	7,500	7,760
Burrell site	70	190	1,000	1,260
Hanover site	<u>70</u>	<u>190</u>	<u>4,250</u>	<u>4,510</u>
Total	210	570	12,750	13,530
<u>Alternative 5</u>				
Canonsburg site	70	190	7,500	7,760
Hanover site	<u>70</u>	<u>190</u>	<u>3,250</u>	<u>3,510</u>
Total	140	380	10,750	11,270

Table A.3-4. Water use by alternative (gallons)

Alternative	Dust control	Truck cleaning	Steam cleaning	Total
<u>Alternative 2</u>				
Canonsburg site	150,000	1,320,000	650,000	2,120,000
Burrell site	<u>125,000</u>	<u>60,000</u>	<u>---</u>	<u>185,000</u>
Total	275,000	1,380,000	650,000	2,305,000
<u>Alternative 3</u>				
Canonsburg site	150,000	1,320,000	650,000	2,120,000
Burrell site	<u>125,000</u>	<u>---</u>	<u>---</u>	<u>125,000</u>
Total	275,000	1,320,000	650,000	2,245,000
<u>Alternative 4</u>				
Canonsburg site	1,000,000	3,700,000	650,000	5,350,000
Burrell site	125,000	60,000	---	185,000
Hanover site	<u>1,600,000</u>	<u>2,400,000</u>	<u>---</u>	<u>4,000,000</u>
Total	2,725,000	6,160,000	650,000	9,535,000
<u>Alternative 5</u>				
Canonsburg site	1,000,000	3,700,000	650,000	5,350,000
Burrell site	125,000	---	---	125,000
Hanover site	<u>1,600,000</u>	<u>2,400,000</u>	<u>---</u>	<u>4,000,000</u>
Total	2,725,000	6,100,000	650,000	9,475,000

Appendix A.4

ORDER-OF-MAGNITUDE COST ESTIMATES FOR PERFORMING REMEDIAL ACTION AT THE ALTERNATIVE SITES

Table A.4-1. Summary of cost estimates

Item	Site		Total
	Canonsburg	Burrell	
<u>Alternative 2</u>			
General site preparation	\$ 465,000 ^a	\$ 670,000 ^b	---
Contaminated soil excavation	275,000 ^a	1,816,000 ^b	---
Building decontamination and demolition	925,000 ^a	---	---
Waste-water treatment plant	510,000 ^a	380,000 ^b	---
Encapsulation	2,417,000 ^a	2,320,000 ^b	---
Fill importation	1,004,000 ^a	1,010,000 ^b	---
Standby equipment and crew ^c	500,000 ^a	500,000 ^b	---
Subtotal	\$6,096,000	\$6,696,000	\$12,792,000
Contingency (15 percent) ^d			\$ 1,919,000
Monitoring and radiation management (15 percent)			1,919,000
Engineering and construction management (15 percent)			1,919,000
Legal, administration, and site acquisition			3,156,000
Total ^{e, f}			\$21,705,000
<u>Alternative 3</u>			
General site preparation	\$ 465,000 ^a	\$ 349,000 ^g	---
Contaminated soil excavation	275,000 ^a	---	---
Building decontamination and demolition	925,000 ^a	---	---
Waste-water treatment plant	510,000 ^a	---	---
Encapsulation	2,417,000 ^a	---	---
Fill importation	1,004,000 ^a	---	---
Standby equipment and crew ^c	500,000 ^a	---	---
Landfill surface stabilization -- contaminated area	---	597,000 ^g	---
Subtotal	\$6,096,000	\$ 946,000	\$ 7,042,000
Contingency (15 percent) ^d			\$ 1,056,000
Monitoring and radiation management (15 percent)			1,056,000
Engineering and construction management (15 percent)			1,056,000
Legal, administration, and site acquisition			3,156,000
Total ^{e, f}			\$13,366,000

Table A.4-1. Summary of cost estimates (continued)

Item	Site		Total
	Canonsburg	Burrell	
<u>Alternative 4</u>			
General site preparation	\$ 465,000 ^h	\$ 670,000 ^b	---
Contaminated soil excavation	4,610,000 ^h	1,816,000 ^b	---
Building decontamination and and demolition	925,000 ^h	---	---
Waste-water treatment plant	510,000 ^h	380,000 ^b	---
Encapsulation	8,500,000 ^h	2,320,000 ^b	---
Fill importation	1,500,000 ^h	1,010,000 ^b	---
Standby equipment and crew ^c	1,000,000 ^h	500,000 ^b	---
Disposal site preparation	1,000,000 ^h	500,000 ^b	---
Disposal site waste-water treatment plant	380,000 ^h	---	---
Subtotal	\$18,890,000	\$7,196,000	\$26,086,000
Contingency (15 percent) ^d			\$ 3,193,000
Monitoring and radiation management (15 percent)			3,193,000
Engineering and construction management (15 percent)			3,193,000
Legal, administration, and site acquisition			3,300,000
Total ^{e, f}			\$38,965,000
<u>Alternative 5</u>			
General site preparation	\$ 465,000 ^h	\$ 349,000 ^g	---
Contaminated soil excavation	4,610,000 ^h	---	---
Building decontamination and demolition	925,000 ^h	---	---
Waste-water treatment plant	510,000 ^h	---	---
Encapsulation	8,500,000 ^h	---	---
Fill importation	1,500,000 ^h	---	---
Standby equipment and crew ^c	1,000,000 ^h	---	---
Landfill surface stabiliza- tion -- contaminated area	---	597,000 ^g	---
Pond rehabilitation	---	1,134,000 ^g	---
Disposal site preparation	1,000,000 ^h	---	---
Disposal site waste-water treatment plant	380,000 ^h	---	---
Subtotal	\$18,890,000	\$ 946,000	\$19,836,000
Contingency (15 percent) ^d			\$ 2,975,000
Monitoring and radiation management (15 percent)			2,975,000
Engineering and construction management (15 percent)			2,975,000
Legal, administration, and site acquisition			2,730,000
Total ^{e, f}			\$31,491,000

^aSee Table A.4-2.^bSee Table A.4-3.^cCost of idle time for inspections, construction quality control, monitoring, and inclement weather.^dBased on Engineering News Record Cost Index 3560.^eAn ion-exchange barrier may be considered a means of controlling the migration of radionuclides in or into the ground water. The approximate cost of \$500,000 is not included in the total.^fTotal does not include the cost of transporting the degradable organics (i.e., wood products) to a controlled low-level waste landfill (Richland, Washington, or Beatty, Nevada).^gSee Table A.4-4.^hSee Table A.4-5.

Table A.4-2. Order-of-magnitude cost estimate for the expanded Canonsburg site -- Alternatives 2 and 3

Item	Approximate cost
General site preparation	
Flood-control berm (2,400 feet)	\$ 240,000
Fencing (7,000 feet)	100,000
Remove railroad embankment and track (1,900 feet)	40,000
Vehicle decontamination	30,000
Worker facility	30,000
Demobilization and cleanup	<u>25,000</u>
Subtotal	\$ 465,000
Contaminated soil excavation (23,985 cubic yards)	
Dewater Area C	60,000
Excavation and material handling	<u>215,000</u>
Subtotal	\$ 275,000
Building decontamination and demolition	
Building decontamination	200,000
Salvageable-steel decontamination (4,700 tons)	30,000
Building demolition	575,000
Demolition-debris handling (18,000 cubic yards)	<u>120,000</u>
Subtotal	\$ 925,000
Waste-water treatment plant -- Subtotal	\$ 510,000
Encapsulation area (6 acres)	
Liner at \$200,000 per acre	\$1,200,000
Material filling at \$4 per cubic yard	182,000
Multilayer cover with vegetation	<u>1,035,000</u>
Subtotal	\$2,417,000
Fill importation (24 acres)	
Minimum of 2-foot cover with vegetation -- Subtotal	\$1,004,000
Standby equipment and crew (100 days at \$5000 per day) -- Subtotal	<u>\$ 500,000</u>
Total	\$6,096,000

Table A.4-3. Order-of-magnitude cost estimate for the Burrell site --
Alternatives 2 and 4

Item	Approximate cost
General site preparation -- Subtotal	\$ 670,000
Contaminated soil excavation	
Excavation (80,000 cubic yards at \$10 per cubic yard)	800,000
Staging and loading (80,000 cubic yards at \$4 per cubic yard)	320,000
Material hauling (80,000 cubic yards x \$8.70 per cubic yard for 70 miles)	<u>696,000</u>
Subtotal	\$1,816,000
Waste-water treatment plant	
Burrell	<u>380,000</u>
Subtotal	\$ 380,000
Encapsulation area (5 acres)	
Liner at \$200,000 per acre	1,000,000
Material filling at \$4 per cubic yard	320,000
Multilayer cover	<u>1,000,000</u>
Subtotal	\$2,320,000
Earth work soil importation and backfilling (16,000 cubic yards at \$10 per cubic yard)	160,000
Backfilling adjacent ponds	<u>850,000</u>
Subtotal	\$1,010,000
Preparation of new disposal ^a site -- Subtotal	\$ 500,000
Standby equipment and crew (100 days at \$5,000 per day) -- Subtotal	<u>\$ 500,000</u>
Total	Alternative 2 \$6,696,000
	Alternative 4 \$7,196,000

^aFor Alternative 4 only.

Table A.4-4. Order-of-magnitude cost estimate for the Burrell site --
Alternatives 3 and 5

Item	Approximate cost
General site preparation	
Lightly grade 8 acres and add fill	\$ 40,000
Apply topsoil on 10 acres and seed	80,000
Construct sedimentation basin and drainage	34,000
Construct access roads and install fencing	150,000
Worker facilities	20,000
Demobilize and clean up	<u>25,000</u>
Subtotal	\$ 349,000
Landfill surface stabilization -- contaminated area	
Construct earth fill for surface slope	180,000
Install earth cover	337,000
Apply topsoil and seed	<u>80,000</u>
Subtotal	\$ <u>597,000</u>
Total	\$ 946,000

Table A.4-5. Order-of-magnitude cost estimate for the Canonsburg site --
Alternatives 4 and 5

Item	Approximate cost
General site preparation	
Canonsburg (see Table A.4-2)	
Subtotal	\$ 465,000
Contaminated soil excavation	
Areas A, B, and C (250,000 cubic yards at \$10 per cubic yard)	2,500,000
Dewater Area C	60,000
Excavation (250,000 cubic yards at \$4 per cubic yard)	1,000,000
Material hauling (250,000 cubic yards x \$4.20 per cubic yard for 20 miles)	<u>1,050,000</u>
Subtotal	\$ 4,610,000
Building decontamination and demolition (see Table A.4-2)	
Subtotal	\$ 925,000
Waste-water treatment plant	
Canonsburg	510,000
Disposal site	<u>380,000</u>
Subtotal	\$ 890,000
Preparation of a new disposal site	
Subtotal	\$ 1,000,000
Encapsulation area at the Hanover site (15 acres)	
Liner at \$250,100 per acre	3,000,000
Material filling at \$10 per cubic yard	2,500,000
Multilayer cover at \$200,000 per acre	<u>3,000,000</u>
Subtotal	\$ 8,500,000
Soil importation and backfilling (150,000 cubic yards at \$10 per cubic yard) -- Subtotal	\$ 1,500,000
Standby equipment and crew (200 days at \$5,000 per day)	
Subtotal	<u>\$ 1,000,000</u>
Total	\$18,890,000

Table A.4-6. Unit costs, including material, labor, and equipment

Item	Cost
Fill -- select	\$ 7.65 per cubic yard
Fill -- placement	2.75 per cubic yard
Borrow and haul	5.10 per cubic yard
Clay fill -- borrow	11.17 per cubic yard
-- place	3.00 per cubic yard
Bentonite	543.00 per ton
Fill and compact (general site)	3.90 per cubic yard
Sand fill	7.15 per cubic yard
Gravel fill	6.90 per cubic yard
Clean fill	5.00 per cubic yard
Topsoil	9.40 per cubic yard
Vegetation	0.60 per square yard
Grading -- rough	2.10 per cubic yard
-- finish	0.60 per square yard
Riprap	18.25 per square yard
Basin excavation	3.10 per cubic yard
2 inches asphalt	4.50 per square yard
Concrete -- pads, etc.	275.00 per cubic yard
Fencing -- 8-foot chain link	12.00 per linear foot
-- gates	51.70 per linear foot
-- posts	131.00 each
Grating	22.50 per square foot
Dewatering	3100.00 each

Appendix A.5

ESTIMATES OF SOIL LOSSES

The following calculations indicate the amounts of soil that are expected to be removed from the sites through erosion and runoff during the various phases of the project.

Table A.5-1. Estimates of current soil loss off the sites

Symbol	Description	Site			Basis
		Canonsburg	Burrell	Hanover	
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--a
L _s	Topographic factor	0.34	1.9	2.35	--b
C	Cover	0.44	0.043	0.090	--c
P	Supporting practices	1.0	1.0	1.0	--d
A	Annual soil loss (tons per acre per year)	5.61	2.86	10.47	--e
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--f
T	Total annual soil loss from site (tons per year) ^g	84.15	64.46	240.81	--g

^a50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

^bSlopes of length 600 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

^cAssumes: Canonsburg site -- An average based on a mixture of lawn, gravel, scrub vegetation and dredged material.
 Burrell site -- 80 percent cover of low-growing vegetation; no appreciable canopy.
 Hanover site -- 80 percent cover of low-growing vegetation; no appreciable canopy.

^dNot applicable -- applies only to intensive farming practices.

^eUsing the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P.$$

^fSDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

$$^gT = R \times K \times L_s \times C \times P \times \text{total acreage} \times \text{SDR}.$$

Table A.5-2. Estimates of soil loss off the sites during construction

Symbol	Description	Site			Basis
		Canonsburg	Burrell	Hanover	
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--a
L _s	Topographic factor	0.34	1.9	2.35	--b
C	Cover	1.0	1.0	1.0	--c
P	Supporting practices	1.0	1.0	1.0	--d
A	Annual soil loss (tons per acre per year)	12.75	66.5	116	--e
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--f
T	Total annual soil loss from site (tons per year) ^g	191.25	1498.91	2668.00	--g

^a50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

^bSlopes of length 600 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

^cAssumes no ground cover.

^dNot applicable -- applies only to intensive farming practices.

^eUsing the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P.$$

^fSDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

$$^gT = R \times K \times L_s \times C \times P \times \text{total acreage} \times \text{SDR}.$$

Table A.5-3. Estimates of soil loss off the sites after remedial action

Symbol	Description	Site			Basis
		Canonsburg	Burrell	Hanover	
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--a
L _s	Topographic factor	0.34	1.9	2.35	--b
C	Cover factor	0.003	0.003	0.003	--c
P	Supporting practices	1.0	1.0	1.0	--d
A	Annual soil loss (tons per acre per year)	0.038	0.199	0.349	--e
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--f
T	Total annual soil loss from site (tons per year)	0.57	4.48	8.03	--g

^a50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

^bSlopes of length 250 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

^cAssumes 95 to 100 percent ground cover with herbaceous plants and decaying duff or litter at least 2 inches deep.

^dNot applicable -- applies only to intensive farming practices.

^eUsing the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P$$

^fSDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

$$^gT = R \times K \times L_s \times C \times P \times \text{total acreage} \times \text{SDR}.$$

Table A.5-4. Estimates of soil loss for 1000 years^a

	Site		
	Canonsburg	Burrell	Hanover
	0.12 inch	0.56 inch	0.98 inch

^aBased on the following:

$$\begin{aligned}
 &\text{Total annual soil loss after remedial action} \left(\frac{\text{tons}}{\text{yr}} \right) \times 2,000 \left(\frac{\text{lbs}}{\text{ton}} \right) \times 1,000 \text{ yrs} \times 12 \left(\frac{\text{in.}}{\text{ft}} \right) \\
 1,000\text{-yr soil loss (in.)} = &\frac{\text{Area (acres)} \times 43,560 \left(\frac{\text{sq ft}}{\text{acre}} \right) \times 90 \left(\frac{\text{lbs}}{\text{cu ft}} \right)}{\text{Total annual soil loss after remedial action}}
 \end{aligned}$$

Appendix A.6
BORROW PITS

Appendix A.6

BORROW PITS

Local contractors in the Canonsburg Borough and Hanover Township areas have borrow pits with the necessary quantities of soil for rehabilitation of either site. The approximate locations and distances to several sites are shown in Table A.6-1. At the present time there are no known active borrow pits in the area near the Burrell site.

It should be pointed out that between now and the actual initiation of cleanup activities these borrow pits may become unavailable, or possibly new, closer pits would be developed. It has been our experience that once a project is slated for startup many contractors and landowners would have the quantity and type of fill required. Prior to beginning any construction activities, all necessary soil testing would be completed to ensure receiving suitable clean soil.

Table A.6-1. Borrow pit locations

Site	Location	Distance to site	
		Canonsburg (miles)	Hanover
Houston	Pike Street	2	10
Houston	Route 519	2	10
Hickory, PA	Route 50	10	10
Bavington	Route 22	17	10
M&M site	Route 18	24	3

Source: Batty, 1982; Orient, 1982.

REFERENCES FOR APPENDIX A

Batty, F., 1982. Batty Excavating, Washington, Pennsylvania, Telephone conversation with Dr. M. V. Mellinger, Roy F. Weston, Inc., West Chester, Pennsylvania on September 10, 1982.

Orient, D., 1982. M&M Equipment Company, Florence, Pennsylvania, Telephone conversation with Dr. M. V. Mellinger, Roy F. Weston, Inc., West Chester, Pennsylvania on September 8, 1982.

Rogers, V. C., G. M. Sandquist, and K. K. Nielson, 1981. Radon Attenuation Effectiveness and Cost Optimization of Composite Covers for Uranium Mill Tailings, RAECO (Rogers and Associates Engineering Corporation), Salt Lake City, Utah.

U.S. DOE (Department of Energy), Uranium Mill Tailings Remedial Action Project Office, Albuquerque Operations Office, 1983. Remedial Action Plan of the Inactive Uranium Mill Tailings Site at Canonsburg, Pennsylvania, UMTRA-DOE/ AL , Albuquerque, New Mexico.

U.S. EPA (Environmental Protection Agency), 1975. Control of Water Pollution from Cropland, Volume I, EP-600/2-75-026a.

Appendix B

METEOROLOGICAL AND AIR QUALITY INFORMATION

Appendix B.1
METEOROLOGICAL MONITORING PROGRAMS

Appendix B.1

METEOROLOGICAL MONITORING PROGRAMS

The meteorological monitoring system employed at the Canonsburg site is the Climatronics Electronic Weather Station (EWS). The electronic weather station is composed of six individual meteorological sensors and a recording device. It continually monitors and records specific meteorological parameters. By using alternating and direct current operation the electronic weather station can operate unattended for as long as 31 days using 115-volts alternating current line power or two standard 6-volt lantern batteries. The recorder and batteries are solid state, and are housed in a weatherproof fiberglass enclosure. The sensors may be located as far as 1000 feet from the recorder without a loss of accuracy.

The meteorological parameters monitored at the Canonsburg site are wind speed, wind direction, relative humidity, temperature, integrated solar radiation, and precipitation. Wind speed is sensed by a photochopper using a solid-state light source. Wind direction is sensed by a precision potentiometer with 540-degrees output (eliminating the problem of crossover). The relative humidity sensor enables full range measurement (0 to 100 percent) between -30°C and $+50^{\circ}\text{C}$. The temperature sensor utilizes a precision thermistor with 0.5°C accuracy. Solar radiation is measured by a photovoltaic sensor. Precipitation is measured by a tipping rain and snow gauge with 0.01-inch resolution. The specifications for the individual sensors and for the recorder are contained in Table B.1-1.

The recorder prints through the impinging action of its two styluses driven by the chopper bar against the pressure-sensitive chart paper. Its presentation is a series of dots appearing as a continuous line. The recorder contains a multiplexer that allows the six meteorological parameters to be recorded on the chart paper simultaneously. The recorder operates by swinging each stylus to three separate zones on each half of the chart paper.

Recording on the chord of the stylus arch by the edge of the chopper bar is possible because the styluses are able to write along their length rather than at their points. This results in chart paper printed with straight lines and rectilinear recordings.

The standard electronic weather station chart operates at 1 inch per hour. Therefore, 24 hours of operation are recorded over 24 inches of chart paper. The entire length of the paper roll is printed with hours (1 to 12) along the left margin and horizontal lines marking each 15 minutes (1/4 inch) interval. The electronic weather station recorder contains an internal timing mark which provides a check of the drive mechanism. All sensors come to rest for 5 minutes every 24 hours, which results in a zero printout on the chart paper.

Table B.1-1. Specifications of the Climatronics Electronic Weather Station

Sensor	Accuracy	Range	Distance or time constant	Threshold	Damping ratio
<u>Sensor specifications (metric)</u>					
Wind speed	0.011 m/sec or 1.5 percent	0 to 50 m/sec	2.4 m	0.33 m/sec	
Wind direction	± 1.5 percent	0 to 360° mechanical 0 to 540° electronic	2.4 m	0.33 m/sec	0.4 to 0.6
Relative humidity	± 2 percent 0 to 100 percent	0 to 100 percent	10 sec		
Temperature	$\pm 0.55^{\circ}\text{C}$	-30° to $+50^{\circ}\text{C}$	10 sec		
Integrated solar radi- ation	± 3 percent	0 to infinity, in 2 Langley steps and 20 Langley cycles			
Precipitation	± 1 percent	0 to infinity, in 0.0254-cm and 0.254-cm cycles			

Sensor	Range	Chart resolution
<u>Electronic weather station recorder specifications (metric)</u>		
Wind speed	0 to 25 m/sec 0 to 50 m/sec	0.22 m/sec
Wind direction	0 to 540°	$\pm 5^{\circ}$
Relative humidity	0 to 100 percent	± 2 percent
Temperature	-30°C to $+20^{\circ}\text{C}$ 0°C to $+50^{\circ}\text{C}$	0.55°C
Integrated solar radiation	0 to ∞ Langleys	2 Langleys/ division
Precipitation	0 to ∞ cm (0.0254-cm events)	0.0254 cm

Source: Climatronics service manual.

The electronic weather station includes a method for site calibration during use. Each parameter is calibrated against a precision internal reference source. The procedure is accomplished by adjusting specific potentiometers contained on an extender board within the recorder. Calibration of the electronic weather station at the Canonsburg site is performed once a month in conjunction with changing the chart paper rolls and batteries.

The Canonsburg site meteorological monitor was installed in April 1979, and has been operating continuously since then. The sensors are situated at the top of a 33-foot tower on the highest level of Building 10 (Figure 1-3). This configuration represents the optimum location within the site confines, minimizing the effects of site structures on wind conditions.

An identical station was installed at the Burrell site in May 1981. The system was located in the open area in the western portion of the site, with the sensors placed on the top of a 33-foot tower which was cemented into the ground. In an effort to prevent vandalism, a cyclone fence with three strands of barbed wire on top was erected around the unit. Within one month, however, the sensors were shot off the tower and the tower stolen from the site. Because of the expense of the system and the inability to provide complete security, the unit was not replaced.

Just under one-month's data was recovered from the Burrell site unit. Because of their similar settings (within valleys) and relative closeness (50 miles) these data were compared with data recorded at the Canonsburg site during the same time period. This comparison revealed that the Canonsburg site wind data could be applied to the Burrell site if an adjustment was made in wind direction values to reflect the difference in valley orientation. The wind speeds did not require any adjustments.

The Hanover site is similar to the Burrell site in that it is an open, easily-accessible property. Therefore, although site-recorded meteorological data would be desirable, it was ruled out. This site is fairly close to the Pittsburgh International Airport (13 miles) and has a similar topographic setting (i.e., both are located on ridge tops). Thus, the airport data were determined to be applicable to the Hanover site.

The results of the temperature data available to date are given in Table B.1-2, and the wind data are depicted on Figures B.1-1, B.1-2, and B.1-3.

Table B.1-2. Temperatures

Category	Site		
	Canonsburg ^a	Burrell ^b	Hanover ^c
	(Temperature, °F)		
Average annual	50	50	50
Maximum ^d winter	63		39
Average winter	28	30	32
Minimum ^d winter	-6		-18
Maximum ^d spring	82		87
Average spring	50	49	51
Minimum ^d spring	30		15
Maximum ^d summer	95		99
Average summer	70	68	73
Minimum ^d summer	36		34
Maximum ^d fall	88		97
Average fall	50	52	52
Minimum ^d fall	10		-1

^aBased on onsite data collected from 1979 to 1981.

^bBased on data collected at the Indiana Airport, Indiana, Pennsylvania from 1967 to 1981. Maximum and minimum temperatures are not available for Burrell.

^cBased on data collected at the Greater Pittsburgh International Airport from 1953 to 1981.

^dThe highest and lowest temperatures recorded during the period of record.

CIRCLES INDICATE PERCENTAGE DURATION
OF WIND FROM THE INDICATED DIRECTION

CANONSBURG SITE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

SOURCE: DATA FROM METEOROLOGICAL TOWER-ON SITE
CANONSBURG SITE

FIGURE B.1-1
ANNUAL AVERAGE WIND FREQUENCY POLYGON
FOR THE VICINITY OF THE CANONSBURG SITE

CIRCLES INDICATE PERCENTAGE DURATION
OF WIND FROM THE INDICATED DIRECTION

BURRELL TOWNSHIP SITE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

SOURCE: CANONSBURG DATA ADJUSTED FOR TOPOGRAPHY
IN THE VICINITY OF THE BURRELL TOWNSHIP SITE

FIGURE B.1-2
ANNUAL AVERAGE WIND FREQUENCY POLYGON
FOR THE VICINITY OF THE BURRELL TOWNSHIP SITE

ANNUAL AVERAGE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

10 YEAR ANNUAL AVERAGE (FOR THE PERIOD 1967 TO 1976)

GREATER PITTSBURGH INTERNATIONAL AIRPORT DATA
(APPROX 12 MILES TO N E OF HANOVER TWP SITE)

FIGURE B.1-3
ANNUAL AVERAGE WIND FREQUENCY POLYGON
FOR THE VICINITY OF THE HANOVER TOWNSHIP SITE

Appendix B.2

NONRADIOLOGICAL AIR-QUALITY INFORMATION

Appendix B.2

NONRADIOLOGICAL AIR-QUALITY INFORMATION

B.2.1 Background

The proposed activities for each alternative would result in the emission of criteria pollutants at each of the sites. The following pollutants could potentially be emitted:

1. Total suspended-particulates (TSP).
2. Carbon monoxide (CO).
3. Nitrogen oxides (NO_x).
4. Sulfur dioxide (SO₂).
5. Hydrocarbons (HC). Although the EPA has revoked the primary and secondary NAAQS (40 CFR 50) for hydrocarbons (48 FR 628-629, January 5, 1983), the revoked hydrocarbon standard is still included for completeness.

These pollutants could be emitted in a variety of activities. Gaseous pollutants (CO, NO_x, SO₂, HC), could be generated by construction vehicles on the site, as well as by trucks bringing clay and fill material onto the site and removing radioactively contaminated materials. Total suspended-particulate emissions could be generated by the following:

1. General construction activities: demolition and earth-moving.
2. Truck traffic on unpaved roads.
3. Storage-pile stacking.
4. Wind erosion from storage piles.
5. Exhaust emissions from construction vehicles and trucks.

The emissions from these activities were calculated for each site and alternative based on the following engineering information:

1. Number and type of construction vehicles on the site for each period and alternative.
2. Number of truck-hauling trips per day for each period and alternative.
3. Amount of fill, clay, and demolition material stacked during each period and the size of the piles.
4. Size of the active construction area at each site.

The first step required to determine the ambient air-quality impacts of any of the proposed remedial actions is to determine the emission rate for each criteria pollutant under each of the remedial-action alternatives. Subsequent subsections of this appendix include a description of the methods used to calculate the emission rates. All emission rates were calculated using EPA emission factors such as those contained in the AP-42 publication (U.S. EPA, 1977), which was used to calculate the vehicle-exhaust-emission rates.

The second step in the analysis is to use an air-pollution dispersion model to estimate the offsite ambient air quality impacts of each alternative. The models used for this determination are part of the EPA-approved UNAMAP Version 4 series, and include a climatological area-source screening model, the Climatological Dispersion Model (Busse and Zimmerman, 1977), and the more sophisticated dispersion model, Industrial Source Complex model (both the short- and long-term versions (Bowers et al., 1979)). The modeling assumptions used for calculating both short-term (1-hour, 3-hour, 8-hour, 24-hour) and long-term (annual) ambient air-quality impacts for each alternative and site are described in subsequent subsections of this appendix.

The final step in the analysis involves combining the model predicted incremental concentrations, and the assumed background (25 PA Code 131) concentrations, and comparing the result to national (40 CFR 50) and Commonwealth ambient air-quality standards (Table B.2-1) in order to determine whether any of the remedial-action alternatives will result in significant offsite concentration levels that may exceed the applicable standards.

B.2.2 Vehicle exhaust emission rate calculations

The exhaust emission rate for all criteria pollutants emitted by the construction and hauling vehicles (trucks, bulldozers, scrapers, rollers, etc.) used on the site were computed using AP-42 (U.S. EPA, 1977) emission factors. The emission factors for both heavy-duty diesel and gasoline-powered construction vehicles were used to calculate the emission rates of these pollutants (Table B.2-2). The maximum emission rate was calculated as follows:

$$\begin{array}{l} \text{Emission rate} \\ \text{(grams per second)} \end{array} = \frac{\begin{array}{l} \text{(Vehicle emission factor in grams per hour)} \\ \times (\% \text{ used}) \end{array}}{3600 \frac{\text{seconds}}{\text{hour}}}$$

Table B.2-1. Air quality standards

<u>National Ambient Air-Quality Standards (NAAQS) (40 CFR 50)</u>						
Pollutants	Averaging times					
	1 hour	3 hours	8 hours	24 hours	1 quarter	1 year
Carbon monoxide (mg/cu m)	40.0		10.0			
Nonmethane hydrocarbons (µg/cu m)		160.	(6:00 a.m. - 9:00 p.m.)			
Nitrogen dioxide (µg/ cu m)						100.
Ozone (µg/cu m)	235.					
Total-suspended particulates (µg/m ³)				260 150 ^a		75 ^a 60 ^b
Sulfur dioxide (µg/cu m)		1300 ^a		365.		80.
Lead (µg/m ³)					1.5	

Pennsylvania Ambient Air-Quality Standards (25 PA Code 131)

Pollutant	Averaging times			
	1 hour	24 hours	30 days	1 year
Settleable particulates (tons/square mile/month)			43	23
Beryllium (µg/m ³)			0.01	
Sulfates (µg/m ³)		30	10	
Fluorides (µg/m ³) (total soluble as hydro- gen fluoride)		5		
Hydrogen sulfide (ppm)	0.1	0.005		

^aSecondary standards.

^bValue is a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

Table B.2-2. AP-42 (U.S. EPA, 1977) emission factors for diesel- and gasoline-powered construction vehicles

Vehicle	Fuel	Emission factor (grams per hour (g/hr))					Percent used ^a
		TSP	CO	NO _x	SO ₂	HC	
Wheeled tractor	Diesel	61.5	973	451	40.9	68.4	100
Wheeled dozer	Diesel	75	335	2290	158	104	80
Scraper	Diesel	184	660	2820	210	284	80
Motor grader	Diesel	27.7	97.7	478	39.0	25.2	80
Wheeled loader	Diesel	77.9	251	1090	82.5	86.4	90
Off-highway truck	Diesel	116	610	3460	206	198	80
Roller	Diesel	22.7	83.5	474	30.5	25.2	100
Miscellaneous	Diesel	63.2	188	1030	64.7	72.0	60
Wheeled loader	Gas	13.5	7060	235	10.6	86.4	50
Miscellaneous	Gas	11.7	7720	187	10.6	255	100

^aPercent used reflects the maximum percentage of the time in an 8-hour work day that the equipment is used on the site.

The emission rate for each vehicle, alternative, and site was calculated for the total time required to perform each remedial action and the total per-period-emission rate for each pollutant for each site and alternative was computed by summing the emissions for each pollutant from all vehicles used in each period for each alternative and site. The annual average emission rate of exhaust pollutants for each site and alternative was calculated by averaging the per-period emission rates (Table B.2-3). The annual emissions were also based on a maximum of 250 days of operation (i.e., no weekend or holiday activities).

The maximum 1-hour, 3-hour, or 8-hour exhaust emission rates were determined by using the maximum emission rate in any period for each site. The maximum 24-hour emission rate was determined by dividing the value in Table B.2-3 by 3. This represents the proportion of the day that the activities are generating emissions (assuming an 8-hour work day) (Table B.2-4).

B.2.3 Construction activity emission-rate calculation

Construction emissions due to demolition and earth-moving activities on the site were calculated using AP-42 (U.S. EPA, 1977) emission factors. The EPA emission factor is based on a silt content of 30 percent in the material being used. Other variables and assumptions being used in calculating the construction activity emission rates are as follows:

1. The quantity of dust generated is proportional to the amount of activity and the area being worked.
2. The emission rate only includes particles less than 100 micrometers.
3. A conservative Thornwaite Precipitation-Evaporation Index (PE) value of 50 (i.e., a semi-arid climate) was used to reflect potential short-term, extended dry periods experienced at all sites. The annual average value of 100 for the area was used for long-term emissions.

Using these conservative assumptions, the maximum per acre emission rate for particulates is 1.2 tons per acre per month of activity, or an average of 0.42 gram per acre per second. The maximum potential-emission rate was scaled on the basis of the level of construction activity for each period. During the most active construction period (based on the number of construction vehicles and trucks working at the site) the emission rate was assumed to be equal to the rates just given. The emission rates for other periods of activity were reduced to reflect the level of activity; i.e.,

$$\begin{array}{l} \text{Emission rate} \\ \text{for period} \\ \text{(g/area-sec)} \end{array} = \frac{\text{Vehicles in period}}{\text{Maximum number of vehicles}} \times \text{Maximum emission rate} \\ \text{in any period for the site}$$

Table B.2-3. Annual average exhaust emission rate of onsite construction vehicles and trucks for criteria pollutants^a

Alternative	Site	Emission rate (g/sec)				
		TSP	CO	NO _x	SO ₂	HC
2	Canonsburg	0.057	3.60	1.65	0.15	0.057
	Burrell	0.044	2.77	0.91	0.088	0.044
3	Canonsburg	0.057	1.94	1.54	0.14	0.041
	Burrell	0.029	2.83	0.99	0.095	0.029
4	Canonsburg	0.065	3.22	2.02	0.19	0.057
	Burrell	0.044	2.77	0.91	0.088	0.044
	Hanover	0.072	2.08	2.09	0.20	0.084
5	Canonsburg	0.065	3.22	2.02	0.19	0.057
	Burrell	0.029	2.83	0.99	0.095	0.029
	Hanover	0.076	1.80	2.05	0.196	0.088

^aAnnual emission rates based on an 8-hour day, 250-day operating period.

Table B.2-4. Maximum exhaust emission rates of onsite construction vehicles and trucks for criteria pollutants^a

Alternative	Site	Emission rate (g/sec)				
		TSP	CO	NO _x	SO ₂	HC
2	Canonsburg	0.37	19.00	13.70	1.26	0.51
	Burrell	0.37	25.05	9.48	0.88	0.42
3	Canonsburg	0.37	19.34	10.28	0.97	0.28
	Burrell	0.20	17.30	6.48	0.59	0.19
4	Canonsburg	0.45	21.55	13.46	1.29	0.49
	Burrell	0.37	25.05	9.48	0.88	0.42
	Hanover	0.32	19.66	20.16	2.17	1.24
5	Canonsburg	0.45	21.55	13.46	1.29	0.49
	Burrell	0.20	17.30	6.48	0.59	0.19
	Hanover	0.66	19.66	20.16	2.17	1.24

^aThese values were used to calculate the 1-hour, 3-hour, 8-hour, and 24-hour exhaust emission rates. The maximum 24-hour exhaust emission rates can be determined by dividing these values by 3.

B.2.4 Fugitive emissions from roadways

The per-vehicle emission rate for particulates generated by vehicular activity on unpaved roadways was calculated using the approach suggested by Cowherd et al. (1979). Based on empirical data, the roadway emissions can be calculated using the following formula:

$$\text{Emission rate (lbs/vehicle-mile)} = 5.9 \left(\frac{s}{12}\right) \left(\frac{S}{30}\right) \left(\frac{W}{3}\right)^{0.7} \left(\frac{w}{4}\right)^{0.5} \left(\frac{d}{365}\right)$$

Where:

- s = Percent silt content of roadway dust.
- S = Average vehicle speed (mph).
- W = Vehicle weight (tons).
- w = Average number of wheels per vehicle.
- d = Dry days per year (precipitation 0.01 inch).

For each site the values for each of these parameters and the miles of roadway traveled on the site per hour and the per-vehicle-emission rate in grams per second are shown in Table B.2-5. These values were used in conjunction with the number of truck trips per hour at each site for each period and alternative to calculate the gram per second emission rate associated with fugitive-roadway emissions. Thus, the emission rate is given by:

$$\text{Emission rate (g/sec)} = \frac{\text{Emission rate (g/vehicle-mile)} \times \text{vehicle miles/hour}}{(3600 \text{ sec/hr})}$$

Table B.2-5. Fugitive roadway-emission-parameter values

Silt content of roadway dust	Vehicle speed	Number of wheels/vehicle	Vehicle weight	Dry days
20%	20 mph	16	40 tons	212
	<u>Miles of roadway^a/hr</u>		<u>Emission rate</u> (g/sec-vehicle)	
Canonsburg	0.57		3.36	
Burrell	0.57		3.36	
Hanover	1.9		11.5	

^aMiles of roadway estimated in engineering design.

B.2.5 Storage-pile-stacking emissions

The emissions associated with stacking fill, clay, and potentially radioactive materials from truck-loading and dumping activities were calculated. The formula (Cowherd et al., 1979) used to make this calculation is as follows:

$$\text{Emission rate (lbs/ton stacked)} = \frac{(0.0018) \left(\frac{S}{5}\right) \left(\frac{U}{5}\right) \left(\frac{H}{10}\right)}{\left(\frac{M}{2}\right)}$$

Where:

S = Silt content of materials (20 percent, based on information given in Cowherd et al., 1979).

U = Annual average wind speed (miles per hour). (Canonsburg site 4.7, Burrell site 4.7, Hanover site 9.4.)

H = Drop height (10 feet).

M = Moisture content of materials (2 percent).

The emission rates calculated for each site using these values are as follows:

Canonsburg site	3.07 grams per ton stacked
Burrell site	3.07 grams per ton stacked
Hanover site	6.14 grams per ton stacked

Each of these emission rates was multiplied by the number of tons stacked per day for each period divided by the 28,800 seconds in an 8-hour day in order to calculate the maximum per-period emission rate in grams per second.

B.2.6 Wind erosion from storage piles

The emissions associated with wind erosion from storage piles were calculated using the emission-rate formula contained in Cowherd et al. (1979). The formula used to calculate the emission rate is:

$$\text{Emission rate (lbs/ton)} = 0.05 \left(\frac{S}{1.5}\right) \left(\frac{d}{235}\right) \left(\frac{f}{15}\right) \left(\frac{D}{90}\right)$$

Where:

S = Silt content of material (20 percent).

d = Number of dry days (precipitation less than or equal to 0.01 inch) (212 days).

f = Percent of time wind speed is greater than 12 miles per hour (Canonsburg site 6.3, Burrell site 6.3, Hanover site 18.8).

D = Duration of material storage (90 days).

The percentages for wind speed greater than 12 miles per hour were obtained from meteorological measurements for 1979-1980. The duration of the 90-day storage cycle is conservative in that it is likely that most materials will be stored less than 90 days. Using this formula and the values just listed, the pound per ton emission rate for each site is as follows:

Canonsburg site	0.25 lb/ton	or	113 g/ton
Burrell site	0.25 lb/ton	or	113 g/ton
Hanover site	0.75 lb/ton	or	340 g/ton

For each period, the amount of material stored (in tons) was multiplied by the emission rate just given, and divided by the total number of seconds in the month to determine the gram per second emission rate for each period.

B.2.7 Mitigative measures for control of fugitive particulates

The fugitive-emission rate for total suspended particulates due to the remedial-action alternatives may cause violations of the total suspended-particulate standards at some sites for some of the alternatives. In order to reduce the emissions, the following mitigative measures were assumed:

1. All roadways for truck-hauling operations will be sprayed with a dust suppressant (e.g., surfactants) monthly in order to reduce fugitive roadway emissions.
2. All storage piles will be sprayed with water or other dust suppressants during dry periods to reduce fugitive wind-blown emissions.
3. Construction areas will be sprayed with water or other dust suppressants during dry periods to reduce fugitive construction emissions.

It is anticipated that these recommended measures can reduce fugitive emissions by 90 percent, based on data referenced in Cowherd et al. (1979). This is slightly above the mid-range of the expected emission reductions (80 to 95 percent). If a higher reduction (i.e., 95 percent) is achieved, the fugitive emissions would be reduced by a factor of 2. If additional total suspended-particulate-emission reductions are required, other mitigative measures, such as those listed in Table B.2-6, could be employed.

Table B.2-6. Example of reasonable precautions for prevention and control of fugitive dust

1. For land clearing, excavating, grading, earthmoving, dredging, or demolition:
 - a. Wetting down, including prewatering.
 - b. Stabilizing with chemicals.
 - c. Applying dust palliatives.
 - d. Disturbing less topsoil per unit of time, and reclaiming disturbed areas as quickly as possible.
 - e. Restricting the speed of vehicles traversing the area.
 2. For constructing, using, altering, or repairing private roads or parking facilities:
 - a. Watering, paving, or chemically stabilizing routinely used haul roads.
 - b. Restricting the speed of vehicles.
 - c. Watering down or chemically stabilizing roadway shoulders.
 - d. Enclosing or covering open-bodied trucks.
 - e. Switching from moving materials by vehicle to moving them by conveyance systems.
 - f. Covering, shielding, or enclosing the area.
 - g. Preventing and/or promptly removing dirt and mud deposits on paved roads.
 - h. Cleaning paved roads frequently.
 3. For exposure of land or materials subject to wind erosion:
 - a. Landscaping and replanting exposed areas with native vegetation.
 - b. Installing wind screens or equivalent wind-speed reduction devices.
 - c. Stabilizing the land with chemicals.
 - d. Physically stabilizing the land by covering with a non-erodible material such as gravel.
 - e. Enclosing aggregate storage piles.
-

B.2.8 Total criteria pollutant maximum emission rates

The total criteria-pollutant maximum emission rates were determined by summing the emissions from all sources. The total suspended-particulate-emission rates reflect a 90 percent reduction in fugitive emissions by the recommended mitigative measures.

Table B.2-7 includes the maximum 24-hour emission rate for particulates. The values contained in this table are associated with relatively low wind speeds (i.e., less than 6 meters per second) over an extended dry period (i.e., Thornwaite index ≤ 50). Fugitive emissions from unpaved roadways are the significant source of particulate emissions. During relatively high wind speeds (i.e., greater than 6 meters per second), wind erosion from storage piles becomes a significant source of fugitive emissions. The annual average total suspended-particulate emissions shown in Table B.2-8 reflect the average emission rate during the entire remedial-action program for each site and alternative. On an average annual basis, fugitive emissions from onsite and access roadways represent the primary particulate emission source. As in the short-term period, the fugitive emissions from pile stacking are the least significant source of fugitive particulate emissions.

The values shown in Tables B.2-2, B.2-3 and B.2-4 for gaseous pollutants and in Tables B.2-7 and B.2-8 for total suspended-particulate pollutants were used in the modeling analyses to predict the maximum ambient air-quality impacts attributable to each of the remedial-action alternatives under consideration at each site.

B.2.9 Ambient air-quality impacts

The maximum potential ambient air-quality impacts for each of the pollutants emitted during the proposed remedial actions were calculated using the EPA-approved area-source emissions Industrial Source Complex (ISC) model (Bowers et al., 1979). This model has a volume source option that is the appropriate dispersion modeling tool for this study. The Industrial Source Complex model has been used for a variety of similar source problems and is the EPA-recommended model for such studies.

The 1-hour, 3-hour, 8-hour, and 24-hour ambient concentrations were calculated using the short-term version of the model, while the annual average-ambient concentrations were calculated using the long-term version. The emission rates for criteria pollutants reported previously were used as input to the model.

Table B.2-7. Maximum 24-hour total suspended-particulate-emission rates with mitigation measures used

Alter- native	Site	Emission rate (g/sec)					Total
		Vehicle exhaust	Construc- tion activities ^a	Wind erosion ^a	Roadway emissions ^a	Pile stacking ^a	
2	Canonsburg	0.123	0.211	0.348	0.951	0.001	1.634
	Burrell	0.123	0.102	0.151	0.282	---	0.653
3	Canonsburg	0.123	0.178	0.475	0.551	0.003	1.330
	Burrell	0.066	0.190	0.044	0.282	---	0.582
4	Canonsburg	0.150	0.162	0.577	1.118	---	2.007
	Burrell	0.123	0.102	0.151	0.282	---	0.658
	Hanover	0.081	0.072	0.352	3.706	---	4.211
5	Canonsburg	0.150	0.162	0.577	1.118	---	2.007
	Burrell	0.066	0.190	0.044	0.282	---	0.582
	Hanover	0.220	0.102	0.274	3.870	0.002	4.468

^aAssumes mitigation measures that reduce emissions by 90 percent.

Table B.2-8. Annual average total suspended-particulate emission rates with mitigation measures used

Alter- native	Site	Emission rate (g/sec)					Total
		Vehicle exhaust	Construc- tion activities ^a	Wind erosion ^a	Roadway emissions ^a	Pile stacking ^a	
2	Canonsburg	0.057	0.081	0.118	0.330	0.002	0.588
	Burrell	0.044	0.055	0.022	0.077	0.001	0.194
3	Canonsburg	0.057	0.062	0.123	0.173	0.002	0.433
	Burrell	0.029	0.082	0.026	0.118	0.004	0.260
4	Canonsburg	0.065	0.081	0.245	0.481	0.006	0.878
	Burrell	0.044	0.055	0.022	0.077	0.001	0.194
	Hanover	0.072	0.037	0.152	1.376	0.003	1.640
5	Canonsburg	0.065	0.081	0.245	0.481	0.006	0.878
	Burrell	0.029	0.082	0.026	0.118	0.004	0.260
	Hanover	0.076	0.034	0.169	1.236	0.005	1.520

^aAssumes mitigation measures that reduce emissions by 90 percent.

Table B.2-9 identifies the model parameters used in the application of both the long-term and short-term versions of the ISC model (Bowers et al., 1979). The model was run in the rural mode for all sites and alternatives. A dense rectangular grid of receptors spaced at 100 meters out to 1000 meters was used to identify the peak impact areas due to the remedial-action alternatives at each site. The particle settling option was used to calculate the deposition rate for particulates as well as to calculate the ambient particulate concentration. The concentration of gaseous pollutants was determined by removing the particle settling option.

The short-term impacts of the remedial-action program were estimated on the basis of assumed most probable worst-case meteorological conditions. These included the following:

1. Wind direction was constrained to be within a 10-degree sector for 24 hours.
2. Wind speed was assumed to be 2 meters per second.
3. Mixing height was assumed to be 500 meters.
4. Stability was category 5 -- slightly stable.

These relatively low wind-speed conditions will occur on the average approximately 5 percent of the time at both the Canonsburg and Burrell sites, and at a slightly lower frequency of occurrence at the Hanover site. It is important to note that although the particulate emission rate for wind erosion is greater at higher wind-speed conditions, the selected most probable, worst-case, short-term meteorological conditions contribute to higher offsite impacts. This is primarily related to the fact that since predicted air pollutant levels are inversely proportional to wind speed, the short-term TSP concentrations at wind speeds of 6 meters per second would be a factor of 3 less than the concentration for the selected most probable low wind-speed conditions if the emissions were assumed to be equal. This is due to the fact that the total emission rates during low wind-speed conditions are only reduced by about 20 percent (due to a reduction in erosion from piles); hence, the highest offsite concentrations will occur during the low wind-speed conditions used in the analysis.

Using these assumptions and the maximum emission rate for each pollutant, alternative, and site, the maximum potential offsite 3-hour, 8-hour, and 24-hour ambient-pollutant concentrations were predicted (Table B.2-10). It should be emphasized that these concentrations represent the maximum potential short-term ambient concentration for each alternative. It is unlikely that these concentrations would occur for any prolonged period.

Table B.2-9. Model parameters used to calculate offsite impacts

Site	Source type	Source dimensions (meters)	Release height (meters)	Y ₀ (meters)	Z ₀ (meters)
Canonsburg	Volume	285 x 285	5	66	10
Burrell	Volume	270 x 270	5	63	10
Hanover	Volume	200 x 200	5	50	10

ISCST (Bowers et al., 1979) options used at all sites

Calculate (concentration = 1, deposition = 2)	ISW(1) = 1
Receptor grid system (rectangular = 1 or 3, polar = 2 or 4)	ISW(2) = 1
Discrete receptor system (rectangular = 1, polar = 2)	ISW(3) = 1
Terrain elevations are read (yes = 1, no = 0)	ISW(4) = 0
Calculations are written to tape (yes = 1, no = 0)	ISW(5) = 0
List all input data (no = 0, yes = 1, meteorological data also = 2)	ISW(6) = 2

Compute average concentration (or total deposition) with the following time periods:

Hourly (yes = 1, no = 0)	ISW(7) = 1
2-hour (yes = 1, no = 0)	ISW(8) = 0
3-hour (yes = 1, no = 0)	ISW(9) = 1
4-hour (yes = 1, no = 0)	ISW(10) = 0
6-hour (yes = 1, no = 0)	ISW(11) = 0
8-hour (yes = 1, no = 0)	ISW(12) = 1
12-hour (yes = 1, no = 0)	ISW(13) = 0
24-hour (yes = 1, no = 0)	ISW(14) = 1
Print "n"-day table(s) (yes = 1, no = 0)	ISW(15) = 0

Print the following types of tables whose time periods are specified by ISW(7) through ISW(14):

Daily tables (yes = 1, no = 0)	ISW(16) = 0
Highest and second highest tables (yes = 1, no = 0)	ISW(17) = 1
Maximum 50 tables (yes = 1, no = 0)	ISW(18) = 1

Table B.2-9. Model parameters used to calculate offsite impacts (continued)

ISCST (Bowers et al., 1979) options used at all sites (continued)

Meteorological data input method (pre-processed = 1, card = 2)	ISW(19) = 2
Rural-urban option (rural = 0, urban mode 1 = 1, urban mode 2 = 2)	ISW(20) = 0
Wind profile exponent values (defaults = 1, user enters = 2, 3)	ISW(21) = 1
Vertical potential temp. gradient values (defaults = 1, user enters = 2, 3)	ISW(22) = 1
Scale emission rates for all sources (no = 0, yes = 0)	ISW(23) = 0
Program calculates final plume rise only (yes = 1, no = 2)	ISW(24) = 2
Program adjusts all stack heights for downwash (yes = 2, no = 1)	ISW(25) = 1
Number of input sources	NSOURC = 1
Number of source groups (= 0, all sources)	NGROUP = 1
Time period interval to be printed (= 0, all intervals)	IPERD = 0
Number of X (range) grid values	NXPNTS = 9
Number of Y (theta) grid values	NYPNTS = 13
Number of discrete receptors	NXWYPT = 0
Number of hours per day in meteorological data	NHOURS = 24
Number of days of meteorological data	NDAYS = 1
Source emission rate units conversion factor	TK = 0.10000 + 007
Entrainment coefficient for unstable atmosphere	BETAL = 0.600

ISCLT (Bowers et al., 1979) options used at all sites

Number of sources	= 1
Number of X axis grid system points	= 8
Number of Y axis grid system points	= 36
Number of special points	= 0
Number of seasons	= 1
Number of wind-speed classes	= 6
Number of stability classes	= 6
Number of wind-direction classes	= 16
File number of data file used for reports	= 1
The program is run in rural mode	
Concentration (deposition) units conversion factor	= 0.10000000+007
Acceleration of gravity (meters/sec = 2)	= 9.800
Height of measurement of wind speed (meters)	= 10.000
Entrainment parameter for unstable conditions	= 0.600
Entrainment parameter for stable conditions	= 0.600
Correction angle for grid system versus direction data north (degrees)	= 0.000

Table B.2-9. Model parameters used to calculate offsite impacts (continued)

ISCLT (Bowers et al., 1979) options used at all sites (continued)

Decay coefficient	= 0.00000000
Calculate (concentration = 1, deposition = 2)	ISW(1) = 1 and 2
Receptor grid system (rectangular = 1, polar = 2)	ISW(2) = 2
Discrete receptor system (rectangular = 1, polar = 2)	ISW(3) = 2
Terrain elevations are read (yes = 1, no = 0)	ISW(4) = 0
Calculations are written to take (yes = 1, no = 0)	ISW(5) = 0
List all input data (3 = print all input data)	ISW(6) = 3
Print seasonal or annual calculations (2 = annual only)	ISW(7) = 2
Print concentration (deposition) data from all or one source (1 = one source)	ISW(8) = 1
Rural/urban option (1 = urban model 1, 2 = urban model 2, 3 = rural)	ISW(9) = 3
Print maximum 10 concentrations/depositions (yes = 0, no = 1)	ISW(10) = 0
Not applicable ISW(11) to ISW (18)	ISW(11) - ISW(18) = 0
Plume rise independent of downwind distance (yes = 0, no = 1)	ISW(17) = 1
Stack tip downwash is applied (yes = 1, no = 0)	ISW(20) = 0

Table B.2-10. Maximum predicted ambient air-quality impacts due to remedial action^a

Alter- native	Site	TSP ^b (µg/m ³)		SO ₂ (µg/m ³)			CO (mg/m ³)		NO _x (µg/m ³)	HC (µg/m ³)	Settleable particulates (tons/sq mi-month)
		Annual ^c	24-hour	Annual ^c	3-hour	24-hour	1-hour	8-hour	Annual	3-hour	
2	Canonsburg	5.9	53	4.9	124	41	1.90	1.86	54	50	0.33
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
3	Canonsburg	4.4	43	4.6	96	31	1.93	1.89	50	28	0.24
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
4	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
	Hanover	9.0	147	3.2	215	68	1.97	1.81	33	123	3.15
5	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
	Hanover	8.5	156 ^d	3.2	215	68	1.97	1.87	33	123	2.86
Background concentration		67 ^e	74 ^e	47 ^e			1.14 ^f		20 ^f		18 ^e
National primary standard (40 CFR 50)		75	260	80		365	40.0	10.0	100	160	
National secondary standard (guideline) (40 CFR 50)		60 ^g	150		1,300		40.0	10.0	100		
Pennsylvania standards (25 PA Code 131) (same as National Primary and Secondary Ambient Air Quality Standards 40 CFR 50)) 43											

^aIncremental levels must be added to background to determine exceedances of standards.

^bAssumes reduction of TSP by 90 percent due to mitigation measures.

^cAssumes an 8-hour per day, 5-day per week, 50-week per year work schedule.

^dSecondary-standard exceedance.

^eMeasured background; TSP and settleable particulates from 1981 data collected at Washington, Pennsylvania; SO₂ from 1981 data collected at Florence, Pennsylvania.

^fEstimated background based on suggested rural background concentrations (U.S. EPA, 1978).

^gValue is a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

The annual average ambient-pollutant concentration for the peak offsite receptor was predicted using the ISC long-term model (Bowers et al., 1979) in conjunction with the emission rates reported previously, and the 1979 meteorological data for each site. For the Canonsburg site onsite meteorological data were available and used. These data were adjusted for the topographical differences between the Burrell and Canonsburg sites, and the modified data were used as input for the Burrell site analysis. Meteorological data collected at the Pittsburgh airport were used for the Hanover site model. The airport data are directly applicable to the Hanover site because of its proximity to the site (13 miles), and its similar topographic setting. The annual average calculated concentrations and the approximate criteria pollutant National (40 CFR 50) and Commonwealth (25 PA Code 131) Ambient Air Quality Standards for all criteria pollutants are shown in Table B.2-10.

B.2.10 Impacts of settleable-particulate matter

The amount of settleable-particulate matter potentially generated at each site under each remedial-action alternative was calculated using the deposition option of the ISCLT (Bowers et al., 1979) model in conjunction with information on the particle size distribution of soils near each site. The size distribution and settling velocity used in the model is contained in Table B.2-11. Only particles less than 100 μm were included since these are the largest particles likely to be transported off the site. Table B.2-10 includes the maximum potential offsite settleable particulate rate. The predicted impact based on the incremental impact due to the project, plus the background value, is well below the Pennsylvania standard (25 PA Code 131) for all sites and alternatives.

B.2.11 Background concentrations used in analysis

In order to compare the impact of the proposed alternative remedial-action plans to the NAAQS (40 CFR 50), the incremental impact due to the project alternatives was added to the background value measured in the vicinity of the sites. The annual geometric mean value for total suspended particulates measured at the Washington, Pennsylvania site was used for the annual total suspended particulates background. This value was increased by 10 percent (as suggested by EPA (Belanger, 1983)) in order to obtain an arithmetic average value that was used for the 24-hour background value. The average background sulfur dioxide concentration was obtained from monitoring data at the Florence, Pennsylvania site. The background values used for carbon monoxide, and nitrogen oxides were based on rural background values suggested by EPA in their modeling guidelines (EPA, 1978). The background value used for settleable particulates is based on data from the official Commonwealth rural background site located in Perry County. A background hydrocarbon value was not available, however, the predicted hydrocarbon levels are quite low relative to the NAAQS (40 CFR 50) (which has been withdrawn by the EPA (48 FR 628-629, January 5, 1983)) so that it is highly unlikely that a violation of the NAAQS (40 CFR 50) will occur.

Table B.2-11. Particle size information and settling velocities based on survey data for 0-2 foot soil samples in the vicinity of the sites

Particle size range (μm)	Mass fraction ^a (%)	Mass median diameter (μm)	Settling velocity ^b (m/s)
Less than 5	45	2.5	0.0001
5 to 10	17	7	0.002
10 to 50	21	30	0.04
50 to 100	<u>17</u>	75	0.25
	100		

^aParticles less than 100 μm .

$$b_{V_s} = \frac{\rho g r^2}{g u}$$

Where:

ρ = Particle density, 1.5 g/cu cm.

r = Particle radius (cm).

u = Absolute viscosity of air - 1.83×10^{-4} gm/cm sec.

g = Acceleration rate of gravity - 980 cm/sec.

REFERENCES FOR APPENDIX B

- Belanger, W., 1983. Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Telephone conversation with Dr. J. Barone, Roy F. Weston, Inc., West Chester, Pennsylvania, March 17, 1983.
- Bowers, J. R., J. R. Bjorkland, and J. C. Cheney, 1979. Industrial Source Complex (ISC) Dispersion Model User's Guide, Volumes 1, 2, and 3, EPA-4501-4-79-030, Washington, DC.
- Busse, A. D., and J. R. Zimmerman, 1977. "User's Guide for the Climatological Dispersion Model," National Technical Information Service, PB-277.346, Washington, DC.
- Cowherd, C., Jr., R. Bohn, and T. Cuscino, Jr., 1979. Iron and steel plant open source fugitive emission evaluation, Midwest Research Institute, Kansas City, Missouri, Prepared for the Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina.
- U.S. EPA (Environmental Protection Agency), Office of Air and Waste Management, Office of Air Quality Planning and Standards, 1977. Compilation of Air Pollutant Emission Factors, AP-42, third edition, Research Triangle Park, North Carolina.
- U.S. EPA (Environmental Protection Agency), Office of Air Quality Planning and Standards, 1978. "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)," EPA-450/2-78019, Research Triangle Park, North Carolina.

Appendix C

SOILS AND GEOLOGICAL INFORMATION

Appendix C.1
SOILS INVESTIGATIONS

Appendix C.1

SOILS INVESTIGATIONS

C.1.1 Canonsburg site

C.1.1.1 Background

A detailed soils investigation of the Canonsburg site was conducted in April 1979. A total of 14 test pits were excavated (Figure C.1-1) and described. The test pit descriptions are given in Table C.1-1. As part of the March 1982 radiological survey of Area C, five additional soil borings were made in this area. The locations of these borings are also shown on Figure C.1-1, and their descriptions are given in Table C.1-2.

Area A of the Canonsburg site consists of buildings, parking lots, a railroad line, and lawns. The soils identified in Area A were classified as made-land or urban land. The original soil profiles in Area A have been disturbed or completely destroyed with the construction of buildings, parking lots, and a railroad line. A total of four test pits were excavated in Area A (test pits 7, 8, 13, and 14). Test pit 7 was excavated in a lawn area adjacent to Strabane Avenue. The soil consisted of a surface layer of grey-black, heavy silt loam underlain by a mottled and gleyed yellowish-brown, silty clay loam subsoil. Moderately weathered shale bedrock was encountered at 75 inches. In the area of test pit 8, fill material covered the surface. The subsoil described was a mottled and gleyed yellowish-brown silty clay loam. An abandoned waste disposal line was encountered at 36 inches. Test pits 13 and 14 in Area A were similar to the other test pits. In Area A water was encountered in only one of the test pits--at about 8 feet in test pit 13 along the northern property line.

Area B of the Canonsburg site was initially mapped by the U.S. Department of Agriculture, Soil Conservation Service (USDA-SCS) as a flood plain of Chartiers Creek. A major portion (estimate 85 percent) of Area B has since been filled with about 8 feet of dredged material. The unfilled area is still in the flood plain of Chartiers Creek and is subject to flooding. A total of six test pits were excavated in Area B. Test pits 1, 2, 3, and 4 were excavated in the filled area. The test pits showed that 51 to 109 inches of fill material overlie the original soil material. The fill material consisted of cinders, wood, metal, bricks, and silty clay to sandy soil material. In test pit 1 the fill was underlain by sandy soil material, while test pits 2, 3, and 4 were underlain by a silty clay loam. Water was encountered in all three test pits. Test pits 5 and 6 were dug along the present flood plain of Chartiers Creek. The soil profiles were typical flood-plain soil profiles, showing deposition and stratification. The soil encountered fit the Soil Conservation Service description for Melvin silt loam.

**FIGURE C.1-1
TOPOGRAPHY AND LOCATION OF SOIL TEST PITS
AND INFILTRATION/PERCOLATION TEST AREAS
EXPANDED CANONSBURG SITE**

Table C.1-1. Test pit descriptions^a -- Canonsburg site

Test pit	Description
<u>Test pit 1</u>	
0 - 8 inches	Channery silt loam -- very dark gray; friable.
8 - 84 inches	Variable fill material -- cinders, oily roots to 8 inches only, bricks, sandy loam to silty clay loam soil material, wood, friable to firm; black, variegated in color.
84 - 98 inches	Fine sandy loam -- black.
98+ inches	Sand -- gray; stratified.
<u>Test pit 2</u>	
0 - 6 inches	Silt loam fill and rock -- variegated.
6 - 51 inches	Rock fill with some wood and metal.
51 - 108 inches	Silty clay loam -- dark gray brown.
Water perched on top of clay -- 51 inches.	
Test pit filled up -- water rushed in through the stone fill.	
<u>Test pit 3</u>	
0 - 7 inches	Silt loam -- gray; 15 percent coarse fragment.
7 - 78 inches	Fill material -- variegated in nature, ranging from brown to gray, black in color; stumps.
108+ inches	Silty clay loam -- brown and gray.
Water seeping in at 64 inches.	
<u>Test pit 4</u>	
0 - 6 inches	Channery silty clay loam -- gray.
6 - 40 inches	Silty clay loam -- variegated brown.
40 - 96 inches	Silty clay loam -- gray; wood, metal in fill.
Test pit caved in.	

^aTest pit locations are shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-1. Test pit descriptions^a -- Canonsburg site (continued)

Test pit	Description
<u>Test pit 5</u>	
0 - 8 inches	Silty clay loam -- gray.
8 - 12 inches	Silty clay loam -- gray brown.
12 - 47 inches	Silty clay loam -- brown.
47 - 55 inches	Silty clay loam -- dark gray.
55 - 96+ inches	Silty clay loam -- brown.
Water at 40 inches.	
<u>Test pit 6</u>	
0 - 7 inches	Heavy silt loam -- dark brown.
7 - 49 inches	Silty clay loam -- brown mottled.
49 - 69 inches	Heavy silt loam -- grayish brown, gleyed.
69+ inches	Silty clay loam -- dark gray, gleyed
Water seeping in at 60 inches.	
<u>Test pit 7</u>	
0 - 8 inches	Heavy silt loam -- gray black.
8 - 30 inches	Silty clay loam -- yellow brown.
30 - 49 inches	Silty clay loam -- yellow brown, mottled, manganese stains.
49 - 75 inches	Silty clay loam -- gleyed, manganese stains.
75+ inches	Moderately weathered shale.
No water detected.	
<u>Test pit 8</u>	
0 - 11 inches	Fill materials, cinders, block.
11 - 16 inches	Layered silty clay loam -- yellow and brown.
16 - 40 inches	Silty clay loam -- yellow brown.
40+ inches	Mottled silty clay -- gray.
Sewerage stone at 36 inches.	
<u>Test pit 9</u>	
0 - 14 inches	Fill -- cinders, coal, wood, loamy; gray black, firm.
14 - 69 inches	Fill, loam -- dredged material, red bricks.
Water at 65 inches.	

^aTest pit locations are shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-2. Soil boring descriptions^a -- Canonsburg site, Area C
(continued)

Bore hole (depth in feet)	Description
<u>Bore hole SB-207</u> (continued)	
8.0 - 10.0	Yellow brown clay loam.
10.0 - 10.5	Yellow brown clay loam.
10.5 - 12.0	Gray clay, 2.5Y5/2.
<u>Bore hole SB-208</u>	
0.0 - 1.5	Reddish loam, brick chips, 2.5YR5/8.
1.5 - 2.0	Gray and red mixed loam.
2.0 - 3.5	Reddish brown sandy clay loam, 5YR4/6.
3.5 - 4.0	Yellow brown sandy clay loam.
4.0 - 5.5	Yellow brown sandy clay loam, 10YR4/6.
5.5 - 6.0	Reddish brown sandy loam.
6.0 - 7.0	Reddish brown sandy clay loam.
7.0 - 8.0	Gray clay.
<u>Bore hole SB-209</u>	
0.0 - 1.0	Red brick material and black coal pieces.
1.0 - 2.0	Yellow brown loam, mottled M/D, 10YR4/6.
2.0 - 4.0	Yellow brown clay mottled M/D, 10YR4/6.
4.0 - 4.5	Yellow brown clay mottled M/D, 10YR4/6.
4.5 - 6.0	Gray clay.
6.0 - 6.5	Gray clay.
6.5 - 7.8	Olive gray clay.

^aSoil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Table C.1-2. Soil boring descriptions^a -- Canonsburg site, Area C

Bore hole (depth in feet)	Description
<u>Bore hole SB-206</u>	
0.0 - 1.5	Black fill coal pieces.
1.5 - 2.0	Orange sandy clay.
2.0 - 4.0	Dark grey to black. Broken brick pieces in sandy clay loam, 10YR3/2.
4.0 - 6.0	Sandy clay loam, mottled, more brown in color, 10YR4/4.
6.0 - 7.5	Sludge material, sandy clay, 10YR4/4.
7.5 - 8.0	Bright yellow sandy clay, 10YR6/8.
8.0 - 10.0	Brown clay, 10YR4/4. 6-10 combined sample.
10.0 - 10.5	Sandy clay.
10.5 - 12.0	Yellow brown sandy clay.
12.0 - 14.0	Yellow brown sandy clay.
14.0 - 15.0	Yellow grey mixed clay.
<u>Bore hole SB-207</u>	
0.0 - 1.0	Red broken bricks, loam.
1.0 - 2.0	Black N 3/0 sandy loam, pieces of coal, metallic.
2.0 - 3.0	Reddish black sandy clay loam.
3.0 - 4.0	Black, metallic.
4.0 - 5.0	Reddish brown, sandy clay loam, 10YR4/4.
5.0 - 6.0	Gritty black sandy clay loam, 11YR3/0.
6.0 - 8.0	Slop/mud and water -- no return.

^aSoil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Table C.1-2. Soil boring descriptions^a -- Canonsburg site, Area C
(continued)

Bore hole (depth in feet)	Description
<u>Bore hole SB-209</u> (continued)	
7.8 - 8.0	Dark gray to black clay, N 3/0.
8.0 - 10.0	Dark gray to black clay with a green tint.
<u>Bore hole SB-210</u>	
0.0 - 3.5	Black metallic (coal pieces) compact, red brick chips.
3.5 - 5.5	Red bricks, red brown sandy clay loam.
5.5 - 6.0	Red brown sandy clay loam.
6.0 - 7.5	Yellow brown clay loam, mixed with gray mottled, 10YR4/6.
7.5 - 9.0	Yellow brown clay loam, mixed with gray mottled, 10YR4/6.
9.0 - 9.5	Red sandy loam, 5YR5/4.
9.5 - 11.5	Reddish brown sandy clay loam.
11.5 - 12.0	Reddish brown sandy clay loam.
12.0 - 13.5	Gray clay.
13.5 - 14.5	Gray clay.
14.5 - 15.0	Grey and yellow brown mottled clay.
15.0	Bedrock.

^aSoil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Four test pits were excavated in Area C. The surface of the area is covered with 6 to 14 inches of red dog. The underlying material was dredged-soil material from Chartiers Creek. The dredged fill consisted of cinders, sediment, bricks, coal, wood, and other debris. Underlying the dredged-fill material was old flood-plain soil of Chartiers Creek. Water was encountered in all four of the test pits from a shallow depth of 37 inches in test pit 12, to 75 inches in test pit 11.

Additional data were collected during the 1982-1983 drilling program. Soil samples were collected with Shelby tubes and split spoons for laboratory analysis. Subsections D.2.2.2 and D.2.2.3 describe the sampling methods used.

C.1.1.2 Soil analysis

Soil samples were collected from the test pits and analyzed for particle size, soil pH, percent organic matter, and cation exchange capacity. The results of the analyses are shown in Table C.1-3.

A wide range can be seen for each parameter analyzed. Soil pH within the dredged material varied from a low of 2.8 to a high of 7.2. The low pH was only found in Area C where the red dog material was placed on the surface. In Areas A and B, the soil pH ranged from 4.9 for the original soil material, to a high of 7.5 for the alluvium along Chartiers Creek.

The percent organic matter varied from a low of 0.10 percent for natural soil material, to a high of 11.09 percent for the dredged fill material. The cation exchange capacity also followed the same trend with a low of 9.4 milliequivalent per 100 grams of soil for original soil material, to a high of 31.7 milliequivalent for the dredged fill. The high cation exchange capacity of 31.7 for the dredged fill was due to the high organic matter content of the sample and not due to a high clay content.

The particle size analysis showed a range of sandy loams to silty clay loams. The coarser materials (sandy loams) were found in the dredged material, and the finer silty and clayey soils were found in the flood-plain soil materials and in the original and disturbed in-situ soil material. Sieve analysis results are shown in Table C.1-4.

C.1.1.3 Soil permeability and soil infiltration tests

The permeability and infiltration rates of the soils were determined by onsite testing. The permeability of the soils was determined by the standard percolation method (U.S. Department of Health, Education, and Welfare, 1967). Soil infiltration rates were determined by the single-ring method (Bertrand, 1965). The tests were run at the ground surface and at depths of 12 and 24 inches. The results of the permeability and infiltration tests are shown in Tables C.1-5 and C.1-6. The locations of the tests are shown on Figure C.1-1.

Table C.1-3. Soil analysis results -- Canonsburg site

Sample location ^a (test pit no.)	Sample depth (in.)	Particle size hydrometer fractionation								Soil pH	Organic matter (%)	Cation exchange capacity (meq/100 g)	
		Percent <2 mm	Percent ≥ 2 mm	3 min.	10 min.	30 min.	90 min.	270 min.	720 min.				
C.1-9	1	Fill	50.8	49.2	0.076	0.141	0.247	0.435	0.762	1.245	7.4	2.85	22.8
	4	7-40	51.8	48.2	0.071	0.133	0.237	0.419	0.743	1.229	7.2	1.71	12.9
	4	40+	44.3	55.7	0.072	0.135	0.239	0.425	0.744	1.229	7.4	3.01	12.0
	6	7-49	27.7	72.3	0.068	0.130	0.234	0.417	0.738	1.216	7.5	1.09	13.3
	6	49-69	4.2	95.8	0.073	0.135	0.240	0.422	0.744	1.229	7.2	1.70	16.3
	7	8-30	30.6	69.4	0.065	0.125	0.225	0.403	0.718	1.202	5.2	0.12	14.7
	7	30-60	47.0	53.0	0.065	0.123	0.221	0.400	0.718	1.199	4.9	0.10	15.4
	9	12-36	48.8	51.2	0.069	0.129	0.231	0.412	0.735	1.216	3.1	6.31	11.9
	11	0-9	60.3	39.7	0.072	0.134	0.238	0.427	0.750	1.240	3.5	3.48	13.4
	11	9-37	45.5	55.5	0.069	0.128	0.277	0.409	0.731	1.216	2.8	11.09	31.7
	11	37-69	37.5	62.5	0.071	0.134	0.238	0.419	0.743	1.232	4.3	1.52	14.6
	13	18-23	39.6	60.4	0.069	0.131	0.237	0.422	0.748	1.250	6.5	0.91	10.0
	13	23-39	28.4	71.6	0.069	0.130	0.235	0.417	0.735	1.208	6.2	0.10	9.4
	13	39+	37.8	62.2	0.075	0.138	0.241	0.424	0.738	1.208	4.9	0.11	11.0

^aTest pits shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-4. Sieve analysis results -- expanded Canonsburg site

Well ^a	Depth (ft)	Unified class- fication	LL	PI	Sieve analysis -- accumulative percent passing									Moist
					200	100	40	10	4	3/8	1/2	3/4		
301S	2.0-4.0	SM	NV	NP	34	51	96	100						11.7
301S	6.0-7.5		--	--	76	80	90	100						32.7
301S	5.0-7.0	MH	71	31	69	73	87	99	100					37.3
302S	2.0-4.0	SM	32	6	30	35	45	62	60	73	---	100		7.0
302S	14.0-16.0	CL	47	23	80	93	98	99	100					33.4
303S	7.0-8.0	ML	37	7	95	97	99	100						20.3
304S	5.0-6.5	ML	42	16	95	96	98	100						15.8
305S	5.0-6.0	CL	37	16	74	79	87	93	95	96	---	100		23.0
305S	9.0-10.0		---	---	72	87	99	100						13.8
306S	0-2.0	SM	31	3	21	25	36	59	74	91	---	100		37.5
306S	8.0-10.0	CL	32	12	52	68	99	100						25.7

^aWell locations are shown on Figure D.2-2.

Source: Weston (1983) field data; laboratory analyses conducted by Sergeant, Hauskins, and Beckwith, Albuquerque, New Mexico.

Table C.1-5. Percolation and infiltration rates -- Canonsburg site

Test pit ^a	Percolation rate (in./sec)	Percolation depth (in.)	Infiltration ^b rate (in./sec)
1	1.9×10^{-5}	0	1.3×10^{-3}
2	1.1×10^{-5}	0	--- ^c
3	1.6×10^{-4}	12	7.0×10^{-4}
4	1.7×10^{-4}	24	5.5×10^{-6}
5	6.2×10^{-5}	12	3.1×10^{-3}
6	5.9×10^{-4}	0	9.4×10^{-4}
7	2.2×10^{-4}	0	3.9×10^{-3}
8	1.6×10^{-3}	0	2.9×10^{-3}
$\bar{x}^d$	3.5×10^{-4}	6	2.2×10^{-3}

^aTest pit locations are shown on Figure C.1-1.

^bInfiltration tests were performed in the top 4 inches of soil.

^cNo test performed.

^d $\bar{x}$ = average.

Source: Weston (1979) field data.

Table C.1-6. Soil permeability --- expanded Canonsburg site

Well location ^a	Well depth	Permeability ^b (in./sec)
302S	15 ft 8 in. to 15 ft 9 in.	2.11×10^{-7} to 2.46×10^{-7}
303S	11 ft 6 in. to 11 ft 8 in.	4.09×10^{-8} to 3.59×10^{-8}
304S	5 ft 3 in. to 5 ft 5 in.	1.76×10^{-8} to 3.14×10^{-8}
305S	10 ft to 10 ft 2 in.	3.98×10^{-8} to 3.39×10^{-8}

^aWell locations are shown on Figure D.2-2.

^bLaboratory analyses conducted by Sergeant, Hauskins, and Beckwith, Albuquerque, New Mexico, using consolidation apparatus.

The percolation rate ranged from 1.1×10^{-5} inches per second to 1.6×10^{-3} inches per second, depending on the type of soil. The natural in-situ soils, both alluvial and residual, showed permeabilities of 1.7×10^{-4} to 5.9×10^{-4} inches per second. These permeabilities are consistent with the permeabilities determined for these upland and flood-plain soil series by the U.S. Soil Conservation Service (USDA-SCS, Washington County, Pennsylvania, unpublished data).

The permeability of the dredged fill areas (Areas B and C) ranged from 1.1×10^{-5} to 2.2×10^{-4} inches per second. The slower permeabilities are due to the particle size of the dredged material. The material, since it is an alluvial deposit, will vary considerably in texture. The permeabilities found are typical for fine-textured alluvial deposits.

C.1.1.4 Soil loss

The current rate of soil loss from the Canonsburg site was determined using soil conditions and the Universal Soil Loss Equation. The result is given in Table A.5-1.

C.1.2 Burrell site

Twelve test pits were excavated to examine the soils at the Burrell site (Figure C.1-2). Soil profile descriptions were completed at each test pit and are presented in Table C.1-7. Each test pit consisted of various fill materials, such as wooden planks, metal strips, slag, gravel, and bottles. The test pits contained very little profile development as evidenced by the lack of horizonation. The few layers occurring in the profiles were caused by the different fill materials being deposited at various times. The USDA-SCS has classified these soils as "made land" (USDA-SCS et al., 1960). According to the USDA-SCS, made land is defined as a miscellaneous land type that consists of areas where the soil material has been covered, moved, or graded by man. In some areas the original soil has been covered or destroyed by earth-moving operations.

Percolation and infiltration rates for the Burrell site soils were determined using these test pits. The results are given in Table C.1-8.

C.1.3 Hanover site

Twelve test pits were excavated to examine the soils at the Hanover site (Figure C.1-3). Soil profile descriptions were completed for each test pit and are presented in Table C.1-9. Each test pit contained mostly rock fragments with only a small amount of fines present. Very little soil profile development (verified by the absence of horizons or layers) was observed at each pit.

The USDA-SCS (1979) outlines an interim classification system that attempts to provide a basis for uniformly identifying soils developed in mine spoil. Under this system, all of the soils at the Hanover site would be classified as Udorthents, sandstone, and shale. The classification of these soils means that they are young in age, contain mostly sandstone and shale boulders, and are found in a humid moisture regime.

Percolation tests were run on the soils in these test pits, and the results are given in Table C.1-10.

Table C.1-7. Test pit descriptions^a -- Burrell site

Test pit	Description
<u>Test pit 1A</u>	
Total depth -- 6 feet	
Percolation hole depth -- 7 feet	
0-12 inches	N2/0. Very abrupt boundary, probably plowed when cover was planted, friable, massive structure.
12-24 inches	10YR5/3. Massive structure, friable, contains metal strips around 24 inches long, a few snail shells (land snails), very moist conditions, gravelly sandy loam.
36 inches	Olive green/gray silty clay, mixed with gravelly sandy loam, massive to weak subangular, blocky structure, friable.
48 inches	Very wet layer, silty clay and loam textures, massive structure, friable.
<u>Additional notes:</u>	
<p>The test pit contained bricks, boulders (chunks of fine-grained sandstone), and a few pieces of wood. This pit was not as gravelly as 2A, but had more gravel than the other pits. There seemed to be more natural soil than fill material. This pit looked the least like fill of all of the pits. The vegetation was a cover of grasses and broadleaves (100 percent cover). Samples were taken at depths of 6, 24, 36, and 48 inches.</p>	
<u>Test pit 1B</u>	
Total depth -- 2 feet 4 inches	Horizonation was similar to test pit 1A.
Percolation-hole depth -- 3 feet 4 inches	However, at 24 inches there was a gravelly clay loam. All layers were firm and very moist with fine gravels.
<u>Additional notes:</u>	
<p>The test pit contained a few land snails, a lot of bricks, but no pieces of wood, and a few metal pieces. This pit was a cross between test pits 1A and 2A, but was most like test pit 1A. The vegetative cover (100 percent) consisted of grasses, sweet clover, and broadleaf weeds. Samples were taken at 6 inches.</p>	

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions^a -- Burrell site (continued)

Test pit	Description
<u>Test pit 2A</u>	
Total depth -- 5 feet	
Percolation hole depth -- 6 feet	
0- 6 inches	Contains 85 percent gravel chips, no structure, looks like gravel from a railroad bed.
6-15 inches	Firm to very firm, compacted by some type of machinery, massive structure, no other apparent horizonation.
<u>Additional notes:</u>	
This test pit contained a lot of smaller gravels and large cobbles, coal slag, bricks, wood, excess metal, twisted metal rods, and rubber hoses. The pit also contained many firm zones and oily or shiny spots in some areas. The color was primarily N2/0 (very black). Some chemical odors were also noted, possibly diesel fuel. The ground cover contained crown vetch, sweet clover, weeds, and grasses (covering approximately 90 percent). This pit contained the most gravel of all of the test pits (approximately 60 percent of the pit was gravel). Samples were taken at 4 inches and 24 inches.	
<u>Test pit 2B</u>	
Total depth -- 24 inches	This test pit was flooded to within 3 inches of the surface. It was similar to test pit 2A.
<u>Test pit 3A</u>	
Total depth -- 4 1/2 feet	
Percolation hole depth -- 5 1/2 feet	
0- 8 inches	Friable, weak granular structure, contains fine gravels.
8-18 inches	Brittle but very firm layer, massive structure.
18-24 inches	A white and orange conglomerate (chemical by-product ?), very firm, massive.

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions^a -- Burrell site (continued)

Test pit	Description
<u>Test pit 3A (continued)</u>	
24-38 inches	Red-brown sandy loam, massive structure.
38-50 inches	Black and dark gold loose material, massive fill.
<u>Additional notes:</u>	
This material looked like natural material but was fill. There were rounded cobble-size material scattered throughout the soil profile. Some metal pieces, wood, and bricks were present, but were few in number. The vegetative cover (80 percent) consisted of crown vetch and foxtail. Samples were taken at 20, 30, and 40 inches.	
<u>Test pit 3B</u>	
Total depth -- 2 feet	
Percolation hole depth -- 32 inches	
Similiar to test pit 3A with some concrete pieces also present.	
<u>Test pit 4A</u>	
Total depth -- 4 feet	
Percolation hole depth -- 56 inches	
0-24 inches	Very moist, water trickling in, fine gravels, sandy loam, 10YR3/2, faint mottling, very friable. At 20 inches very firm, compacted coal-mine waste, fine coal pieces mixed with red slag layer.
24-28 inches	Red slag, very firm, clayey, pieces of coal.
36 inches	Concrete pieces, tie rods (metal), smaller gravels than test pits 5 and 6.
48 inches	Very firm, compacted, wire boxes, bricks, weathered rock, very sandy, possibly boiler waste, very lightweight, massive.

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions^a -- Burrell site (continued)

Test pit	Description
<u>Test pit 4A</u> (continued)	
<u>Additional notes:</u>	
This test pit was located in a swampy area with 80-percent vegetative cover consisting of low grasses and broadleaves. There was slag or rocks at the bottom of the percolation hole that covered the entire bottom of the pit. There was slight unpleasant chemical odor coming from the pit. Samples were collected at 10, 24, and 40 inches.	
<u>Test pit 4B</u>	
Total depth -- 2 1/2 feet	
0-10 inches	Loose, fine gravels, sandy loam, very wet.
18 inches	
Red layer similar to that in test pit 4A.	
<u>Additional notes:</u>	
The test pit flooded to within 1 foot of the surface, therefore, no percolation test was run. A few pieces of wood and bricks were noted in the pit. The vegetation consisted of grasses and tall broadleaves (80 percent cover). No samples were collected.	
<u>Test pit 5A</u>	
Total depth -- 4 1/2 feet	
Percolation hole depth -- 5 1/2 feet	
0- 6 inches	Friable, weak subangular blocky structure, small amounts of gravel.
6-10 inches	Red crumbled brick layer, firm, discontinuous.
24 inches	Firm, very dark, coal fragments, moist, cobble-size material, structure is weak, subangular and blocky due to compaction.

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions^a -- Burrell site (continued)

Test pit	Description
<u>Test pit 5A (continued)</u>	
30 inches	Yellowish gray sandy clay loam, waste product, white porcelain or glass pieces mixed in, possibly insulators from electric lines.
48 inches	Olive green to gray silty clay, plastic, sticky, friable.
<u>Additional notes:</u>	
There were more color variations (bricks) and different layers of fill in this pit. There was virtually no wood or was it as gravelly as test pit 6A. There were bricks and metal bars at a depth of 36 inches. The vegetation consisted of grasses and broadleaf weeds (100 percent cover). Samples were collected at 6, 10, 30, and 48 inches.	
<u>Test pit 5B</u>	
Total depth -- 3 feet Percolation hole depth -- 4 feet	
0-10 inches	Loose, cobbles, no structure.
30 inches	Band of weathered blue gray shale, very firm.
35-37 inches	Small, discontinuous band of weathered sandstone or ironstone, loamy sand, dark rusty color, single grain.
18 and 42 inches	Pockets of crumbled red brick.
<u>Additional notes:</u>	
This test pit contained many wooden boards and metal cable pieces. The vegetation consisted of grasses as well as broadleaf weeds with some moss. Samples were collected at 6 inches and 30 inches.	

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions^a -- Burrell site (continued)

Test pit	Description
<u>Test pit 6A</u>	
Total depth -- 4 feet	
Percolation hole depth -- 5 feet	
0- 6 inches	Weak, friable, massive structure.
15 inches	Very firm slag material.
6-30 inches	Firm, metal strips and bars, dark color (N2/0), massive structure.
30 inches	Small clay layer.
48 inches	Friable, massive, interbedded white chemical by-product.
<u>Additional notes:</u>	
This test pit contained iron strips, electrical lines, railroad ties, bottles, bricks, rounded gravel, coal slag, and sandstone. The cover vegetation (approximately 70 percent) consisted of mosses, low-lying broadleaf cover, and tall grasses. Samples were taken at 15, 30, and 48 inches.	
<u>Test pit 6B</u>	
Total depth -- 3 feet	
Percolation hole depth -- 4 feet	
10 inches	Gravelly, black (N3/0), very coarse material, compacted layer (roadbed gravel?).
30 inches	Mottled, gray brown, loam, higher clay content, massive structure, firm.
<u>Additional notes:</u>	
This test pit contained many wooden boards, railroad ties, bricks, cement chunks, metal trash, and pieces of rubber. The ground cover (70 percent) consisted of broadleaf cover and grasses. Samples were collected at depths of 10 and 30 inches.	

^aTest pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-8. Percolation and infiltration rates -- Burrell site

Test pit ^a	Percolation rate (in./sec)	Test depth (in.)	Infiltration rate (in./sec)
1A	2.6×10^{-3}	84	2.2×10^{-3}
1B	9.2×10^{-4}	40	8.3×10^{-4}
2A	2.4×10^{-3}	72	2.0×10^{-3}
2B	Flooded	--	7.3×10^{-3}
3A	6.7×10^{-4}	66	6.2×10^{-3}
3B	2.8×10^{-3}	32	9.7×10^{-3}
4A	1.2×10^{-3}	56	6.7×10^{-4}
4B	Flooded	--	2.2×10^{-3}
5A	8.3×10^{-3}	0	1.7×10^{-4}
5B	1.4×10^{-3}	48	1.5×10^{-3}
6A	1.2×10^{-3}	60	1.7×10^{-3}
6B	7.8×10^{-4}	48	9.2×10^{-3}
$\bar{X}^b$	1.5×10^{-3}	57.2	3.6×10^{-3}

^aTest pit locations are shown on Figure C.1-2.

^b $\bar{X}$ = average.

Source: Weston (1982) field data.

TP1 SOIL TEST PIT LOCATION/DESIGNATION

1240 SURFACE CONTOUR — ELEVATION (FT)

FIGURE C.1-3
TOPOGRAPHY AND LOCATION
OF SOIL TEST PITS
HANOVER TOWNSHIP SITE

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site

Test pit	Description
<u>Test pit 1</u>	
90 percent coarse fragments	
0-12 inches	Loam, 10YR5/4, granular, friable, heaviest growth of roots
12-59 inches	Yellow orange, coarse sandstone, gravelly loamy sand, 10YR6/8.
	Gray-white coarse sandstone, gravelly loamy sand, 10YR5/4, predominant unit.
	Very soft black fractured shale, pockets of heavy silt loam, 10YR3/1.
	Highly weathered dark brown sandstone, loamy coarse sand, 5YR3/2
<u>Test pit 2</u>	
90 percent coarse fragments	
0- 8 inches	Sandy loam to loam, variegated colors, main root zone.
8-57 inches	Micaceous gray shale, gravelly silt loam, 10YR5/3, friable.
	Gray-white coarse sandstone, loamy coarse sand, 10YR6/3, predominant unit.
	Yellow-orange coarse sandstone, gravelly loamy sand, 10YR6/8.

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site (continued)

Test pit	Description
<u>Test pit 3</u>	
90 percent coarse fragments	
0- 9 inches	Sandy loam to loam to silt loam, 10YR4/3, granular, weak, friable, main root zone.
9-60 inches	<ul style="list-style-type: none"> Gray-white sandstone, loamy coarse sand, predominant rock unit. Brown sandstone, sandy loam, 10YR4/3 predominant soil color. Black shale, pockets of silt loam.
<u>Test pit 4</u>	
90 percent coarse fragments	
0-24 inches	Sandy loam and loam, 10YR4/3, predominant soil color, main root zone.
24-52 inches	<ul style="list-style-type: none"> Light gray shale, siltstone, and very fine-grained sandstone. Coarse gray sandstone, coarse sandy loam predominant unit. Brown coarse sandstone with pockets of hard coal.

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site (continued)

Test pit	Description
<u>Test pit 5</u>	
90 percent coarse fragments	
0-15 inches	Loamy coarse sand, 10YR4/3, main root zone.
15-57 inches	<div> Coarse brown sandstone, predominant unit, several tree branches and pieces of wood present. </div> <div> Yellow-orange sandstone, loamy sand. </div> <div> Light gray shale, silt loam. </div>
<u>Test pit 6</u>	
80 percent coarse fragments	
0-28 inches	Loamy sand, 10YR4/3, main root zone.
28-55 inches	<div> Gray-white sandstone, sandy loam. </div> <div> Yellow-orange sandstone, sandy loam. </div> <div> Light gray fine siltstone, loam to silt loam, pockets of lignite. </div>

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site (continued)

Test pit	Description
<u>Test pit 7</u>	
98 percent coarse fragments	
0-60 inches	<div> Sandy loam, 10YR4/3, main root zone, granular, weak, friable. </div> <div> Alternating bands of loamy sand, yellow orange and silt loam, black-gray lignite, subangular blocky, weak, friable. </div>
<u>Test pit 8</u>	
70 percent coarse fragments	
0-10 inches	Main root zone, silt loam, 10YR4/3.
10-60 inches	<div> Gray-white sandstone, gravelly coarse sandy loam, 10YR4/3. </div> <div> Black shale and lignite pockets, gravelly loam to silt loam. </div>
<u>Test pit 9</u>	
90 percent coarse fragments	
0-11 inches	Gravelly sandy loam, 10YR4/3, main root zone.

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site (continued)

Test pit	Description
<u>Test pit 9</u> (continued)	
11-56 inches	<ul style="list-style-type: none"> Gray-white coarse sandstone, gravelly coarse sandy loam. Yellow-orange coarse sandstone, coarse sandy loam, lignite and coal pockets.
<u>Test pit 10</u>	
90 percent coarse fragments	
0-22 inches	Gravelly loam, 10YR4/3, granular, weak, main root zone.
22-56 inches	<ul style="list-style-type: none"> Gray-white sandstone, gravelly coarse sandy loam, subangular, blocky, weak. Fine-grained black siltstone, loam to silt loam. Yellow-orange sandstone, sandy loam. Limestone, light gray, gravelly silt loam.
<u>Test pit 11</u>	
90 percent coarse fragments	
0- 9 inches	Gravelly loam, 10YR5/2, main root zone.

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions^{a,b} -- Hanover site (continued)

Test pit	Description
<u>Test pit 11</u> (continued)	
9-36 inches	<div> <div></div> <div>Gray-white sandstone, gravelly loam.</div> <div>Yellow-orange sandstone, gravelly loam.</div> <div>Gray shale, loam.</div> </div>
<u>Test pit 12</u>	
90 percent coarse fragments	
0-12 inches	Sandy loam, 10YR4/3, granular, very weak, friable, main root zone.
12-58 inches	<div> <div>Gray-white sandstone, sandy loam, large pockets of lignite.</div> <div>Coarse brown sandstone, sandy loam.</div> <div>Yellow-orange sandstone, sandy loam.</div> </div>

^aTest pit locations are shown on Figure C.1-3.

^bSoils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-10. Percolation rates -- Hanover site

Test pit ^a	Percolation rate (in./sec)	Percolation depth (in.)
1	5.5×10^{-5}	73
2	1.1×10^{-4}	69
2	1.2×10^{-3}	41
3	1.4×10^{-4}	75
3	3.3×10^{-4}	45
6	1.1×10^{-4}	69
7	3.9×10^{-4}	45
8	No movement	72
8	1.1×10^{-4}	45
10	3.3×10^{-4}	72
10	2.8×10^{-4}	44
$\bar{x}^b$	3.0×10^{-4}	59

^aTest pit locations are shown on Figure C.1-3.

^b $\bar{x}$ = average.

Source: Weston (1982) field data.

Appendix C.2
GEOLOGICAL INFORMATION

Appendix C.2

GEOLOGICAL INFORMATION

Geological investigations were conducted at the expanded Canonsburg site, and at the Burrell and Hanover sites to determine the following:

1. Site stratigraphy.
2. Depth to bedrock.
3. Regional setting.
4. Geological structure.
5. Mineral resources.

At each site the investigations utilized the extensive regional data in the literature. The regional data were augmented and verified during the site-specific drilling programs conducted for hydrogeological analysis. These drilling programs are described in Appendix D.2.

CROSS-SECTION AA' **UNCONSOLIDATED MATERIAL** **BEDROCK**

10^{-3} PERMEABILITIES (PACKER TEST) —cm/sec

DEPTH (FT) — ROCK QUALITY DATA

HIGHLY FRIABLE — HORIZONTAL

— FRACTURING

— VERTICAL

— FRACTURING

— DIAGONAL FRACTURING

DEPTH (FT)
 16 5 20 86 29
 RECOVERY
 ROD

FIGURE C.2-1
GEOLOGICAL CROSS-SECTION AA'
EXPANDED CANONSBURG SITE

FIGURE C.2-2
GEOLOGICAL CROSS-SECTIONS BB' & CB'
EXPANDED CANONSBURG SITE

SCALE LEGEND AND ELEVATION THE SAME AS FIGURE C.2-1
(FOR LOCATION OF CROSS-SECTIONS SEE FIGURE C.2-1)

FIGURE C.2-3
SITE CONFIGURATION — 1949
BURRELL TOWNSHIP SITE

FIGURE C.2-4
GEOLOGICAL CROSS-SECTION
BURRELL TOWNSHIP SITE

FROM U.S. GEOLOGICAL SURVEY PP 1114 (1980) —AFTER ALGERMISSSEN 1969

FIGURE C.2-6
SEISMIC RISK ZONES IN THE UNITED STATES

AMITY
ANTICLINE PROMINENT ANTICLINE AND NAME

FINNEY
SYNCLINE PROMINENT SYNCLINE & NAME

'NINEVEH' (QUOTATION MARKS INDICATE STRUCTURE
SYNCLINE RECENTLY DETERMINED TO BE
DISCONTINUOUS)

STRUCTURE CONTOURS (PITTSBURGH COAL BED) IN FEET ABOVE SEA LEVEL

SOURCE WAGNER ET AL 1975 USGS MAP 43

**FIGURE C.2-7
REGIONAL FOLD AXIS
AND STRUCTURAL CONTOURS
OF THE PITTSBURGH
COAL BED IN THE VICINITY
OF THE CANONSBURG SITE**

WAGNER LYTLE LINES, LINES OF
STRUCTURAL DISCONTINUITY

PRINCIPAL ANTICLINE

PRINCIPAL SYNCLINE

FEATURES OF INTERMEDIATE LINEAR
EXPRESSION

'B'

ALINEMENT OF SEGMENTS OF STREAMS
WITHOUT EVIDENT WATER

'C'

ALINEMENT OF TONAL FEATURES

SOURCE BRIGGS & KOHLE 1976 USGS MISC
FIELD STUDY MAP MF 8150

**FIGURE C.2-8
MAJOR GEOLOGIC STRUCTURAL
FEATURES IN THE VICINITY
OF THE CANONSBURG SITE**

**FIGURE C.2-9
BEDROCK SURFACE CONTOURS
EXPANDED CANONSBURG SITE**

NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY
BY KURCH-HOUSLEY & ASSOC, PITTSBURGH, PA, DATED
MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK
BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS,
PITTSBURGH, PA, DATED 6/3/73,

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG
PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY
KURCH-HOUSLEY & ASSOC, PITTSBURGH, PA DATED 9/8/82
FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS

REFERENCES FOR APPENDIX C

- Algermissen, S., 1969. Map published in Coffman, J. L. and C. A. von Hake, 1973, Earthquake History of the United States, Publication No. 41-1, National Oceanic and Atmospheric Administration, Environmental Data Services, Washington, DC.
- Bertrand, A. R., 1965. "Rate of Water Intake in the Field," Methods of Soil Analysis, Part 1, Monograph No. 9, American Society of Agronomy, Madison, Wisconsin.
- Briggs, R. and W. Kohle, 1976. Correlation of Geologic Data from Four Sources, Southwestern Pennsylvania and Vicinity, U.S. Geological Survey, Miscellaneous field studies, map MF-815.
- USDA-SCS (Department of Agriculture, Soil Conservation Service), Pennsylvania State University, College of Agriculture, Agricultural Experiment Station; and Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission, 1960. Indiana County Soil Survey, Pittsburgh, Pennsylvania.
- USDA-SCS (Department of Agriculture, Soil Conservation Service), Northeast Technical Service Center, 1979. "Interim Classification System for Mine Soils," Bulletin No. N32-9-4, Washington, DC.
- U.S. Department of Health, Education, and Welfare, 1967. Manual of Septic Tank Practice, Public Health Service, Publication No. 526, Washington, D.C.
- Wagner, W. R., J. C. Craft, L. Heyman, and J. A. Harper, 1975. Greater Pittsburgh Regional Geologic Map and Cross-sections, U.S. Geological Survey, Map 13.

Appendix D

WATER RESOURCES INFORMATION

Appendix D.1
SURFACE-WATER INFORMATION

Appendix D.1

SURFACE WATERS

Information on existing water quality and flow conditions in Chartiers Creek and the Conemaugh River was obtained from the Pennsylvania DER's STORET system. In addition, Weston performed a surface-water sampling effort at the Canonsburg site in July 1979 (the results are given in Table D.1-4) to determine the nonradiological-contaminant loading of Chartiers Creek from the site, and to compare it to input from other local sources.

An EPA-water quality study (Downie and Petrone, 1980) was performed in May 1980 on the surface waters in the vicinity of the Hanover site, as part of a permit application by the site's owner (Starvaggi Industries) to construct an industrial landfill. The results of this study, along with the results from an owner-performed water-quality testing program conducted in October 1980 were used to characterize the waters in the Hanover site area.

**FIGURE D.1-1
100 YEAR AND 500 YEAR FLOOD BOUNDARIES
EXPANDED CANONSBURG SITE**

FIGURE D.1-2
SURFACE WATER RUNOFF PATTERN
EXPANDED CANONSBURG SITE

Table D.1-1. Flood elevations and discharges on Chartiers Creek adjacent to the Canonsburg site

Stream location	Flood elevations (USGS data) (mean sea level)			
	10 yr	50 yr	100 yr	500 yr
ConRail railroad bridge	938	941.5	942.5	944
Strabane Ave. bridge	940	943.5	945.5	949.3
Just upstream of site	945.5	949.5	951.5	954.1
Stream discharge (cfs)				
Near site	5,600	10,100	12,600	19,400

Source: U.S. Department of Housing and Urban Development (1979) .

Notes: Flood elevations reflect the completion of a portion of the ongoing channelization project in the Canonsburg-Houston area. The channel-improvement project has been completed from the North Central Avenue bridge crossing upstream to the ConRail bridge crossing, just downstream of the site. As channel improvements continue, flood elevations will be reduced.

Refer to the U.S. Army Corps of Engineers (1975) .

Flooding patterns are shown on Figure D.1-1.

Table D.1-2. Estimated runoff volume (acre-feet) from the Canonsburg site

Return period (yrs)	Duration (hrs)	Intensity ^a (in./hr)	Subbasin 1 ^b			Subbasin 2 ^b			Subbasin 3 ^b			Subbasin 4 ^b			Subbasin 5 ^b			Subbasin 6 ^b			Total runoff volume (acre-ft)
			Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	
2	0.25	2.5	8.5	0.22	0.10	11.7	0.29	0.18	4.4	0.07	0.02	5.9	0.15	0.05	5.0	0.10	0.03	2.5	0.12	0.02	0.40
2	1	1.1	8.5	0.22	0.17	11.7	0.29	0.31	4.4	0.07	0.03	5.9	0.15	0.08	5.0	0.10	0.05	2.5	0.12	0.03	0.67
2	6	0.27	8.5	0.22	0.25	11.7	0.29	0.46	4.4	0.07	0.04	5.9	0.15	0.12	5.0	0.10	0.07	2.5	0.12	0.04	0.98
2	12	0.15	8.5	0.22	0.28	11.7	0.29	0.51	4.4	0.07	0.05	5.9	0.15	0.13	5.0	0.10	0.08	2.5	0.12	0.05	1.10
10	0.25	3.3	8.5	0.22	0.13	11.7	0.29	0.23	4.4	0.07	0.02	5.9	0.15	0.06	5.0	0.10	0.03	2.5	0.12	0.02	0.49
10	1	1.5	8.5	0.22	0.23	11.7	0.29	0.42	4.4	0.07	0.04	5.9	0.15	0.11	5.0	0.10	0.06	2.5	0.12	0.04	0.90
10	6	0.4	8.5	0.22	0.37	11.7	0.29	0.68	4.4	0.07	0.06	5.9	0.15	0.18	5.0	0.10	0.10	2.5	0.12	0.06	1.45
10	12	0.22	8.5	0.22	0.41	11.7	0.29	0.75	4.4	0.07	0.07	5.9	0.15	0.19	5.0	0.10	0.11	2.5	0.12	0.07	1.60
50	0.25	4.0	8.5	0.25	0.18	11.7	0.32	0.31	4.4	0.08	0.03	5.9	0.18	0.09	5.0	0.12	0.05	2.5	0.13	0.03	0.69
50	1	2.0	8.5	0.25	0.35	11.7	0.32	0.62	4.4	0.08	0.06	5.9	0.18	0.18	5.0	0.12	0.10	2.5	0.13	0.05	1.36
50	6	0.5	8.5	0.25	0.53	11.7	0.32	0.94	4.4	0.08	0.09	5.9	0.18	0.27	5.0	0.12	0.12	2.5	0.13	0.08	2.03
50	12	0.28	8.5	0.25	0.60	11.7	0.32	1.05	4.4	0.08	0.10	5.9	0.18	0.30	5.0	0.12	0.17	2.5	0.13	0.09	2.31
100	0.25	4.50	8.5	0.25	0.18	11.7	0.32	0.35	4.4	0.08	0.03	5.9	0.18	0.10	5.0	0.12	0.06	2.5	0.13	0.03	0.75
100	1	2.20	8.5	0.25	0.39	11.7	0.32	0.69	4.4	0.08	0.06	5.9	0.18	0.19	5.0	0.12	0.11	2.5	0.13	0.06	1.50
100	6	0.53	8.5	0.25	0.56	11.7	0.32	0.99	4.4	0.08	0.09	5.9	0.18	0.28	5.0	0.12	0.16	2.5	0.13	0.09	2.17
100	12	0.30	8.5	0.25	0.64	11.7	0.32	1.09	4.4	0.08	0.11	5.9	0.18	0.32	5.0	0.12	0.18	2.5	0.13	0.10	2.55

^aRainfall intensity -- U.S. Department of Commerce (1955).

^bRunoff patterns are shown on Figure D.1-2.

Methodology: Modified rational formula, $V = C i A$
 Where: V = Runoff volume (acre-feet).
 C = Runoff coefficient.
 i = Total inches of rainfall divided by 12.
 A = Drainage area (acres).

Table D.1-3. Water-quality data for Chartiers Creek

Parameter	State water-quality criteria (25 PA Code 93)	Canonsburg ^a		Carnegie ^b	
		Average	Extreme	Average	Extreme
(in mg/l, unless otherwise indicated)					
Bacteria (fecal coliforms)	5/1 through 9/30 -- ≤200/100 ml (geometric average of five consecutive samples collected on dif- ferent days)	2,794 ^{c,d} 14,760 ^e	6,700 ^{c,d} 20,000 ^e	3,337 ^{c,d} 2,300 ^e	20,000 ^{c,d} 6,000 ^e
	10/1 through 4/30 -- ≤2000/100 ml (geometric average of five consecutive samples collected on dif- ferent days)				
Total dissolved solids	Monthly average ≤500 mg/l ≤750 mg/l at all times	549 ^c 696 ^e	778 ^c 1,180 ^e	729 ^c 853 ^e	972 ^c 1,340 ^e
Total iron	≤1.5 mg/l	1.27 ^c 1.38 ^e	4.68 ^c 3.25 ^e	3.45 ^c 6.09 ^e	5.00 ^c 10.00 ^e
Sulfate	NS ^f	193 ^c 299 ^e	334 ^c 630 ^e	323 ^c 276 ^e	400 ^c 405 ^e
Dissolved oxygen	2/15 through 7/31 -- minimum daily average = 6.0 mg/l, ≥5.0 mg/l at all times	11.2 ^e	7.0 (low) ^e	9.4 ^e	9.4 ^e
	8/1 through 2/14 -- minimum daily average = 5.0 mg/l, ≥4.0 mg/l at all times				
pH	≥6.0 ≤ 9.0	7.3 ^{c,g} 7.0 ^e	7.8 ^{c,g} 8.2 ^e	7.1 ^{c,g} 6.9 ^e	8.1 ^{c,g} 6.8 ^e
Total manganese	≤1.0 mg/l	0.6 ^e	0.6 ^e	3.0 ^e	3.0 ^e
Alkalinity	≥20 mg/l as CaCO ₃	148 ^c 136 ^e	112 (low) ^c 108 (low) ^e	116 ^c 100 ^e	100 (low) ^c 74 (low) ^e
NO ₂ and NO ₃	≤10 mg/l as nitrate nitrogen	3.41 ^c 2.80 ^e	6.2 ^c 4.0 ^e	2.1 ^c 2.5 ^e	3.8 ^c 4.0 ^e

^aPennsylvania DER, STORET retrieval, Water Quality No. 0916.^bPennsylvania DER, STORET retrieval, Water Quality No. 0914.^cData from 1982 STORET file.^dUnits per 100 ml.^eData from 1978 STORET file.^fNS = No standard.^gIn standard units (SU).

Table D.1-4. Concentration of parameters in surface-water samples taken from Chartiers Creek

Parameter	State water quality criteria (25 PA Code 93) (mg/l)	Analysis results (mg/l unless noted)						Estimated annual pollutant load ^c		Comparable pollutant load ^d lbs/acre-in.
		Sampling date -- July 22, 1979			Sampling date -- July 26, 1979			lbs/yr	lbs/acre-in.	
		Chartiers Creek -- upstream ^a	Ditch corner of Strabane Ave. and Ward St.	Chartiers Creek -- downstream ^b	Chartiers Creek -- upstream ^a	Ditch -- Strabane Ave. near Chartier Creek	Chartiers Creek -- downstream ^b			
BOD ₅	NS ^e	2	5	1	---	2	2	126	0.005	0.35
Suspended solids	NS	42	753	15	---	253	39	19,000	0.76	2.0
NH ₃ -N	NS	0.4	<0.14 ^f	<0.14	---	0.8	0.8	<3.5	0.00014	---
NO ₃ -N	≤10 ^g	6.7	1.5	2.9	---	0.76	2.9	38	0.0015	---
Silicon	NS	7.3	4.9	7.2	---	10.4	8.6	124	0.005	---
Total phosphorus	NS	1.21	0.61	1.08	---	0.96	0.65	15	0.0006	0.007
TOC	NS	5	13	12	---	---	6	328	0.013	---
Silver	NS	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.5	0.00002	---
Arsenic	<0.05 ^h	0.018	0.182	0.014	---	0.096	0.015	4.6	0.00018	---
Selenium	NS	0.045	0.047	0.044	---	0.025	0.049	1.2	0.000047	---
Iron	≤1.5 ^h	3.21	22.2	1.05	---	8.8	1.51	560	0.022	---
Nickel	≤0.01 ⁱ	<0.02	<0.2	<0.02	---	<0.02	<0.02	<0.5	0.00002	0.064
Lead	≤0.05	0.02	0.44	0.02	---	0.06	0.02	11	0.00044	0.01
Chromium	≤0.05 ^j	<0.02	0.03	<0.02	---	<0.02	<0.02	0.75	0.00003	0.105
Barium	NS	<0.2	<0.2	<0.2	---	<0.2	<0.2	<5.0	0.0002	---
Mercury	NS	<0.2	<0.2	<0.2	---	<0.2	<0.2	<5.0	0.0002	---
Cadmium	NS	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.5	0.00002	---
Boron	NS	<0.12	0.11	0.16	---	0.12	0.15	2.8	0.00011	---
Sulfate	NS	335	126	322	---	155	262	3,180	0.13	---
Turbidity (JTU)	NS	17.5	860	13	---	400	22	---	---	---

^aApproximately 4700 feet upstream from the Strabane Avenue bridge.

^bApproximately 50 feet downstream from the Strabane Avenue bridge.

^cBased on July 22, 1979 storm. During this storm approximately 0.57 inch of rain fell on the Canonsburg site. The runoff volume from this storm was estimated at 0.14 acre-feet based on a runoff coefficient of 0.29 and a drainage area of 10.4 acres. The pollutant loads measured during the July 22, 1979 storm were scaled up to an annual estimate using a value of 36.9 inches of annual precipitation for the Canonsburg site area.

^dHeartland Industrial Park, Long Island, New York.

^eNS = No standard.

^f"<" in an analytical results column indicates a detection limit; actual concentrations may actually be lower.

^gIn combination with NO₂-N concentrations.

^hTotal.

ⁱNot to exceed the stated amount of the 96-hour LC₅₀ for representative important species.

^jHexavalent chromium only.

Source: Weston (1979) field data.

Table D.1-5. Public water suppliers within 3 miles of the sites.

Canonsburg site

Western Pennsylvania Water Company, Washington District
62 East Wheeling Street
Washington, Pennsylvania 15301

Burrell site

Blairsville Borough Water Authority
244 South Stewart Street
Blairsville, Pennsylvania 15717

Lower Indiana County Municipal Authority
P.O. Box 444
Black Lick, Pennsylvania 15716

Central Pennsylvania Water Supply Company
P.O. Box 367
10th and Chestnut Streets
New Florence, Pennsylvania 15944

Hanover site

Smith Township Municipal Authority
P.O. Box 387
Burgettstown, Pennsylvania 15021

Western Pennsylvania Water Supply Company
Burgettstown District

Paris - Florence Area Water Association

Source: Chnupa (1983)

FIGURE D.1-3
"FULL POOL" BOUNDARY
BURRELL TOWNSHIP SITE

Table D.1-6. Estimated runoff volume (acre-feet) from the Burrell site

Return period (yrs)	Duration (hrs)	Intensity ^a (in./hr)	Subbasins -- Groundwater recharge and discharge ponds ^b			Subbasins -- Direct river discharge			Total runoff volume (acre-ft)
			Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	
2	0.5	1.9	32.6	0.35	0.90	16.4	0.35	0.45	1.35
2	1	1.17	32.6	0.35	1.11	16.4	0.35	0.56	1.67
2	6	0.32	32.6	0.35	1.83	16.4	0.35	0.92	2.75
2	12	0.2	32.6	0.35	2.28	16.4	0.35	1.15	3.43
10	0.5	2.9	32.6	0.35	1.38	16.4	0.35	0.69	2.07
10	1	1.8	32.6	0.35	1.72	16.4	0.35	0.86	2.58
10	6	0.48	32.6	0.35	2.74	16.4	0.35	1.38	4.12
10	12	0.28	32.6	0.35	3.19	16.4	0.35	1.61	4.80
50	0.5	3.7	32.6	0.39	1.96	16.4	0.39	0.99	2.95
50	1	2.35	32.6	0.39	2.49	16.4	0.39	1.25	3.74
50	6	0.63	32.6	0.39	4.00	16.4	0.39	2.01	6.01
50	12	0.37	32.6	0.39	4.70	16.4	0.39	2.36	7.06
100	0.5	4.2	32.6	0.39	2.22	16.4	0.39	1.12	3.34
100	1	2.6	32.6	0.39	2.75	16.4	0.39	1.39	4.14
100	6	0.67	32.6	0.39	4.26	16.4	0.39	2.14	6.40
100	12	0.41	32.6	0.39	5.21	16.4	0.39	2.62	7.83

^aRainfall intensity -- U.S. Department of Commerce (1955).^bSee subsection 4.6.2.2.Methodology: Modified rational formula, $V = CiA$ Where: V = Runoff volume (acre-feet). C = Runoff coefficient. i = Total inches of rainfall divided by 12. A = Drainage area (acres).

Table D.1-7. Water-quality data for the Conemaugh River -- Burrell site

Parameter	State water-quality criteria (25 PA Code 93)	Water-quality data (mg/l) ^a							
		Seward, 1977		Vandergrift, 1979		Tunnelton, 1970-1979		Josephine, 1977	
		Average	Extreme	Average	Extreme	Average	Extreme	Average	Extreme
Fecal coliforms	5/1 through 9/30 -- $\leq 200/100$ ml 10/1 through 4/30 -- $\leq 2000/100$ ml	13,500	25,000	18,000	25,000	---	---	---	---
Suspended solids	NS ^b	303	561	---	---	---	---	506	1,246
Total iron	≤ 1.5 mg/l	5.0	9.5	2.9	5.5	5.5	17.7	12.0	21.0
Dissolved sulfate (SO ₄)	≤ 250 mg/l	221	360	144	270	144	144	262	820
Dissolved oxygen	Minimum daily average = 5.0 mg/l; ≥ 4.0 mg/l at all times	10.0	7.5	11.5	10.0	10.0	13.0	9.8	7.0
pH	$\geq 6.0 \leq 9.0$	4.7	4.2	5.1	4.7	4.6	3.4	4.3	3.3
Total manganese	≤ 1.0 mg/l	1.5	3.2	0.9	1.6	1.6	5.0	1.0	1.8
Total dissolved solids	Monthly average ≤ 500 mg/l, ≤ 750 mg/l at all times	257	257	402	322	538	538	---	---
Alkalinity	20 mg/l as CaCO ₃	3.2	0	1.2	0	8	8	0.3	0
Ammonia nitrogen	1.5 mg/l	1.02	2.7	0.4	1.0	0.5	0.5	0.52	2.5
Temperature °F	No measurable rise when the am- bient temperature reaches 87°F or above; not more than a 5°F rise above the ambient temperature until the stream reaches 87°F -- not to be changed by more than 2°F during any 1-hour period.	55.1	32/81	46.8	32/66	45	---	48.0	32/81
Location from site downstream		15 miles upstream		30 miles downstream		10 miles downstream		7 miles north (on Black Lick Creek)	

^aU.S. Geological Survey (1977).^bNS = No standard.

Table D.1-8. Water supply surface intakes -- Allegheny River.

River mile	Water plant	County
29.4	Freehold Water Company 1705 Rear Freeport Road Natrona Heights, Pennsylvania 15065	Armstrong
24.2	Clearview Water Company 1705 Rear Freeport Road Natrona Heights, Pennsylvania 15065	Allegheny
23.2	Brackenridge Water Works 1000 Brackenridge Avenue Brackenridge, Pennsylvania 15014	
22.4	Tarentum Water Works c/o J. Lemmer 304 Lock Street Tarentum, Pennsylvania 15084	Allegheny
20.8	New Kensington Municipal Authority Box 577, 720 Fourth Avenue New Kensington, Pennsylvania 15068	Westmoreland
13.3	Oakmont Municipal Water Authority 721 Allegheny Avenue Oakmont, Pennsylvania 15139	Allegheny
10.8	Fox Chapel Water Authority 1389 Old Freeport Road Pittsburgh, Pennsylvania 15238	Allegheny
8.8	Wilkinsburg-Penn Joint Water Authority 2200 Robinson Boulevard Wilkinsburg, Pennsylvania 15221	Allegheny
8.2	Pittsburgh Water Works 226 Delafield Road Pittsburgh, Pennsylvania 15215	Allegheny
3.8	Millvale Water Works 501 Lincoln Avenue Millvale, Pennsylvania 15209	Allegheny

Table D.1-9. Pond surface-water quality -- Burrell site

Pond ^a	pH	Specific conductance (μ mhos/cm)	Cl ⁻ (mg/l)	SO ₄ (mg/l)	NO ₃ N (mg/l)	Fe (mg/l)	Pb (mg/l)	Ba (mg/l)	B (mg/l)
Pond A	7.0	1250	19.7	420	ND ^b	ND	ND	0.02	0.76
Pond B	6.9	1200	20.2	290	ND	ND	ND	0.03	0.41
Pond C	5.7	12	22.3	440	0.72	ND	ND	ND	0.07
State water quality criteria (25 PA Code 93)	≥ 6.0	≤ 9.0	NS ^c	NS	≤ 250	$\leq 10^d$	$\leq 1.5^e$	≤ 0.05	NS

^aPond locations given on Figure 1-5.

^bND = None detectable.

^cNS = No standard.

^dIn combination with NO₂-N concentrations.

^eTotal.

Source: Weston (1982) field data.

Table D.1-10. Estimated runoff volume (acre-feet) from the Hanover site

Return period (yrs)	Duration (hrs)	Intensity ^a (in./hr)	To Harmon Creek			To unnamed tributary			To Ward Run			Total runoff volume (acre-ft)
			Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	Area (acres)	Runoff coefficient	Runoff volume (acre-ft)	
2	0.25	2.5	201	0.35	3.66	90	0.35	1.64	136	0.35	2.48	9.7
2	1	1.1	201	0.35	6.45	90	0.35	2.89	136	0.35	4.36	13.7
2	6	0.3	201	0.35	10.55	90	0.35	4.73	136	0.35	7.14	22.4
2	12	0.2	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
10	0.25	3.3	201	0.35	4.84	90	0.35	2.17	136	0.35	3.27	10.3
10	1	1.5	201	0.35	8.79	90	0.35	3.94	136	0.35	5.95	18.7
10	6	0.4	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
10	12	0.2	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
50	0.25	4.0	201	0.39	6.5	90	0.39	2.92	136	0.39	4.42	13.9
50	1	2.0	201	0.39	13.06	90	0.39	5.85	136	0.39	8.84	27.8
50	6	0.5	201	0.39	19.60	90	0.39	8.78	136	0.39	13.26	41.6
50	12	0.3	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0
100	0.25	4.5	201	0.39	7.35	90	0.39	3.29	136	0.39	4.97	15.6
100	1	2.2	201	0.39	14.37	90	0.39	6.43	136	0.39	9.72	30.5
100	6	0.6	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0
100	12	0.3	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0

^aRainfall intensity - U.S. Department of Commerce (1955).

Methodology: Modified rational formula, $V = CiA$

Where: V = Runoff volume (acre-feet).

C = Runoff coefficient.

i = Total inches of rainfall divided by 12.

A = Drainage area (acres).

Table D.1-11. Results of EPA surface-water analysis --
Hanover site, May 7, 1980

Parameter	State water quality criteria (25 PA Code 93)	Sample location		
		At chemical seep on the site	Upstream -- unnamed tributary	Downstream -- unnamed tributary
Sample type		Grab	Grab	Grab
Temperature (water), °F	No measurable rise when the ambient temperature reaches 87°F or above; not more than a 5°F rise above the ambient temperature until the stream reaches 87°F -- not to be changed by more than 2°F dur- ing any 1-hour period.	55	57	57
pH	$\geq 6.0 \leq 9.0$	3.2	6.1	6.1
COD (mg/l)	NS ^a	40	15	20
Total arsenic (mg/l)	≤ 0.05	0.028	0.003	0.004
Total cadmium (mg/l)	NS	0.025	0.003	0.005
Total lead (mg/l)	≤ 0.05	0.011	0.038	0.028
Total mercury (mg/l)	NS	0.0004	0.0006	0.0004
Toxicity	---	Very toxic	---	---
Volatile organics	NS	ND ^b	ND	ND

^aNS = No standard.

^bND = Not detectable.

Source: Downie and Petrone (1980).

**FIGURE D.1-4
LOCATION OF SURFACE WATER
QUALITY SAMPLING POINTS
IN THE VICINITY OF
THE HANOVER TOWNSHIP SITE**

Table D.1-12. Results of surface-water sampling program, Starvaggi Industries landfill, Hanover Township -- October 6, 1980

Sample location ^a	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	Chloride (mg/l)	Oil and grease (mg/l)	Phenol (mg/l)	Cyanide (mg/l)	Alkalinity (mg/l)	pH (SU)	Ammonia (mg/l)
S-1	5	784	4	4	1.7	0.001	0.005	2	5.2	0.15
S-2	3	792	2	23	0.4	0.001	0.004	92	7.9	0.13
S-3	3	878	4	4	0.4	0.002	0.006	34	7.6	0.12
S-4	6	893	2	20	0.4	0.001	0.004	24	7.2	0.125
S-5	8	901	5	104	0.6	0.001	0.008	2	5.0	0.16
S-6	8	945	3	42	0.2	0.004	0.004	10	6.2	0.11
S-7	7	890	3	9	0.2	0.001	0.004	26	7.0	0.175
S-8	10	941	2	5	0.4	0.001	0.006	56	7.1	0.16
S-9	8	956	2	7	0.8	0.000	0.004	24	6.9	0.14
S-10	7	439	2	814	1.6	0.000	0.003	4	5.0	0.15
S-11	52	461	25	12,922	0.8	0.013	0.003	6	5.2	1.95
S-12	15	358	11	1,436	0.8	0.000	0.005	4	5.1	0.19
State water quality criteria (25 PA Code 93)	NS ^b	NS	NS	NS	NS	≤0.005	≤0.005 (free Cn)	≥20 (as CaCO ₃)	≥6.0 ≤9.0	NS

Sample location ^a	TSS (mg/l)	Total dissolved solids (mg/l)	Zinc (mg/l)	Lead (mg/l)	Nickel (mg/l)	Magnesium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Iron (mg/l)	Aluminum (mg/l)
S-1	6	3,187	0.70	0.002	0.63	90	0.01	0.02	0.02	4.4
S-2	0.1	1,363	0.01	0.002	0.04	20	≤0.002	0.01	0.20	0.3
S-3	7	1,626	0.02	0.003	0.05	32	0.002	0.01	0.13	0.3
S-4	0.5	1,608	0.04	0.002	0.08	34	0.002	0.01	0.20	0.1
S-5	19	2,518	0.40	0.001	0.34	68	0.006	0.02	2.32	10.0
S-6	13	1,883	0.14	0.001	0.15	44	0.002	0.02	0.76	28.6
S-7	22	1,607	0.36	0.002	0.21	100	0.002	0.01	5.34	3.8
S-8	16	3,087	0.11	0.001	0.22	116	0.002	0.02	6.80	2.4
S-9	7	2,774	0.11	0.002	0.14	102	0.004	0.02	3.52	0.7
S-10	5	3,370	0.15	0.002	0.20	78	0.004	0.02	0.57	5.0
S-11	15	30,171	0.40	0.008	1.50	175	0.052	0.11	7.02	4.6
S-12	47	4,365	0.34	0.002	0.36	84	0.008	0.02	4.62	16.0
State water quality criteria (25 PA Code 93)	NS ^b	Monthly average ≤500 mg/l; ≤750 mg/l at all times.	≤0.01 of the 96-hr LC ₅₀ for representative important species.	≤0.05	≤0.01 of the 96-hr LC ₅₀ for representative important species.	NS	NS	≤0.05 (as hexavalent chromium)	≤1.5 (total iron)	≤0.1 of the 96-hr LC ₅₀ for representative important species.

^aSample locations are shown on Figure D.1-4.

^bNS = No standard.

Appendix D.2
GROUND-WATER INFORMATION

Appendix D.2

GROUND-WATER INFORMATION

D.2.1 Description of hydrogeological data collection program

D.2.1.1 Expanded Canonsburg site

The objectives of the data collection program at the expanded Canonsburg site were as follows:

1. Determine the extent to which ground water is currently being radioactively contaminated by the radioactively contaminated materials.
2. Define the ground-water system at the expanded Canonsburg site.
3. Project future conditions.

The collection of hydrogeological and ground-water quality data began in the spring of 1979 with the completion of shallow and deep ground-water wells on the Canonsburg site. At this time the following constraints were placed on the data collection program:

1. Wells were restricted to the Canonsburg site.
2. Wells could only be drilled on the periphery of Area C because of the suspected high levels of radioactive contamination in the area.
3. Aquifer pump tests were prohibited because of the potential for withdrawing radioactively contaminated ground water.

To obtain data on aquifer characteristics of the Canonsburg site, slug tests were conducted on a number of wells. The slug tests were performed by instantaneously injecting a known volume of water into a well after measuring the well's static water level. The rate at which the water level returned to the static level was determined by measuring the water levels as a function of time. The success of slug tests can be affected by the nature of subsurface materials, and, at the Canonsburg site, the highly variable nature of the onsite materials led to widely-varying measurements.

Aquifer slug tests are used to estimate values of transmissivity and storage within a small radius of the bore hole and are greatly influenced by the material that surrounds the bore hole. Most of the 1979 bore holes at the Canonsburg site were completed in the fill material and well construction limited the ability of the wells to accept water. Therefore, slug test results were variable and not considered useful in determining the true conditions at the Canonsburg site. Additional slug tests conducted in 1983 used wells that were constructed with gravel packs and a screen size that did not limit water flow.

Ground-water elevations in the wells were determined approximately once a month. In addition, one well (well 10B) was fitted with a continuous water-level recorder. Water levels in the unconsolidated material varied through the period of record; the variation of most of the wells was 5 feet or less. The curves resulting from plotting changes in ground-water elevations are, with only a few exceptions, remarkably similar. The shallowest water levels occurred May 21, 1979, August 27, 1979, and October 11, 1979. The deepest water levels occurred on May 1, 1979, July 23, 1979, and November 20, 1979. The shallow-water levels correlate well with periods of high precipitation, and are of significantly shorter duration than the periods of deeper water levels. These data were reduced and plotted.

Based on the initial ground-water contours and flow directions, it appeared that a ground-water high existed in Area A, suggesting that ground water was flowing into the former Georges Pottery property. Permission was requested, and granted, to drill wells on the former Georges Pottery property. This program, conducted in 1980, confirmed this suspicion.

In March 1982 permission was obtained to drill in Area C to further characterize the ground-water regime and to obtain data on radiological contamination in the subsurface materials.

At the conclusion of the 1982 field program it was apparent that there were still significant data gaps in the expanded Canonsburg site's hydrogeological information. In particular, additional information was needed in the following areas:

1. Onsite background ground-water quality data needed to be updated and expanded.
2. Background ground-water quality was needed in the offsite areas across Chartiers Creek.
3. Surface-water levels were needed in Chartiers Creek and ground-water levels in the areas across the creek. (This was needed to determine the hydrological relationship between the ground waters and Chartiers Creek.)
4. Hydrogeological data for the expanded Canonsburg site needed to be updated and expanded.

In order to fill these data gaps, a field program was developed, approved and performed. The field work was conducted from December 1982 through March 1983, and included the following:

1. Construction of onsite monitoring wells in the overburden and in the bedrock.
2. Construction of offsite monitoring wells south of the expanded Canonsburg site and across Chartiers Creek.

3. Completion of a stream survey (water level) on Chartiers Creek.
4. Collection of aquifer data in the unconsolidated material and in the bedrock.
5. Collection of structural data on and near the expanded Canonsburg site.

The results of this data collection program have been incorporated into this document.

Table D.2-1 is a summary of the various drilling programs that have been conducted at the expanded Canonsburg site. The data collection methods and data summaries are presented in the following subsections.

D.2.1.2 Burrell site

The data collection program at the Burrell site began with the installation of four ground-water wells in 1980. These wells were installed to determine the current levels of contamination. From the analysis results, it was determined that additional data were required. Therefore, additional wells were drilled to more completely define the contaminant levels, and to define the relationship between ground water in the fill, alluvium and colluvium, and bedrock.

Because the contaminant levels in the ground water at the Burrell site were negligible, pump tests were conducted on selected wells in unconsolidated material and bedrock. These data, in conjunction with water-level measurements, were used to construct a flow net and develop a ground-water budget for the site.

D.2.1.3 Hanover site

The purpose of hydrogeological data collection at the Hanover site was to provide sufficient baseline data to determine whether it is feasible to use the site as a disposal area, and to project the impacts of using the site.

Wells were constructed in both bedrock and the overlying mine rubble on the upper slopes of the site. A limited amount of aquifer data were collected during pump tests on selected wells. These data were used to determine flow patterns in the site and its immediate vicinity. Samples were collected and analyzed to determine the baseline water quality.

Table D.2-1. Drilling programs at the Canonsburg site

Well number	Date installed	Screen type	Screen location	Remarks
1-31	1979	Field slotted	Overburden	Some wells are no longer usable.
1A-31A	1979	No screen	Bedrock - open hole	"A" wells were constructed adjacent to selected wells in the 1 to 31 series.
GP1-GP7	1980	Field slotted	Overburden	This series includes only wells on the Georges Pottery portion of the site.
GP2A-GP4A	1980	No screen	Bedrock - open hole	
201-205	March 1982	Johnson wound screen	Overburden	This series of wells was installed in Area C.
202A-204A	March 1982	No screen	Bedrock - open hole	
301S-306S	December 1982 to January 1983	PVC screen - No. 10 slots	Overburden	
301R-306R	December 1982 to January 1983	No screen	Bedrock - open hole	
401-411	December 1982 to January 1983	PVC screen - No. 10 slots	Overburden	
501-503	December 1982 to January 1983	PVC screen - No. 10 slots	Deep bedrock	

D.2.2 Methods and procedures

D.2.2.1 Drilling procedures

Auger boring

Hollow-stem augers were used for drilling and clearing in completing all borings in the overburden, the 300-series, the 400-series, and the 500-series surface casing holes. This method was used for drilling the overburden and for collecting standard penetration test samples.

The depth to the first-encountered free water was determined during augering. When encountered, drilling ceased immediately and the water level was allowed to stabilize inside the auger for a minimum of 15 minutes. This established the depth of the top of the screen in each of the screened wells in the 300 and 400 series. (The top of the screen was set at 1 foot above the stabilized depth to water.)

The auger borings were advanced until the bedrock was encountered. For the purposes of this study, bedrock was defined during drilling as the refusal of the auger to advance, a standard penetration test of 50 blows for 6 inches or less of penetration, and evidence in the sampler of rock fragments indicative of regolith.

Pneumatic Rotary Boring

Pneumatic rotary drilling with heavy (type NW) rods and a tri-cone roller bit of not less than 6 inches diameter was used for all overburden drilling where auger drilling was not feasible or unnecessary. This drilling was used to emplace screened casing or surface casing in an open hole.

Air rotary drilling with NW rods and a tri-cone roller bit of not less than 4 inches diameter was used for reaming rock holes where required, and for clearing the inside of surface casings prior to coring rock.

Air rotary coring of the bedrock was conducted with NW rods and a diamond coring bit on a core barrel with a free-rotating inner core sleeve. The core barrel was capable of a minimum run of 10 feet.

Pneumatic rotary boring eliminates the artificial prejudice of water quality samples by introducing water to the formation by hydraulic rotary drilling.

Major Drilling Equipment

The drilling equipment used in this project was primarily of the following types:

1. CME 55 drill rig (or equivalent) equipped for drilling with appropriate hollow-stem augers and for sampling by standard penetration test and by thin-walled sampler (Shelby tube).

2. Mobile B-80 drill rig (or equivalent) equipped for drilling by pneumatic rotary as just described, and for drilling with an auger for boring and sampling as described previously.

D.2.2.2 Sampling procedures

Overburden

Samples were collected in the overburden using the standard penetration test methods described in ASTM D-1586 and D-1584. The most commonly used method was the standard penetration test. Where required, standard methods of sampling by thin-walled sampler were employed. Standard penetration test samples were continuous from the surface to bedrock in all borings of the 300 series. Standard penetration test samples were taken at 5-foot intervals from the surface for penetrations of 24 inches in all wells of the 400 series.

Rock

Rock coring was conducted using NX core barrels. The cores were recovered as nearly intact as practical. The optimum run of the core was 10 feet. Coring runs were continuous, depending on drilling conditions, from the top of the bedrock to the target depth of the boring. The target depth for the 300-series rock wells was approximately 30 to 35 feet into rock; and for the 500-series wells, approximately 100 to 150 feet into rock. These depths were adjusted by the field geologist in consultation with project management.

Ground water

Selected wells at each of the three sites were sampled for ground-water quality analyses. Samples were obtained from the wells by pumping and bailing.

Before sampling, the static water level in the well was measured using a Soiltest water-level indicator (Model DR-762A). The volume of standing water in the well was calculated. A standard (one-half horsepower) submersible pump was placed in the well, and five times the volume of standing water was removed from the casing. Samples were then obtained from the discharge line of the pump. In cases where the well would not sustain pumping, a hand bailer was used to remove five volumes of water from the casing. The well was allowed to recover and samples were taken with the bailer. Between wells, the pump and bailer were rinsed with deionized water to prevent cross contamination. The sampling was conducted in accordance with Weston's Standard Operating Procedure No. 2.1, as follows:

1. Measure the depth from the top of the casing to the top of the water. Record the depth for future use in the development of the ground-water contour map. All measuring devices used in the well must be thoroughly rinsed with distilled water prior to use.

2. Measure the depth from the top of the casing to the bottom of the well casing (total depth of cased hole) for initial sampling of a new well or use the previously-recorded depth for resampling an established well.
3. Subtract the depth to the top of the water from the depth to the bottom of the casing to determine the height of standing water in the casing.
4. Remove a quantity of water from the well equal to five times the calculated volume of water in the well.
5. If the well goes dry during pumping or bailing, allow the well to recover and again empty the well.
6. Obtain a sample for chemical analysis immediately after pumping or bailing is completed. In case a well is pumped or bailed dry, obtain a ground-water sample as soon as possible while the well is recovering.
7. The sampling bailer or pump should be flushed with distilled water after sampling to prevent cross contamination between sampling wells. Materials incidental to sampling, such as bailer ropes and tubing, must also be flushed with distilled water. Sampling equipment must be protected from the ground surface by clean plastic sheeting. No sampling should be accomplished when windblown particles may contaminate the sample or sampling equipment.
8. All samples for organic chemical analysis should be placed in specially-cleaned amber glass bottles with Teflon-lined lids. Samples for inorganic chemical analysis should be placed in polyethylene bottles. The sample bottle should be partially filled, and the contents should be agitated and discarded. The cap should be rinsed with the water to be sampled. The bottle should be filled to the top and capped securely. The sample bottle should be placed in a temperature-controlled (4°C) chest immediately after sampling and delivered to the laboratory as soon as possible.

D.2.2.3 Sample processing

Overburden

Overburden samples taken for use by Weston were placed in prepared pint or quart brown glass jars or double-lined plastic bags directly from the sampler. The samples were appropriately marked on the jars and this information noted in the field log. USATHAMA procedures were used.

Overburden samples from either the standard penetration test sampler or the thin-walled sampler were described as soon as practical after collection.

Descriptive procedures follow USATHAMA requirements and use the Munsell Soil Color Charts. In addition, the thin-walled samples had field penetrometer tests performed on the open bottom end after trimming. All descriptions were recorded in the permanent field notes log and in the boring log when practical.

Rock

Rock cores were placed in appropriate core boxes. The boxes were marked and the core runs were segregated by dividers. The boxes were closed and secured.

Rock cores were described as soon as practical after recovery from the core barrel. Field description consisted of the following:

1. Measurement of the recovery ratio as the length of the recovered core divided by the length of the run of the core.
2. Calculation of the rock quality data (index) of all fragments above 0.25 foot in length (RQD25) and all fragments of the core above 0.50 foot in length (RQD50); the index is derived from the sum of the lengths of the respective fragments divided by the total length of the recovered core.
3. Standard physical descriptions followed USATHAMA procedures and the Munsell Soil Color Charts.

A fixed number of rock cores (approximately 20 percent) were redundantly described in a peer-review fashion.

Ground water

Ground-water samples were of two types: those for metals analysis and those for analysis of field parameters and gross properties. These samples were taken in a common working container at the discharge of the pump, or from the bailer. This working container was rinsed a minimum of three volumes with the water from the well to be sampled prior to sampling. The samples for gross properties and field parameters were transferred to a clean container(s) immediately. The samples were filtered with a vacuum apparatus with a 0.45-micron filter and introduced into a prepared sample bottle, with preservation by HNO_3 to a pH of less than 5 as soon as practical, but no more than 4 hours after collection. All samples were stored at a temperature of about 4°C. USATHAMA and standard EPA procedures were followed. One liter minimum volume was preserved for gross properties analysis; 500 milliliters was preserved for metals analysis. Samples were transferred to Weston laboratories for ionic analysis, and to Teledyne Isotopes, Inc. or Bendix Corporation for radiological analysis. Samples to be analyzed at laboratories other than Weston were handled according to the protocols required by the particular laboratory.

Within 4 hours after collection, all samples of ground water and surface water were tested, mainly while transferring the sample from the working container to the discrete containers, for pH and specific conductance (SC) prior to preservation and storage for shipment. As part of these tests, the calibration of the device was noted along with the reading value.

D.2.2.4 Aquifer analysis

Hydrogeological information, such as the ground-water flow rate and the rate of recharge specific to the expanded Canonsburg site area, was obtained through a series of onsite pump- and slug-testing.

Pump tests

Three individual pump tests were conducted at three different locations that had been selected to provide the best overall expanded Canonsburg site coverage. These locations were in the former Georges Pottery property, in Area B, and in Area C. A submersible pump was used for withdrawing a constant amount of water from the pumping well over a continuous 24-hour period. In addition to the well being pumped, at least four other surrounding wells were used for monitoring changes in ground-water levels during the test. All water levels were measured using graduated flexible tapes or graduated flexible electric probes. Simultaneous measurements were taken at each well over a predetermined schedule.

After measuring the ground-water levels for 24 hours the pumping was discontinued, and all of the monitoring wells were measured in the same format to assess the rate of ground-water recovery in each well. This was conducted for 200 minutes or until 90-percent recovery was achieved.

Slug tests

Slug tests also provide site-specific information on ground-water flow and recharge rates. While pump tests involve monitoring ground-water levels during long-term ground-water withdrawal, slug tests measure the water-level response to a single injection of water. Thus, a slug covers a smaller portion of an aquifer than a pump test. This also makes slug tests unsuited to aquifers with high transmissivities where ground-water recharge is rapid.

In 1983 four slug tests were conducted at the expanded Canonsburg site to supplement the results of the pump tests.

The first step was the selection of appropriate test (monitor) wells. Care was taken to avoid wells with inconsistencies in the well intake screen since this could cause artificially increased conductivity in the gravel pack. Next, the water level, or hydraulic head, was "instantaneously" raised by injecting a known volume of water, a slug, directly into the well. Immediately following injection, the water-level changes were monitored using a flexible calibrated tape or a flexible calibrated electronic water probe. The water level was monitored until it reached 80 percent recovery.

Interpretation of test data from the pump and slug tests was performed in accordance with the type of aquifer encountered (e.g., confined, leaky confined, or unconfined). Values for permeability and transmissivity were developed using standard methods (Bouwer and Rice, 1976). These methods, as well as documentation of the test validity, are on computer programs filed at Weston in West Chester, Pennsylvania.

*NOTE 1 LETTER "B" WELLS ARE WIDE DIAMETER (6" PVC CASING) WELLS INTO BEDROCK INSTALLED THE SAME AS THE "A" WELLS
 2 GP (GEORGES POTTERY) WELLS SIMILARLY INSTALLED

NOT TO SCALE

FIGURE D.2-1
DIAGRAMS OF TYPICAL WELL CONSTRUCTION
EXPANDED CANONSBURG SITE

- GROUNDWATER SAMPLING WELL
- 1-31 — ORIGINAL SERIES — CANON INDUSTRIAL PARK (1979)
- GP1-GP7 — WELLS — GEORGES POTTERY (1980)
- 201-205 — "200" SERIES — AREA C, CANON INDUSTRIAL PARK (1982)
- NO LETTER — WELL TO BEDROCK LETTER A — WELL INTO BEDROCK
- LETTER B — WELL INTO BEDROCK — EXTRA WIDE
- 301-306 — "300" SERIES — PAIRED WELLS (1982)
- LETTER S — WELL TO BEDROCK
- LETTER R — WELL INTO BEDROCK
- 401-411 — "400" SERIES — WELL TO BEDROCK (1983)
- 501-503 — "500" SERIES — EXTRA DEEP WELL INTO BEDROCK (1983)
- SURFACE CONTOUR — ELEVATION (FT/MSL)

FIGURE D.2-2
GROUNDWATER SAMPLING WELL LOCATIONS
EXPANDED CANONSBURG SITE

NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73.

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG, PA AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED 9/8/82. FOR SITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

FIGURE D.2-4
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL — 14 MARCH 1983
EXPANDED CANONSBURG SITE

FIGURE D.2-5
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL — 3 MARCH 1983
EXPANDED CANONSBURG SITE

NOTE: 1. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73.

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL. CHECK RUN BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

FIGURE D.2-6
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL—14 APRIL 1982
EXPANDED CANONSBURG SITE

**FIGURE D.2-7
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL—11 OCTOBER 1979
CANONSBURG SITE**

FIGURE D.2-9
PIEZOMETRIC SURFACE CONTOURS
BEDROCK — 14 MARCH 1983
EXPANDED CANONSBURG SITE

FIGURE D.2-10
PIEZOMETRIC SURFACE CONTOURS
BEDROCK — 3 MARCH 1983
EXPANDED CANONSBURG SITE

FIGURE D.2-11
PIEZOMETRIC SURFACE CONTOURS
BEDROCK—14 APRIL 1982
EXPANDED CANONSBURG SITE

Table D.2-2. Concentrations of parameters in ground-water samples taken from the expanded Canonsburg site and adjacent offsite areas

Well# number	Number of samples	Parameter																		Sulfate (mg/l)	Vanadium (mg/l)				
		Arsenic (mg/l)	Boron (mg/l)	Bar- ium (mg/l)	Cad- mium (mg/l)	Cal- cium (mg/l)	Chloride (mg/l)	Chrom- ium (mg/l)	Iron (mg/l)	Lead (mg/l)	Magne- sium (mg/l)	Molyb- denum (mg/l)	Nickel (mg/l)	Nitrate (mg/l)	PH fil- tered	PH unfil- tered	Phos- phate (mg/l)	Potas- sium (mg/l)	Selenium (mg/l)			Silicon (mg/l)	Silver (mg/l)	Sodium (mg/l)	
1	1	<0.002 ^b	0.16	<0.2	<0.02	---	---	<0.02	<0.02	0.02	---	---	<0.02	0.02	---	---	---	---	0.004	9.3	<0.02	---	256	---	
1A	1	<0.002	0.15	<0.2	<0.02	---	---	<0.02	<0.02	0.02	---	---	<0.02	0.07	---	---	---	---	0.003	9.8	<0.02	---	162	---	
5	6	---	0.19	---	---	---	---	---	11.0	---	---	---	---	---	---	---	---	---	0.009	12.7	---	---	66	---	
5A	8	<0.025	0.08	---	---	---	82	---	4.3, 255	---	---	---	<15	---	---	---	---	---	0.008, <0.01	4.8	---	---	282	---	
6	8	---	0.18	---	---	---	---	---	17.0	---	---	---	---	---	---	---	---	---	0.012	7.3	---	---	809	---	
6A	8	---	0.11	---	---	---	---	---	2.3	---	---	---	---	---	---	---	---	---	0.010	8.8	---	---	522	---	
10	1	<0.02	0.10	<0.2	<0.02	---	---	<0.02	<0.02	0.02	---	---	<0.02	1.91	---	---	---	---	0.003	11.2	<0.2	---	140	---	
17	8	---	0.28	---	---	---	---	---	1.4	---	---	---	---	---	---	---	---	---	0.016	13.2	---	---	845	---	
17A	8	---	0.005	---	---	---	---	---	28.0	---	---	---	---	---	---	---	---	---	0.014	10.9	---	---	751	---	
22	8	---	0.15	---	---	---	---	---	61.0	---	---	---	---	---	---	---	---	---	0.011	9.7	---	---	305	---	
22A	7	---	---	---	---	---	---	---	5.9	---	---	---	---	---	---	---	---	---	0.010	8.2	---	---	364	---	
24	1	0.043	0.17	<0.2	<0.02	---	---	<0.02	0.16	0.02	---	---	<0.02	4.13	---	---	---	---	0.017	52.5	<0.2	---	730	---	
24A	1	0.051	0.06	<0.2	<0.02	---	---	<0.02	12.9	0.02	---	---	<0.02	0.16	---	---	---	---	0.086	14.4	<0.2	---	1940	---	
201	1	---	---	---	---	---	14.2	---	ND ^d	---	---	---	---	---	---	---	---	---	---	---	---	---	995	---	
201A	1	---	---	---	---	64	493	---	ND	ND	17	<0.025	---	ND, 38	7.9	8.1	<0.10	4	---	6.4	---	403	306	<0.025	
201A	1	0.029	---	---	---	---	397, 394	---	ND, <0.01	ND	---	---	---	ND, ND	---	---	---	---	<10	---	---	---	278, 259	---	
202	1	---	---	---	---	---	16.3	---	ND	ND	---	---	---	1.4	---	---	---	---	---	---	---	---	2070	---	
202A	1	<0.025	---	---	---	310	214, 173	---	ND, 0.009	ND	48	<0.025	---	ND, <15	7.4	6.7	<0.10	3	<10	9.7	---	293	555, 209	<0.025	
203	1	---	---	---	---	---	48.9	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	1010	---	
203A	1	---	---	---	---	---	723	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	220	---	
204	1	---	---	---	---	---	124	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	1010	---	
205	1	1.013	---	---	---	490	10.6, 16	---	ND, 0.006	ND	114	0.113	---	ND, <15	7.8	7.0	<0.10	10	<10	19.4	---	245	1430, 815	<0.025	
301R	---	<0.025	0.05	---	---	290	190.0, 211	---	0.002	---	34	<0.025	---	<15	7.3	6.8	<0.10	2	0.047, <0.01	11.0	---	242	520, 411	<0.025	
301S	---	<0.025	---	---	---	260	32	---	<0.010	---	21	<0.025	---	<15	7.9	6.8	<0.10	5	18	8.0	---	141	423	<0.025	
302B	---	<0.025	0.20	---	---	240	37.9, 63	---	0.001	---	23	<0.025	---	<15	---	---	<0.10	1	0.032, <0.01	4.6	---	96	376, 363	<0.025	
302B	---	<0.025	0.07	---	---	330	295.0, 315	---	0.001	---	53	<0.025	---	<15	7.6	7.1	<0.10	3	0.044, <0.01	11.0	---	264	470, 538	<0.025	
303 ^e	---	---	0.17	---	---	---	50.0	---	---	---	---	---	---	---	---	---	---	---	0.016	---	---	---	120	---	
303B	---	<0.025	0.26	---	---	410	85.8, 60	---	0.049	---	71	<0.025	---	<15	6.6	6.2	<0.10	11	0.190, <0.01	12.4	---	383	1950, 1875	<0.025	
303B	---	<0.025	0.11	---	---	270	178.0, 262	---	0.001	---	49	<0.025	---	---	7.7	6.9	<0.10	5	0.140, <0.01	8.9	---	236	1210, 916	<0.025	
304B	---	<0.025	0.17	---	---	65	32.7, 33	---	<0.010	---	21	<0.025	---	<15	7.4	6.8	<0.10	2	0.040, <0.036	5.5	---	85	156, 148	<0.025	
304R	---	<0.025	0.06	---	---	104	182.0, 32	---	0.010	---	21	<0.025	---	<15	7.9	7.2	<0.10	3	0.046, <0.017	6.4	---	115	460, 182	<0.025	
305B	---	<0.025	0.18	---	---	210	29.2, 38	---	0.045	---	14	<0.025	---	<15	7.3	6.9	<0.10	1	0.021, <0.01	7.6	---	35	140, 137	<0.025	
305B	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
306B	---	<0.025	7.66	---	---	151	20.6, 21	---	0.020	---	12	<0.025	---	<15	7.4	8.0	<0.10	2	0.029, <0.01	7.3	---	110	268, 224	<0.025	
306R	---	<0.025	0.17	---	---	230	125.0, 141	---	0.001	---	21	<0.025	---	<15	7.4	7.0	<0.10	3	0.076, <0.01	9.8	---	411	806, 670	0.196	
401 ^f	---	<0.025	ND	---	---	147	28.8, 29	---	<0.010	---	15	<0.025	---	<15	7.4	7.1	<0.10	1	0.018, <0.01	5.7	---	24	107, 91	<0.025	
402	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
403	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
404	---	<0.025	0.19	---	---	275	85.8, 106	---	0.002	---	32	<0.025	---	<15	7.4	7.0	<0.10	3	0.035, <0.01	4.8	---	116	390, 330	<0.025	
405 ^g	---	<0.025	ND	---	---	38	28.8, 36	---	0.026	---	8	<0.025	---	<15	6.8	6.4	<0.10	3	0.013, <0.01	2.3	---	26	87, 78	<0.025	
406 ^g	---	<0.025	0.017	---	---	315	37.1, 41	---	0.033	---	46	<0.025	---	<15	7.4	7.2	<0.10	4	0.027, <0.01	8.6	---	34	132, 196	<0.025	
407 ^g	---	<0.025	0.11	---	---	210	59.7, 65	---	0.040	---	21	<0.025	---	<15	7.6	0	<0.10	4	0.026, <0.01	7.0	---	75	198, 140	<0.025	
408 ^g	---	<0.025	---	---	---	250	44	---	0.077	---	55	<0.025	---	<15	7.8	7.3	<0.10	7	<0.01	10.6	---	56	85	<0.025	
409 ^g	---	<0.025	---	---	---	26	12	---	0.018	---	13	<0.025	---	<15	6.8	6.4	<0.10	6	<0.01	8.1	---	12	64	<0.025	
410 ^g	---	<0.025	ND	---	---	43	21.9, 22	---	0.001	---	11	<0.025	---	<15	6.8	6.4	<0.10	3	0.020, <0.01	8.0	---	38	126, 136	<0.025	
411	---	<0.025	ND	---	---	330	175.0, 135	---	0.033	---	21	<0.025	---	<15	7.4	6.8	0.40	7	0.160, <0.01	8.5	---	680	1590, 960	<0.025	
501 ^h	---	<0.025	---	---	---	730 ^g	2140 ^g	---	0.025	---	93	<0.025	---	<15	---	6.9	<0.10	4	<0.01	9.1	---	360 ^g	94	<0.025	
502 ^h	---	<0.025	---	---	---	200	238	---	0.340	---	39	<0.025	---	<15	7.6	7.2	<0.10	3	<0.01	8.1	---	296	315	<0.025	
503 ^h	---	0.089	---	---	---	92	40	---	0.013	---	18	<0.025	---	<15	---	7.8	<0.10	2	<0.01	7.9	---	40	16	<0.025	
5A	---	<0.025	---	---	---	235	82	---	---	---	19	<0.025	---	<15	---	7.0	<0.10	2	<0.01	7.2	---	258	405	<0.025	
601 ^h	---	---	ND	---	---	---	0.16	---	---	---	---	---	---	---	---	---	---	---	ND	---	---	---	<1.0	---	---
Creek	---	<0.025	---	---	---	93	96	---	0.012	---	16	0.060	---	<15	8.1	7.6	0.54	5	<0.01	2.7	---	60	132	<0.025	
602 ^h	---	<0.025	---	---	---	0.7	<1	---	<0.010	---	0.04	<0.025	---	<15	---	---	<0.10	0.02	<0.01	<0.1	---	0.11	<5	<0.025	
Standard		0.05 ⁱ	---	1.0 ⁱ	0.01 ⁱ	250 ^j	---	0.05 ⁱ	0.3 ^j	0.05 ⁱ	---	---	---	10.0 ⁱ	6.5	8.5 ^j	---	---	0.01 ⁱ	---	0.05 ⁱ	---	250 ^j	---	

^aWell locations shown on Figure D.2-2.

^b< indicates a detection limit; actual concentrations may be lower.

^c--- indicates no analysis was performed.

^dNone detected.

^eChartiers Creek adjacent to wells 303B and 303A.

^fWell is located off the expanded Canonsburg site.

^gQuestionable result.

^hField blank.

ⁱEPA National Interim Primary Drinking Water standards (40 CFR 141).

^jEPA National Secondary Drinking Water guidelines (40 CFR 143).

Source: Weston field data (1979-1983).

Table D.2-3. Wells within a 1-mile radius of the
Canonsburg site

Address	Use
132 1/2 Latimer Avenue	Wash cars
351 Bluff Street	Abandoned
402 Ridge Avenue	None
32 West Pitt Street	Abandoned
154 E. College Street	Never used
15 Latimer Avenue	None
302 W. Grant Street	Abandoned
202 W. Grant Street	None
213 Reed Street	None
126 W. Pike Street	None
19 Latimer Avenue	Water garden
16 Strabane Avenue	Abandoned

Source: Weston (1979) socioeconomic survey, Chnupa (1983).

FIGURE D.2-14
GROUNDWATER SAMPLING WELL LOCATIONS
BURRELL TOWNSHIP SITE

Table D.2-4. Flow-net calculations -- Burrell site

Flow through unit cross-section:

$$q = K \Delta h \frac{N_f}{N_d} \cdot \frac{a}{b} \quad (\text{Perloff and Baron, 1976})$$

Where:

K = Hydraulic conductivity.

N_f = Number of flow channels.

a/b = Ratio of spacing of equipotential lines (a) to flow lines (b).

Δh = Change in potential (head) between two equipotential lines (h_1-h_2).

n_d = Equipotential units between h_1 and h_2 .

Δh = Drop in head between W19 and W7.

K = 0.16 ft/min.

n_f = 2.

a/b = 0.1.

$$q = (0.16 \text{ ft/min.}) (942.2' - 937.9') \cdot \frac{2}{4.7} (0.1)$$

$$q = 0.029 \text{ ft}^3/\text{min.}$$

Total flow across 2000 ft. cross-section Q :

$$Q = 58 \text{ ft}^3/\text{min.} = 452 \text{ gpm (does not discharge to the onsite ponds).}$$

Δh = Drop in head between edge of site and Pond D.

K = 0.16 ft/min.

n_f = 2.

a/b = 0.19.

$$q = K \Delta h \frac{n_f}{n_d} \cdot \frac{a}{b}$$

$$q = (0.16 \text{ ft/min.}) (950 - 937) \cdot \frac{2}{9} (0.19)$$

$$q = 0.089 \text{ ft}^3/\text{min.}$$

Total flow across 950 ft. cross-section:

$$Q = 39.1 \text{ ft}^3/\text{min.} = 305 \text{ gpm (discharges to the onsite ponds)}$$

Outflow from Pond D = 200 gpm (field estimate).

$$\begin{array}{r} 305 \\ -200 \\ \hline 105 \text{ gpm -- direct seepage to river} \end{array}$$

Total direct seepage to river:

$$\begin{array}{r} 452 \\ +105 \\ \hline 557 \text{ gpm} \end{array}$$

- NOTE
- 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G. BACH & ASSOC. ZELIENOPLE, PA-DATED 11/16/77
 - 2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F. WESTON INC. BY KURCH-HOUSLEY & ASSOC. PITTSBURGH, PA-DATED 11/6/81 REV 3/2/82
 - 3 ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE AND ARE SHOWN IN FT/MSL. ELEVATION CHECK BY KURCH-HOUSLEY PITTSBURGH, PA-DATED 6/11/82

FIGURE D.2-15
WATER TABLE MAP — 19 JANUARY 1982
BURRELL TOWNSHIP SITE

- NOTE
- 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G BACH & ASSOC ZELLENOPLE PA-DATED 11/16/77
 - 2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F. WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
 - 3 ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE PA AND ARE SHOWN IN FT/MSL ELEVATION CHECK RUN BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-16
ISOPLETH MAP OF GROUNDWATER pH
BURRELL TOWNSHIP SITE

- NOTE
- 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G. BACH & ASSOC. ZELIENOPLE PA-DATED 11/16/77
 - 2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F. WESTON INC. BY KURCH-HOUSLEY & ASSOC. PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
 - 3 ELEVATIONS ARE TO USGS DATUM, BLAIRSVILLE. DATA ARE SHOWN IN FT/MSL ELEVATION CHECK BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-17
ISOPLETH MAP OF GROUNDWATER
SULFATE CONCENTRATION
BURRELL TOWNSHIP SITE

Table D.2-5. Ground-water quality -- Burrell site

Well ^a number	Date sampled	pH	Specific conductance (μ hos/cm)	Chloride (mg/l)	Sulfate (mg/l)	Nitrate (mg/l)	Iron (mg/l)	Lead (mg/l)	Barium (mg/l)	Boron (mg/l)
1	Dry									
2	1-29-82	6.8	1100	29.8	91	NF ^b	0.06	NF	0.07	0.63
3	1-29-82	6.9	1175	14	348	NF	0.22	NF	0.02	0.40
4	Dry									
5	Blocked									
6	2-4-82	7.2	1200	35.2	170	NF	0.10	NF	0.11	0.45
7	1-29-82	7.7	1300	59.8	200	NF	NF	NF	0.10	1.13
8	1-29-82	7.4	900	9.3	131	NF	NF	NF	0.04	0.59
9	1-29-82	8.8	4900	106	1590	6.5	142	NF	0.41	1.70
10	2-4-82	7.3	900	21.2	108	NF	0.07	NF	0.02	0.18
11	1-29-82	7.1	2000	795	NF	NF	NF	NF	NF	0.20
12	1-29-82	5.8	750	8.3	720	0.34	3.84	NF	NF	0.27
13	1-29-82	7.2	1975	24.3	300	NF	NF	NF	0.07	0.24
14	1-29-82	3.5	1825	23.4	880	1.62	50.1	0.52	NF	0.07
15	1-29-82	4.6	1250	17.8	680	0.33	0.40	NF	NF	0.06
16	2-4-82	6.7	1550	16.8	198	NF	0.06	NF	NF	0.22
17	2-4-82	6.8	1100	19.1	380	NF	NF	NF	0.02	0.24
18	2-2-82	7.0	570	9.1	112	0.23	1.62	NF	NF	0.17
19	1-29-82	6.9	1500	15.5	266	NF	0.07	NF	NF	0.94
20	2-4-82	6.6	1300	20.4	665	I ^c	NF	NF	0.03	0.07
21	1-29-82	3.7	---	5.6	891	0.32	0.72	NF	NF	NF
	2-2-82	3.3	1850	8.8	1120	0.73	3.7	NF	NF	0.10
22	2-4-82	5.2	1600	18	845	NF	NF	NF	NF	NF
23	2-2-82	6.9	1425	51.8	390	NF	NF	NF	NF	0.43
24	2-2-82	7.8	325	4.2	34.8	NF	0.49	NF	0.10	0.15
25	2-2-82	7.6	1200	24	169	NF	NF	NF	0.09	0.50
26	2-2-82	7.0	700	18.3	79	NF	0.14	NF	0.03	0.16
27	2-4-82	6.6	---	11	895	NF	13	NF	NF	0.12
28	2-4-82	7.5	350	7.0	9.6	NF	NF	NF	0.72	0.08
Pond A	2-4-82	7.0	1250	19.7	420	NF	NF	NF	0.02	0.76
Pond B	2-4-82	6.9	1200	20.2	290	NF	NF	NF	0.03	0.41
Pond C	2-4-82	5.7	12	22.3	440	0.72	NF	NF	NF	0.07
<u>Standard</u>										
			6.5-8.5 ^d		250 ^d	10 ^e	0.3 ^d	0.05 ^e	1.0 ^e	

^aWell locations shown on Figure D.2-14.^bNF = Not found.^cI = Interference^dEPA National Secondary Drinking Water guidelines (40 CFR 143).^eEPA National Interim Primary Drinking Water standards (40 CFR 141).

Source: Weston (1982) field data.

- GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION
- 1179 WATERTABLE SURFACE CONTOURS (FT/MSL)
- GROUNDWATER FLOW DIRECTION

FIGURE D.2-19
WATER TABLE MAP—12 MARCH 1982
HANOVER TOWNSHIP SITE

**FIGURE D.2-21
ISOPLETH MAP OF GROUNDWATER
SULFATE CONCENTRATIONS
HANOVER TOWNSHIP SITE**

Table D.2-6. Ground-water quality -- Hanover site

Well number ^{a,b}	Iron (mg/l)	Lead (mg/l)	Nitrate (mg/l)	Sulfate (mg/l)	Total cyanide (mg/l)	Total organic carbon (mg/l)	Specific conduc- tance (mmhos)	pH	Total dis- solved solids (mg/l)
1	ND	ND	0.94	1660	0.03	50.5	3100	6.3	4792
2	ND	ND	0.2	910	0.02	26.0	2200	8.2	1706
5	ND	ND	0.2	1250	0.03	16.0	1500	7.7	2004
6	0.07	ND	3.75	2500	0.03	11.0	2300	6.8	3918
7	0.27	ND	0.33	3030	0.03	6.5	3000	4.4	4884
8	ND	ND	0.2	2840	0.03	22.5	2200	6.9	4724
9	ND	ND	0.2	2240	0.03	16.5	2400	7.0	2874
11	0.14	ND	0.2	2320	0.03	5.5	2300	7.3	3196
"A"	ND	ND	0.64	1910	0.03	5.5	2500	7.3	3196
"B"	0.06	ND	0.2	1860	0.03	6.0	2700	7.0	3230
Creek	ND	ND	0.21	1550	0.02	1.5	2100	6.3	2690

Standards0.05^c10^c250^d6.5-8.5^d

ND - Not detectable.

^aWell locations are shown on Figure D.2-18.^bWells 3, 4, and 10 did not contain sufficient water for sampling.^cEPA National Interim Primary Drinking Water standards (40 CFR 141).^dEPA National Secondary Drinking Water guidelines (40 CFR 143).

Source: Weston (1982) field data.

Table D.2-7. Wells within a 1-mile radius of the Hanover site

Location	Type
Goodwill Hill Fishing and Hunting Club	Spring
Dr. Glen Roberts property	Two wells, each approximately 100 feet deep
John Smith property	Drilled well
Dr. Glen Roberts property	Three wells drilled by Smith Township Water Company (presently capped and not in use)

Source: Chnupa (1983).

REFERENCES FOR APPENDIX D

- Bouwer, H. and R. C. Rice, 1976. "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells," Water Resc. Res., 12(3):423-428.
- Chnupa, J. W., 1983. Sanitarian Regional Manager, Pennsylvania Department of Environmental Resources, Bureau of Community Environmental Control, Letter to T. R. Fabian, Regional Protection Director, Pennsylvania Department of Environmental Resources, Southwestern Regional Office, Pittsburgh, Pennsylvania, May 10, 1983.
- Downie, J., and F. Petrone, 1980. Site inspections report, U.S. Environmental Protection Agency, Region III, Wheeling, West Virginia.
- Perloff, W. H. and W. Baron, 1976. Soil Mechanics: Principles and Applications, John Wiley and Son, New York, New York.
- U.S. Army Corps of Engineers, Pittsburgh, Pennsylvania District, 1975. Final Environmental Statement, Chartiers Creek Local Flood Protection Project, Chartiers Creek Basin.
- U.S. Department of Commerce, Weather Bureau, 1955. Duration Frequency Curves, Technical Paper No. 25.
- U.S. Department of Housing and Urban Development, Federal Insurance Administration, Federal Emergency Management Agency, 1979. Flood Insurance Study, Borough of Canonsburg, Pennsylvania (Washington County), Community No. 420849, Washington, DC.
- U.S. Geological Survey, 1977. Water Resources Data for Pennsylvania, Pennsylvania Water Year, 1977.

Appendix E
BIOLOGICAL INFORMATION

Appendix E.1
TERRESTRIAL ECOLOGY STUDIES

Appendix E.1

TERRESTRIAL ECOLOGY SURVEYS

E.1.1 Overview

The purpose of the terrestrial ecology surveys conducted at the Canonsburg, Burrell, and Hanover sites was to perform qualitative observations for use in developing a general description of their ecological resources. Observations were to be made for the following reasons:

1. To determine the site habitats and their associated wildlife.
2. To identify any unusual ecological features of the site (as a whole, or in part) with respect to the surrounding area.
3. To provide input to determining the need for further quantitative ecological studies.

Because of its small size, the entire Canonsburg site was traversed during the survey. The Burrell and Hanover sites, being larger (about 50 acres each), were surveyed by selecting key areas and representative zones for study.

An overview of the Burrell site and its surrounding area was made from a chartered airplane on February 11, 1980. This reconnaissance provided an overall comparison between the site and its surroundings. It was also used to delineate major vegetation zones on the Burrell site, and to choose areas for ground-level investigation. The 1980 ground survey was performed by walking through representative transects of the site. A segment of the river bank and the complete pond perimeters were also traversed.

The Hanover site is an open property lacking the variation in features of the other sites. Therefore, the ecological survey was based on a walk-through of random sectors.

These surveys concentrated on the following activities:

1. Identifying tree species.
2. Identifying the major herbaceous and brush species.
3. Estimating the vegetative zones over the site--their relative size and location.
4. Identifying any unique or unusual vegetation with respect to the general area.
5. Determining the habitat types on the site and identifying the animals associated with them.

All of the major vegetation types encountered during the walk-throughs were identified in the field, and their relative abundance and location were noted. (Numerous photographs were also taken to document site conditions.) In addition, physical conditions were noted which might affect the site's ecology.

Wildlife information was also obtained through careful site observation. The major impetus was placed on noting the indirect signs of habitation (e.g., tracks, droppings, burrows, nests, trails, runways, etc.). During the checks of the Canonsburg and Burrell sites, key areas were traversed to verify the earlier observations and note any changes.

E.1.2 Observations

E.1.2.1 Canonsburg site

Mature woodland trees line the bank of Chartiers Creek along Areas B and C and occur in the area between the rail line and George Street. These strip woodlands consist mainly of elm, box elder, cherry, hickory, and occasional willows. Common colonizing or early successional tree species such as quaking aspen, black locust, sumac, and cherry are found along the edge of these woodlands and along fences, with scattered individuals within the Canonsburg site.

Grasses and mosses are the dominant ground covers in Areas A, B, and C. Within the fenced section of Area A, broomsedge sparsely covers the tile field (to the north of Building 18), and another thick bunch grass is found along the fence. Outside the fence is a mowed lawn of crabgrass and native fescue.

The flat central portion of Area B (the dredge fill) is sparsely covered with various tall grasses and dense patches of clover, while its slopes are thickly covered with bunchgrass. (Bulrush also occurs in water lenses on top of the dredge fill area and seeps on the side slopes.) Runoff ditches along the roadways (mainly along the perimeters of Areas A and B) are choked with cattail and bulrush, where water stands and sediment from the building area is accumulating.

The ballfield, Area C, has a sparse cover of grasses, asters, and goldenrod. The availability of soil moisture appears to be very low in the foot-deep surface layer of red dog which covers the entire ballfield. An examination of soil test pits in the area indicate that grass roots do not penetrate this red-dog layer. Premature wilting and burning was observed throughout the field, particularly in the old "infield" in early summer (possibly from a moisture deficit). A pervasive layer of mosses may provide the major moisture retention in this area.

Although the ballfield (in Area C) has been inactive for some time, definite patterns remain in the ground cover. Round bare areas of red dog occur in the infield and a distinct area of short grasses extends from

the fence gate opening into the field and curves toward left field. A bare strip of red dog nearly devoid of vegetation extends from home plate along the third base line into left field. This strip, from 3 to 8 feet wide, has radioactivity levels consistently above background, with one of the highest surface levels of activity within the study area (15,000 counts per second) occurring on third base. The vegetation patterns may well be a result of various species' success on variable depths and consistencies of the red-dog fill. These patterns may also be remnants of fill placement, research investigations, or ballfield maintenance activities. (A map of the Canonsburg site's vegetation zones is shown on Figure E.1-1. Table E.1-1 gives a listing of the plant species growing on the Canonsburg site.)

Although Areas A, B, and C all have relatively sparse vegetative cover because of poor growth on cinders, dredge spoils, and red dog, each area is ringed by a less-disturbed fringe area of good vegetative cover along fence lines, ditches, and spoil area slopes. Overall these areas provide suitable habitat for significant small mammal populations. Runways were observed in all areas, particularly along fringe sectors. Kestrels were observed successfully hunting in all three areas.

More heavily vegetated fringe or edge areas surrounding the field areas provide habitat for rabbits and groundhogs whose burrows were only observed along the relatively undisturbed slopes of the creek, the intermittent stream (B4), and the fence line of Area A. Rabbit trails and feeding areas were common throughout all areas.

Edge areas and woodlands provide suitable habitat for a variety of passerine birds. In addition to kestrels already mentioned, screech owls and redtail hawks probably hunt in the Canonsburg site area at times. A few old trees along the creek may even be used for nesting, as well as for raccoon and squirrel dens.

According to the local game warden, muskrats are commonly associated with Chartiers Creek and its tributaries. Migrating waterfowl utilize Chartiers Creek to a minor extent during spring and fall. Mallards and wood ducks were observed on the creek immediately upstream of the site in the fall. Green herons were occasionally observed along the creek in the area, and it is likely that great blue herons also use the creek near the site.

A general list of wildlife common to the Canonsburg site region is given in Table E.1-2.

All areas of natural vegetation have some value as wildlife habitat. Chartiers Creek and its riparian woodlands have the greatest value for wildlife of the Canonsburg site's habitats, mainly due to their unique nature in an urban setting. Although every small habitat area which contributes to the support of wildlife has some value, perhaps the greatest value of Canonsburg site habitats may be seen in their use as undeveloped or potential urban parkland. If the well-worn trails along Chartiers Creek and through field areas are any indication, the area is heavily visited by local residents. However, no organized hunting or other recreational activity is known to occur in or near the Canonsburg site area.

Table E.1-1. Plants of the three project sites

Scientific Name	Common name
<u>Canonsburg site</u>	
<u>Ulmus americana</u>	American elm
<u>Prunus</u> sp	Cherry
<u>Acer negundo</u>	Box elder
<u>Carya</u> sp	Hickory
<u>Salix</u> sp	Willow
<u>Populus tremuloides</u>	Quaking aspen
<u>Robina pseudoacacia</u>	Black locust
<u>Rhus</u> sp	Sumac
<u>Typha latifolia</u>	Cattail
<u>Scirpus validus</u>	Bulrush
<u>Andropogon virginicus</u>	Broomsedge
<u>Trifolium</u> sp	Clover
<u>Aster</u> sp	Aster
<u>Solidago</u> sp	Goldenrod
<u>Dipsacus sylvestris</u>	Teasel
Gramineae	Grasses
<u>Burrell site</u>	
<u>Platanus occidentalis</u>	Sycamore
<u>Populus tremuloides</u>	Quaking aspen
<u>Betula</u> sp	Birches
<u>Robina pseudoacacia</u>	Black locust
<u>Crataegus</u>	Hawthorne
<u>Quercus</u> sp	Oaks
<u>Carya</u> sp	Hickory
<u>Rhus</u> sp	Sumac
<u>Dipsacus sylvestris</u>	Teasel
<u>Arctium minus</u>	Burdock
<u>Verbascum thapsus</u>	Common mullein
<u>Phragmites communis</u>	Reed grass
<u>Daucus carota</u>	Queen Anne's lace
Gramineae	Grasses
<u>Hanover site</u>	
<u>Trifolium</u> sp	Clover
Gramineae	Grasses
(Near the site)	
<u>Quercus</u> sp	Oaks
Coniferae	Conifers
<u>Populus</u> sp	Aspen
<u>Carya</u> sp	Hickory
<u>Acer</u> sp	Maple
<u>Rhus</u> sp	Sumac
<u>Betula</u> sp	Birch

Table E.1-2. Wildlife common to the region of the three sites

Scientific Name	Common name
<u>Mammals</u>	
<u>Didelphis marsupialis</u>	Opossum
<u>Blarina brevicauda</u>	Shorttail shrew
<u>Scalopus aquaticus</u>	Eastern mole
<u>Peromyscus leucopus</u>	White-footed mouse
<u>Microtus pennsylvanicus</u>	Meadow vole
<u>Procyon lotor</u>	Raccoon
<u>Mustela rixosa</u>	Least weasel
<u>Mustela frenata</u>	Longtail weasel
<u>Mustela vison</u>	Mink
<u>Mephitis mephitis</u>	Striped skunk
<u>Vulpes fulva</u>	Red fox
<u>Urocyon cinereoargenteus</u>	Gray fox
<u>Marmota monax</u>	Woodchuck
<u>Tamias striatus</u>	Chipmunk
<u>Sciurus carolinensis</u>	Eastern gray squirrel
<u>Sciurus niger</u>	Eastern fox squirrel
<u>Ondatra zibethica</u>	Muskrat
<u>Sylvilagus floridanus</u>	Eastern cottontail
<u>Odocoileus virginianus</u>	Whitetail deer
<u>Waterfowl</u>	
<u>Gavia immer</u>	Common loon
<u>Podilymbus podiceps</u>	Pied-billed grebe
<u>Olor columbianus</u>	Whistling swan
<u>Branta canadensis</u>	Canada goose
<u>Anas platyrhynchos</u>	Mallard
<u>Aix sponsa</u>	Wood duck
<u>Lophodytes cucullatus</u>	Hooded merganser
<u>Ardea herodias</u>	Great blue heron
<u>Butorides striatus</u>	Green heron
<u>Raptors</u>	
<u>Accipiter gentilis</u>	Goshawk
<u>Accipiter cooperii</u>	Cooper's hawk
<u>Buteo jamaicensis</u>	Red-tailed hawk
<u>Falco sparverius</u>	American kestrel
<u>Otus asio</u>	Screech owl
<u>Bubo virginianus</u>	Great horned owl
<u>Tyto alba</u>	Barn owl

E.1.2.2 Burrell site

From the air the Burrell site appeared to be a flat, grassy plateau with a thin fringe of intermediate-sized trees along its perimeters. The river bend containing the Burrell site resembled the other river bends in the area, and was distinguishable only by the presence of the steep-banked ponds in its western region.

At ground-level, the Burrell site's substrate is clearly its most outstanding feature. Apparently the entire Burrell site is a plateau of railroad ties. The presence of exposed ties along the steep river and pond banks suggests that they may be present to a considerable depth. Many stretches of the Burrell site consist solely of ties with little to no soil material present. There are also small irregular subsidence areas where the ties appear to have settled.

Except for the rail corridor running along its northern perimeter, the entire Burrell site is vegetated (see Figure E.1-2). The majority of its cover consists of grasses and other herbaceous plants, such as: teasel, burdock, goldenrod, common mullein, multiflora, raspberry, and Queen Anne's lace (Table E.1-1). Trees present on the Burrell site are generally early-successional types: sycamore, hawthorn, birches, maples, quaking aspen, locust, and sumacs. The only stands of trees occur along the river bank and along the bluff to the north of the rail lines, forming a fringe along the perimeters. Taller trees in the bluff area also include some oaks and hickories.

The steep-banked pond areas contain often dense patches of brushy vegetation (mainly sumacs and multiflora and hawthorn); however, it is questionable whether the bank area could support significant tree growth because of its loose railroad tie composition. Individual trees, roughly 15 years old, occur irregularly throughout the Burrell site. The age of these trees, and the fact that they are early colonizing species that typically grow in stands, suggests that vegetative succession is being inhibited at the Burrell site. It may be that tree growth over the majority of the Burrell site area is being limited by the presence of the railroad ties and the subsequent lack of a stable soil substrate. Wet areas in the vicinity of the ponds and along the river bank also contain stands of reed grass.

The overall Burrell site is best characterized as an old field habitat. It is too open, even along the river bank, to support true forest dwellers. The dominant wildlife supported at the Burrell site appears to be burrowing and den-dwelling animals. The irregularity of the landfill material is well suited for this use, as evidenced by many den openings and well-worn runs and paths traversing the site. Signs (droppings and tracks) of rabbits, opossum, mice, voles, shrews, and woodchucks were observed during the surveys. The carcass of a red fox was also encountered in February 1980.

Areas of loose landfill material (especially piles of railroad ties, rocks, and scrap metal) also provide suitable habitat for snakes. Black rat snakes and several types of garter snakes were observed at the Burrell site.

SOURCE: FIELD SURVEY 2/21/80 AND AERIAL PHOTOGRAPHS

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR
CARBIDE CORP. BY RICHARD G. BACH & ASSOC.,
COLE, PA-DATED 11/16/77

FIGURE E.1-2
GENERALIZED VEGETATION TYPE MAP
BURRELL TOWNSHIP SITE

The Burrell site serves as a hunting area for a variety of carnivorous animals such as foxes and kestrels, which have been observed at the site.

Although the Burrell site's trees do not appear to be well-suited for nesting raptors, many are used as nest sites for a variety of passerines typical of old-field habitats. Sparrows, finches, blackbirds, cardinals, and woodpeckers were observed at the site during the surveys. During the February survey, the presence of a large number of their nests was noted.

Although the Burrell site does not support forest dwellers, there is evidence, in the form of droppings and worn paths, that deer regularly pass through the Burrell site.

The only standing water occurs in the three steep-banked ponds. These were not sampled during any of the ecology surveys. The pond north of the railines contains a large amount of roofing shingles and automobile tires, and the western-most pond is covered with an oily sheen and contains red staining on the bottom. Based on the observed conditions of these ponds, their value as aquatic habitat is questionable.

The river valley in this area is in open use, much of it being wooded. The Burrell site's open condition is not unusual for the area, and its plant and animal species are common to the area. No unusual species or habitats were encountered that would necessitate further quantitative study. The Burrell site region supports the same type of animal species as the Canonsburg site (Table E.1-2).

E.1.2.3 Hanover site

The most outstanding feature of the Hanover site is its rocky substrate. This appears to have limited vegetative growth over the entire Hanover site area, while some of the steeper slopes have bare rocky areas. Outside the Hanover site there are steep hill areas that have not been strip-mined like the site. These areas contain wooded growth that includes oaks, conifers, hickories, maples, and aspen, with sumacs and birches along their perimeters (Table E.1-1). The Hanover site does not contain any trees. Its major vegetation consists of clover and bunch grasses. Dense stands of cattails grow within the wet drainage areas.

The Hanover site represents an old field habitat. It supports a variety of small mammals, such as mice, voles, shrews, and rabbits. Since there are no trees on the Hanover site, den- or tree-nesting animals were not observed at the site. The Hanover site is included in the range of larger, woodland-dwelling animals. Deer were observed on the Hanover site and it is likely that raptors and other carnivores hunt on the site. The Hanover site is contained within the same regional area as the Canonsburg site. Therefore, the general area contains similar animal species.

Appendix E.2

**AQUATIC BIOLOGY SURVEY
OF CHARTIERS CREEK**

Appendix E.2

AQUATIC BIOLOGY SURVEY OF CHARTIERS CREEK

E.2.1 Purpose

Two surveys were conducted to assess the general condition of the biota in Chartiers Creek near the expanded Canonsburg site. The purpose of the surveys was to describe the biota of the creek in order to predict what effects remedial actions at the Canonsburg site would have on stream life. The first survey was conducted on April 3, 1979, and the second on July 25, 1979.

E.2.2 Methods

Four sampling stations were established (Figure E.2-1) in Chartiers Creek. Station 1 was located well upstream of the expanded Canonsburg site, and was designed to serve as a reference. Stations 2 and 3 were located along the expanded Canonsburg site, above and below the small ditch draining the expanded Canonsburg site. This ditch empties into Chartiers Creek at the Strabane Avenue bridge. Station 4 was located in the channelized portion of Chartiers Creek, approximately 400 meters downstream from the railroad bridge.

A Smith-Root Type VII backpack electroshocker, and a beach seine were used for fish sampling, while macrofauna were sampled by kicknet. The suitability of the electroshocker for stream conditions was determined by performing preliminary water-quality measurements. These water conditions are given in Table E.2-1. The conductivities measured in April were 420 to 440 micromhos, using the equipment's optimum range (20 to 1000 micromhos). The measurements in July (1080-1200 micromhos), although high, can still be expected to provide accurate results.

E.2.3 Physical conditions

Table E.2-2 presents a description of the physical nature of each station. In general, Chartiers Creek flows over shale bedrock overlain by a thin layer of rubble and silt, and is characterized by a steep gradient. This gradient results in swift currents and numerous riffles. Undercut banks and snags are common. The banks tend to be muddy, but the mud extends less than 1 meter into the stream, where it is replaced by the rocky substratum.

Station 1 yielded large numbers of oligochaetes and chironomids in April, but no other species. In July, the kicknet samples contained numerous oligochaetes and nematodes, as well as a snail. Few chironomids were noted, probably reflecting adult emergence between April and July. Extensive growths

■ AQUATIC BIOLOGY—SAMPLING SITES
—APRIL AND JULY 1979

FIGURE E.2-1
LOCATION OF THE AQUATIC BIOLOGY SURVEY
SAMPLING SITES ON CHARTIERS CREEK IN THE
VICINITY OF THE EXPANDED CANONSBURG SITE

Table E.2-1. Water-quality parameters in Chartiers Creek associated with the biological sampling efforts (1979)

Station	Temperature (°C)		<u>Specific conductance</u> (micromhos)		<u>pH</u> (units)		<u>Dissolved oxygen</u> (mg/l)	
	April	July	April	July	April	July	April	July
1	4.7	21.8	420	1200	7.6	---	---	3.9
2	4.6	22.7	420	1080	7.8	---	---	4.5
3	4.7	22.8	420	1100	7.8	---	---	4.6
4	4.9	23.5	440	1160	7.5	---	---	7.4

Source: Weston (1979) field data.

of aquatic vegetation contained large numbers of snails. No fish were captured by either seining or electrofishing, although local inhabitants claimed that carp are occasionally caught near Station 1.

Station 2 was dominated by oligochaetes and chironomids in April, with a few leeches. In July, the chironomids were uncommon, leeches and snails were dominant, and oligochaetes were subdominant. The kicknet samples in July also contained a small dead crayfish, a dead isopod, and a water beetle. Numerous crayfish holes were present in the bank. No fish were captured in an electrofishing effort, which extended from Station 2 to the waterfall at the railroad bridge.

Station 3 was characterized by numerous leeches and chironomids in April. Oligochaetes were rare. One physid snail and one juvenile crayfish were noted. In July, oligochaetes were common, as were leeches and snails. Chironomid larvae were rarely observed, but pupae were observed. One crayfish (2.5 cm long) was captured.

In April, the fauna at Station 4 consisted of chironomids and oligochaetes with occasional leeches, and appeared to be sparse in numbers. In July, however, the samples contained numerous snails, oligochaetes and chironomid larvae and pupae. Leeches and an isopod were also present, as well as a dead crayfish.

These results suggest that the stream reach under study is in a zone of recovery from the input of sewage. Dissolved oxygen and species diversity both increase in a downstream direction, indicating a gradual improvement in conditions. Although no fish were captured during this study, their presence was evident, and local fishermen are known to have caught carp in the study reach. The physical nature of the habitat is good; it is likely that the very poor water quality is the principal limiting factor to fish.

E.2.4 Additional aquatic information

As an additional source of aquatic information on Chartiers Creek, Weston drew upon a field study performed by Gary Kreamer (1978).

"Between sites 9 and 10 (Figure E.2-2), Chartiers Creek flows through light residential and commercial areas and receives iodide compounds, oil, fluoride, and acid rinse water in effluents from local industries. Oily films, milky-colored films, and brownish scums are extensive on the water surface. A wide, rapid riffle, bottomed with boulders, and rubble, grades upstream to a shallower riffle of moderate current and a rubble-gravel substrate. Above the riffles, a long pool section of mostly bedrock overlain with some rubble, gravel and silt (especially at the sides), follows a short pool section of silted flat rubble and gravel. Pools are mostly of moderate flow, and uniform in depth with some small eddies, and shelter in the form of debris and overhanging vegetation. The shade is fair in the riffles, which

MAJOR STREAM AND/OR BRANCH
 TRIBUTARY STREAM
 * FISH SAMPLING SITE/NUMBER

SOURCE KREAMER 1973

FIGURE E.2-2
LOCATION OF FISH SAMPLING SITES
CHARTIERS CREEK BASIN
WASHINGTON COUNTY, PENNSYLVANIA

Table E.2-2. Physical conditions at aquatic sampling stations
(April and July 1979)

Station	Substratum	Banks	Shade	Aquatic vegetation
1	Shale bedrock covered with periphyton and cobbles; silt in the interstices.	Muddy and low.	None--banks covered with grass and bushes.	Numerous attached green algae and <u>Sphaerotilus</u> in April; abundant algae in July.
2	Boulders and cobbles covered with periphyton; silt in interstices.	Steep, undercut; trash dumped along banks.	Moderately shaded by trees.	Sparse attached green algae and <u>Sphaerotilus</u> in April; abundant algae in July.
3	Shale bedrock covered with cobbles; periphyton abundant; silt in interstices.	Steep, undercut.	Well shaded by trees.	Sparse attached green algae in April; moderately-abundant in July.
4	Shale bedrock; areas of cobbles and gravel; periphyton abundant.	Steep, riprapped.	None.	Very sparse--attached green algae in April; abundant algae in July.

Source: Weston (1979) field data.

Table E.2-3. Fish collected at sites on Chartiers Creek

Scientific name	Common name	Stream order	
		4	4
		Site number	
		10	13
<u>Semotilus atromaculatus</u>	Creek chub	0	1
<u>Catostomus commersoni</u>	White sucker	0	17
<u>Notropis chrysocephalus</u>	Striped shiner	0	
<u>Cyprinus carpio</u>	Carp	0	6
Total individuals		0	24
Total species		0	3
Diversity		0	1.04

Source: Kreamer (1978).

are banked by fairly steep, wooded hills. The pool areas sampled (except below a bridge), were more exposed to the sun with low and grassy banks. No fish were collected at site 10 (Table E.2-3).

"Site 13 is the farthest downstream on Chartiers Creek. Between sites 10 and 13 the waters of Chartiers Creek have been greatly altered by channelization as the stream passes through the highly developed towns of Houston and Canonsburg. Within this section, Chartiers Creek receives substantial amounts of mine drainage, particularly from Chartiers Run, and a large outflow from an inactive deep mine near the Fort Pitt Bridge Works in Canonsburg (Table E.2-4). Numerous industrial discharges also enter the stream in this area, containing crude oil, brine, cooling water, clays, silage wastes, and potato wastes (WCPC, 1973). Within the 7-mile reach separating sites 10 and 13, the waters of Chartiers Creek become very turbid, in addition to increasing substantially in flow.

"Site 13 is located about 100-yards downstream from the Hahn Portal of Montour Mine No. 4, and about a half-mile downstream from a primary sewage treatment plant that services the Canonsburg area. Decomposing organic matter is quite evident on the surface of the extremely turbid water. The stream is mostly moderately flowing, with wide (65 feet) pools of fairly uniform depth (16 to 34 inches). Substratum in the pools is mostly rubble and gravel with some exposed bedrock. Still eddies to the sides of the pool areas, laden with organic-rich sediments, reach a depth of 2 feet and contain some logs and debris. Shelter, however, is generally poor, and deep lurking areas are scarce. A wide riffle flows rapidly over bedrock, boulders, and rubble within the study area. Stream banks are well vegetated with deciduous trees and brush. Fish were collected in the waters of Chartiers Creek at site 13, including several large carp in the moderate pools and young white suckers and creek chubs that inhabited only the still organic-rich eddies at the pool margins."

Table E.2-4. Physical/chemical data for sites on Chartiers Creek

Parameter	<u>Site number</u>	
	10	13
Nitrates (ppm)	53	48
Sulfates (ppm)	195	260
Iron (ppm)	0.8	4.0
Chlorides (ppm)	87	81
Specific conductance (μ mhos/cm)	835	750
pH	7.6	7.4
M.O. (alkalinity) (ppm)	171	188
Hardness (ppm)	325	325
Flow volume (cfs)	78	137
Stream gradient (feet/mile)	13	6
Substrate composition (%)		
Bedrock	40	5
Boulders	10	15
Rubble	25	45
Gravel	15	15
Sand	0	5
Silt	10	10
Clay	0	0
Muck	0	0
Pool-riffle ratio	3	2
Riffle habitats		
Maximum width (ft)	55	65
Average depth (in.)	9	14
Maximum depth (in.)	14	20
Maximum length (ft)	60	80
Siltation	1	1
Pool habitats		
Maximum width (ft)	50	65
Average depth (in.)	20	18
Maximum depth (in.)	33	34
Maximum length (ft)	100	100
Siltation	2	2
Flow rate (%)		
Rapid	25	20
Moderate--riffle	20	30
Moderate-- pool	50	40
Sluggish	5	10

Source: Kreamer (1978).

Appendix E.3

**CORRESPONDENCE ON THREATENED
OR ENDANGERED SPECIES**

Appendix E.3

ENDANGERED SPECIES

Both state and Federal agencies were asked to review the three site areas for the presence of endangered or threatened species, unusual habitats or areas of special concern. In each case, none of these species or habitats were discovered. The accompanying letters document the agencies' findings.

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

P. O. BOX 1567
HARRISBURG, PENNSYLVANIA 17120

ADMINISTRATIVE DIVISIONS

ACCOUNTING	787 - 4492
ADMINISTRATION	787 - 5670
LICENSE SECTION	2084
PERSONNEL	7836
GAME MANAGEMENT	5529
	787 - 6711
INFORMATION & EDUCATION	787 - 6286
LAW ENFORCEMENT	787 - 5743
LAND MANAGEMENT	787 - 6818
REAL ESTATE	787 - 6568

August 11, 1982

Mr. Michael V. Mellinger, PhD
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

In re: Borough of Canonsburg,
Cleanup of Landfill Site

Dear Mr. Mellinger:

Thank you for forwarding the above referenced information to our office for review and comment.

We have made a determination that this project will not affect the habitat of any Federally listed threatened or endangered wildlife species under our jurisdiction.

We appreciate the opportunity to comment on proposed projects during the developmental stages, and to provide technical assistance as available.

If we can be of further assistance, please contact this office.

Very truly yours,

Jacob I. Sitlinger, Chief
Division of Land Management

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

P. O. BOX 1567
HARRISBURG, PENNSYLVANIA 17120

ADMINISTRATIVE DIVISIONS

ACCOUNTING	787	4492
ADMINISTRATION	787	5670
LICENSE SECTION	787	2084
PERSONNEL	787	7836
GAME MANAGEMENT	787	5529
	787	6711
INFORMATION & EDUCATION	787	6286
LAW ENFORCEMENT	787	5743
LAND MANAGEMENT	787	6818
REAL ESTATE	787	6568

July 21, 1982

Mr. Michael V. Mellinger, PhD
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

In re: Proposed Sites - Hanover Township,
Washington County, Burrell Township,
Indiana County

Dear Mr. Mellinger:

This is in response to your above referenced requests for information.

A field assessment team from our Southwest Division office has recently reviewed this project and made a determination that the proposed project would not affect any Federally listed, endangered or threatened wildlife species under our jurisdiction. A determination was also made that this project would not affect any critical or unique habitat of special concern to the Pennsylvania Game Commission.

If you have any further questions, please contact this office.

Very truly yours,

Jacob I. Sitlinger, Chief
Division of Land Management

814-359-2754

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
Bureau of Fisheries and Engineering

Robinson Lane
Bellefonte, PA 16823

August 10, 1982

Mr. Michael V. Mellinger
Roy F. Weston, Inc.
Weston Way
West Chester, PA 19380

Dear Mr. Mellinger:

I have examined the maps depicting the uranium mill tailings site in Canonsburg, Washington County, and the two proposed disposal sites in Hanover Township, Washington County, and Burrell Township, Indiana County.

None of the fishes, amphibians or reptiles listed by us as endangered or threatened are presently known to occur at or in the vicinity of these sites. The only federally listed fish, amphibian or reptile species recorded from Pennsylvania are the shortnose sturgeon (Delaware River only), blue pike, and longjaw cisco. The latter two species were listed for the Great Lakes only, and have been proposed for deregulation by the Fish and Wildlife Service due to probable extinction (F.R. Vol 47, No. 101, May 25, 1982).

If you require additional information about endangered or threatened species under our jurisdiction, please do not hesitate to contact this office.

Sincerely,

Clark N. Shiffer
Herpetology and Endangered
Species Coordinator

jb
Enclosure
cc: R. Snyder

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

Post Office Box 1467
Harrisburg, Pennsylvania 17120
August 25, 1982

(717) 787-3444

In reply refer to
RM-F FAS
Bureau of Forestry

Michael V. Mellinger, Ph.D.
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

Dear Dr. Mellinger:

The Bureau of Forestry knows of no endangered plant species at, or near, the proposed disposal areas at Canonsburg, Hanover Township and Burrell Township. There is no State Forest Land near these areas.

You should contact the Pennsylvania Game Commission concerning endangered mammals and birds and the proximity of State Game Lands to these sites. Contact the Pennsylvania Fish Commission concerning endangered fish where the site is near water.

Sincerely,

Malcolm D. Waskiewicz
MALCOLM D. WASKIEWICZ
Assistant forest Resource Planner

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Suite 322
315 South Allen Street
State College, PA 16801

October 20, 1982

Mr. David Lechel
Manager, Environmental Services
Jacobs Engineering Group Inc.
5301 Central Avenue N.E.
Suite 1700
Albuquerque, NM 87108

Dear Mr. Lechel:

This is in response to your letter of October 4, 1982, requesting information on the presence of federally listed or proposed endangered and threatened species, within the impact area of the Department of Energy Uranium Mill Tailings Remedial Action Project at the former processing site in the borough of Cannonsburg, Washington County; the former disposal site in Burrell Township, Indiana County; and a potential disposal site in Hanover Township, Washington County, Pennsylvania.

Except for occasional transient species, no federally listed or proposed threatened or endangered species under our jurisdiction are known to exist in the impact area of the proposed projects. Therefore, no Biological Assessment or further Section 7 consultation under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required with the Fish and Wildlife Service (FWS). Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered. A compilation of federally listed endangered and threatened species in Pennsylvania is enclosed for your information.

This response relates only to endangered species under our jurisdiction. It does not address other FWS concerns under the Fish and Wildlife Coordination Act or other legislation.

Sincerely,

Edward W. Perry
Acting Field Supervisor

Enclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES
IN PENNSYLVANIA

Common Name	Scientific Name	Status	Distribution
<u>FISHES:</u>			
Cisco longjaw	<u>Coregonus alpenae</u>	E	Lake Erie - probably extinct
Pike, blue	<u>Stizostedion vitreum glaucum</u>	E	Deep water of Lake Erie - probably extinct
Sturgeon, shortnose*	<u>Acipenser brevirostrum</u>	E	Delaware River and other Atlantic coastal rivers
<u>REPTILES:</u>			
NONE			
<u>BIRDS:</u>			
Eagle, bald	<u>Haliaeetus leucocephalus</u>	E	Entire state
Falcon, American peregrine	<u>Falco peregrinus anatum</u>	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic peregrine	<u>Falco peregrinus tundrius</u>	E	Entire state migratory - no nesting
Warbler, Kirtland's	<u>Dendroica kirtlandii</u>	E	Entire state - occasional migrant
<u>MAMMALS:</u>			
Bat, Indiana	<u>Myotis sodalis</u>	E	Entire state
Cougar, eastern	<u>Felis concolor cougar</u>	E	Entire state - probably extinct
<u>MOLLUSKS:</u>			
NONE			
<u>PLANTS:</u>			
NONE			

* Principal responsibility for this species is vested with the National Marine Fisheries Service.

REFERENCES FOR APPENDIX E

- Kreamer, G., 1978. "Factors Influencing the Distribution, Abundance, and Composition of Fishes in Several Small, Upland Streams of the Appalachian plateau, Southwestern Pennsylvania," Master's thesis, Washington and Jefferson College, Washington, Pennsylvania.

Appendix F
RADIOLOGICAL INFORMATION

Appendix F.1
BASELINE RADIOLOGICAL INFORMATION

Table F.1-1. Comparison of radiological observations at the Canonsburg and Burrell sites with pertinent regulatory guidelines and standards

Pathway	Medium	Type of contamination	Standard or guideline	Source	Limit	Maximum value found at Canonsburg	Maximum value found at Burrell
Surface contamination	Building material	Gross alpha (from Ra-226)	Regulatory Guide 1.86, "Decontamination Guidelines for Facilities and Equipment"	USNRC, 1976	300 dpm/100 sq cm	40,000 dpm/100 sq cm	Not applicable
		Removable gross alpha (from Ra-226)			20 dpm/100 sq cm	400 dpm/100 sq cm	Not applicable
		Gross beta			0.2 mrad/hour at 1 cm	8.5 mrad/hour at 1 cm	Not applicable
External radiation	Not applicable	Not applicable	"Dose Limits to Public Individuals"	ICRP, 1971	500 mrem/year	4,000 mrem/year	1,260 mrem/year
			"Clean-up Criteria for Uranium Mill Sites"	USNRC, 1978	140 mrem/year		
			Regulatory Guide 1.86, "Decontamination Guidelines for Facilities and Equipment"	USNRC, 1976	0.2 mrad/hour	25 mrad/hour	5.4 mrad/hour
Air	Concentration within buildings	Rn-222	DOE 5480.1 ^a	USDOE, 1981	3 pCi/l	300 pCi/l	2.65 pCi/l
		Pb-210			4×10^{-3} pCi/l	1.3×10^{-4} pCi/l	No data
		Ra-226			3×10^{-3} pCi/l	8.1×10^{-5} pCi/l	No data
		Th-230			8×10^{-5} pCi/l	2.1×10^{-4} pCi/l	No data
		U-238			3×10^{-3} pCi/l	3.5×10^{-4} pCi/l	No data
		Rn-222 + daughters	10 CFR 20 40 CFR 192	USNRC, 1960 USEPA, 1983	0.033 WL 0.030 WL	0.51 WL	0.001 WL

^aAlso 10 CFR 20, except for U-238.

Table F.1-1. Comparison of radiological observations at the Canonsburg and Burrell sites with pertinent regulatory guidelines and standards (continued)

Pathway	Medium	Type of contamination	Standard or guideline	Source	Limit	Maximum value found at Canonsburg	Maximum value found at Burrell
Ground water	Onsite	Ra-226 U-238	10 CFR 20	USNRC, 1960	30 pCi/l 40,000 pCi/l	4,500 pCi/l 14,380 pCi/l (U-235 + U-238)	
Soil	Floor drain sediments	U-238	10 CFR 40	USNRC, 1961	172 pCi/g	270 pCi/g	Not applicable
		Ra-226				310 pCi/g	Not applicable
	Surface onsite	U-238	46 FR 52061-52063 (October 23, 1981)	USNRC, 1981	200 pCi/g ^a	51,000 pCi/g	360 pCi/g
		Ra-226	40 CFR 192	USEPA, 1983	5 pCi/g	4,200 pCi/g	5,000 pCi/g
		U-238	46 FR 52061-52063 (October 23, 1981)	USNRC, 1981	10 pCi/g	10 pCi/g	No data
	Surface offsite	Ra-226	40 CFR 192	USEPA, 1983	5 pCi/g	3,100 pCi/g	No data

^aAbove this level, the site is to have access restricted.

- GROUNDWATER SAMPLING WELL
- NUMBERS ORIGINAL WELLS—CANON INDUSTRIAL PARK
- 200 SERIES NEW WELLS—AREA C CANON INDUSTRIAL PARK
- GP NEW WELLS—GEORGES POTTERY
- LETTER A WELLS INTO BEDROCK
- ▲ SOIL BORING LOCATION

NOTE THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH HOUSLEY & ASSOC. PITTSBURGH PA DATED MARCH 1983 AND ON MAPS OF THE CHARTIERS CREEK BASIN PA BY THE US ARMY CORPS OF ENGINEERS PITTSBURGH PA DATED 6/3/73

**FIGURE F.1-1
GROUNDWATER AND SUBSURFACE SOIL SAMPLING
LOCATIONS USED FOR RADIOLOGICAL SURVEY
EXPANDED CANONSBURG SITE**

Table F.1-2. Radiological analysis of subsurface soil samples taken from the Canonsburg site

Sample location and depth (feet)	Sample (results in picocuries per gram (pCi/g))			
	Ra-226	U-234	U-235	U-238
203				
2-3	3,400	3,020	5.0	35.3
3.5-3.8	10,900	464	12	307
5.6-6.8	18,400	4,240	188	1,960
8.5-9.5	130	38.1	1.2	30.3
204				
5-6	2,260	1,090	19.5	267
11-12	21.4	4.8	0.13	3.91
13-14	38.7	10.3	0.33	10.3
205				
3.5-4	10,000	128	3.2	73.8
4.5	21,800	961	33	395
6	18,500	950	32	325
206				
4-6	8,480	186	5.1	119
6-7	3,790	406	7.9	3.37
16-17	39.6	8.79	0.33	8.66
207				
0-2	18,900	81.7	1.9	17.1
2-4	785	26.6	1.6	25.8
8-10	5,930	1,630	31	424
208				
2-4	12,000	628	19	470
4-6	7,850	125	3.6	91
6-8	7,220	282	3.3	209
210				
0-3	2,000	400	13.5	218
3.5-5.5	548	54	2.4	50.8
5.5-7.5	6,490	4,590	48	329
11.5-13.5	2,110	1,280	3.43	639

^aLocations are shown on Figure F.1-1.

Source: Weston (1982) field data.

Table F.1-3. Radiological analysis of sediment samples taken from Chartiers Creek near the expanded Canonsburg site

Location	Nuclide (results in picocuries per gram-dry (pCi/g))								
	Th-230	U-235	U-238	Ra-226	Ac-228	Bi-214	Th-232	Cs-137	K-40
Upstream of site near railroad track	6.5	<0.26	<10	2.0	1.2	0.86	0.52	0.12	12
North of Wilson Avenue	8.3	<0.39	<5.9	1.9	0.98	0.76	0.17	0.11	11
Northeast corner of site	1.5	<0.37	<6.7	2.8	1.2	0.82	0.27	0.30	13

Source: Weston (1979) field data.

Table F.1-4. Concentrations of nuclides in ground-water samples taken from the expanded Canonsburg site and adjacent offsite properties

Well location ^a	U-234			U-235 (soluble)			U-238 (soluble)			Total uranium			Ra-226 (soluble)			Ra-226 (soluble)			Gross alpha			Gross beta			Ac-227			Ac-228			Th-230			Th-232			Po-210			Bi-214		
	I ^b	II ^c	III ^d	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III			
5	8			380			8 161						4 500																													
5A		7 5 ^e	8 0	<25			11 3		8 3				16 2		<1 ^f	1 0		<2		<5 ^g	150		<9 ^h	<75	378		31		13 823		40 6		2 2		4 400							
6A				<13			8 8																																			
17				<28			450																																			
17A				<13			29 6																																			
22				<23			127 8																																			
22A				<11			9 1																																			
24				<12			440																																			
24A				<29			14 8																																			
27				<28			259 7																																			
201	117			4 2			119																																			
201A	5 5		4 2	0 15			2 54		1 9				6 1																													
202	146			5 8			142																																			
202A	5 13		3 3	0 18			4 11		3 7				7 0		25																											
203	2 66			0 13			2 87																																			
203A	4 21			0 20			3 30																																			
204	3 310			74			3 270																																			
205	3 780		4 240	97			3 950		4 300				8 540		518		670																									
301R			220				200						420				1 6																									
301R		3 66	1 9	<0 1			2 51		2 8				4 7		<1	10																										
302R		32 6	30 1	0 52			34		31 9				62		<1	2 2																										
302R		0 77	1 5	<0 02			0 41		1 2				2 7		<1	4 9																										
303R		6 5 ^e	2 4	<0 1			3 34		2 2				4 6		<1 ^f	4 0																										
303R		1 6 ^e	6 6	<0 2			7 57		6 0				12 6		<1 ^g	5 4																										
304R	162	253		45			161		242				495		<1	2 6																										
304R		1 43	31 2	0 05			1 22		31 2				62 4		<1	4 3																										
305R																																										
305R		4 8	6 6	0 13			5 08		7 4				14 0		<1	1 0																										
306R		119	95 9	3 2			128		103				199		<1	1 7																										
306R		307	305	110			262		305				610		3 45 ^f	3 7																										
401R		1 33	0 6	<0 02			1 01		0 6				<2		<1	1 9																										
402																																										
403																																										
404		84 9	79	2 6			79 7		79				158		<1	2 4																										
405R		0 75	0 4	<0 02			0 71		0 5				<2		<1	1 0																										
406R		1 69	2 8	<0 02			1 45		2 1				4 9		<1	1 8																										
407R		1 6	3 3	0 15			1 38		3 1				6 4		<1	2 0																										
408R			0 8						0 8				<2		<1	1 4																										
409R			0 1						0 2				<2		<1	1 1																										
410R		310	0 7	<0 2			9 51		0 7				<2		<1	2 2																										
411		1 110 ^f	1 100	159			574		1 100				2 200		<1 ^g	0 72																										
501R			0 7						0 8				<2		<1	1 4																										
502R			1 9						9				3 8		<1	3 8																										
503R			0 7						0 4				<2		<1	1 6																										
601R		0 12		<0 01			0 33		0 6				<2		<1	0 85																										
602R			0 5						0 8				<2		<1	0 16																										
Creek			0 6																																							
GP-1									93 5				0 167																													
GP-2									8 42				0 594																													
GP-2A									3 11				0 316																													
GP-4									4 570				10 3																													
GP-4A									291				1 65																													
GP-5									375				0 46																													
GP-6									4 96				0 279																													
GP-7									139				0 213																													
MFC standard (10 CFR 20)	30 000			30 000			40 000			30 000 ⁱ			30				30 ^j		3 000 ^k			2 000			90 000		2 000			2 000			100		3 000							

^aWell locations are shown on Figure D 2 2

^bI = Analyses conducted by Radiation Management Corporation (1979-1982)

^cII = Analyses conducted by Teledyne (March 1983)

^dIII = Analyses conducted by Bendix Corporation (April 1983)

^eDashes indicate no analysis was performed

^fAnalyses conducted by Teledyne (April 1983)

^gWell is located off the expanded Canonsburg site

^hField blank

ⁱThis limit is for natural uranium

^jThis limit is for an unknown radionuclide(s) that decays by alpha emission or spontaneous fission

^kThis limit is for an unknown radionuclide(s) that decays by other than alpha emission or spontaneous fission with a half life greater than 2 hours

Source: Weston field data (1979-1983)

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82

**FIGURE F.1-2
LOCATION OF GROUNDWATER SAMPLING WELLS
USED FOR RADIOLOGICAL SURVEY
BURRELL TOWNSHIP SITE**

Table F.1-5. Radiological analysis of ground-water samples from the Burrell site

Well number ^a	Nuclide (results in picocuries per liter (pCi/l))				Gross alpha	Gross beta
	Ra-226	U-234	U-235	U-238		
Sample dates July 27-30, 1981						
2	2.02	0.54	<0.05	0.52	< 5	17
3	<1.0	1.81	<0.10	1.63	<10	17
5	<1.0	3.56	0.12	3.28	<40	<40
6	<1.0	2.78	0.13	2.37	<10	15
7	<1.0	1.17	<0.05	0.93	< 5	25
8	<1.0	0.60	<0.05	0.52	<10	18
9	1.28	6.57	0.22	5.34	<40	66
10	<1.0	0.30	<0.05	0.21	< 5	3.5
11	<1.0	3.74	0.13	3.81	<10	< 4
12	1.37	0.56	<0.05	0.52	6	6.1
13	<1.0	5.87	0.40	5.73	16	21
14	<1.0	3.51	0.16	2.86	<10	5.2
15	<1.0	0.13	<0.05	<0.10	< 4	4.0
16	<1.0	1.7	<0.10	1.62	< 4	4.3
17	<1.0	0.47	<0.05	0.42	< 4	3.7
18	1.34	0.10	<0.05	<0.10	4.0	5.8
19	<1.0	1.30	<0.05	1.27	<10	21
20	1.00	0.74	<0.05	0.77	< 4	4.4
21	<1.0	<0.10	<0.05	<0.10	<30	<40
22	<1.0	0.85	<0.05	<0.10	< 7	13
23	<1.0	<0.10	<0.05	0.67	< 9	16
24	--- ^b	---	---	---	---	---
25	---	---	---	---	---	---
26	---	---	---	---	---	---
27	---	---	---	---	---	---
28	---	---	---	---	---	---

^aLocation of wells is shown on Figure F.1-2.

^bDashes indicate no sample was taken.

Source: Weston (1982) field data.

Table F.1-5. Radiological analysis of ground-water samples from the Burrell site (continued)

Well number ^a	Nuclide (results in picocuries per liter (pCi/l))				Gross alpha	Gross beta
	Ra-226	U-234	U-235	U-238		
Sample dates						
January 21 -						
<u>February 11, 1982</u>						
2	--- ^b	---	---	---	--- ^b	---
3	---	---	---	---	---	---
5	---	---	---	---	---	---
6	<1.0	1.33	<0.04	1.12	< 2	15
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	<1.0	4.38	0.16	3.44	51	110
10	---	---	---	---	---	---
11	<1.0	0.75	<0.02	0.70	< 4	5.7
12	---	---	---	---	---	---
13	<1.0	0.97	<0.02	0.74	< 3	16
14	<1.0	0.88	<0.03	0.92	< 3	4.3
15	---	---	---	---	---	---
16	---	---	---	---	---	---
17	---	---	---	---	---	---
18	---	---	---	---	---	---
19	---	---	---	---	---	---
20	---	---	---	---	---	---
21	---	---	---	---	---	---
22	---	---	---	---	---	---
23	---	---	---	---	---	---
24	<1.0	0.30	<0.03	0.18	< 5	3.7
25	<1.0	0.21	<0.02	0.13	< 2	4.0
26	<1.0	1.3	<0.10	0.95	< 2	8.1
27	<1.0	0.22	<0.02	0.16	< 3	3.8
28	<1.0	0.55	0.068	0.16	< 4	< 2

Appendix F.2

DESCRIPTION OF THE MILDOS COMPUTER CODE AND THE INPUTS USED

Appendix F.2

DESCRIPTION OF THE MILDOS COMPUTER CODE AND THE INPUTS USED

F.2.1 Introduction

The MILDOS computer code (U.S. NRC, 1980) was developed by the NRC to serve as the primary licensing evaluation tool for assessment of radiological impacts resulting from uranium-milling operations. The code can be used to evaluate compliance with the EPA's uranium fuel cycle radiation protection standard (40 CFR 190), compliance with the EPA's remedial-action standards for inactive uranium-processing sites (40 CFR 192), and the maximum air-concentration limits and radiation doses embodied in the NRC's standards for protection against radiation (10 CFR 20). MILDOS uses the calculational models and data, as described in the NRC Regulatory Guide 3.51, "Calculational Models for Estimating Radiation Doses to Man from Airborne Radioactive Materials Resulting from Uranium Milling Operations," except the inhalation dose factors have been modified to reflect new information on radionuclide dosimetry.

F.2.2 Calculational regime

The MILDOS code calculates radiation doses to people resulting from releases of solid particulates and gases from uranium-mill operations, including releases from tailings piles. The code allows for area sources that change with time. As used for tailings it assumes 30 percent fines and 70 percent coarse material (mean diameters of 5 and 35 micrometers, respectively, of density 2.4). Also input to the code are the distribution of the population around the source and the joint frequency distribution of winds averaged throughout the year. The code takes into account resuspension, atmospheric dispersion, and deposition on the ground. The code calculates resultant doses by radionuclide (uranium-238, thorium-230, radium-226, radon-222, and lead-210), by organ (whole body, bone, lung, liver, kidneys, and bronchial epithelium), and by pathway (inhalation, external irradiation, and ingestion). The outputs of the code are expressed as population doses in each population distribution segment (actually committed dose equivalents in man-rem per year of exposure) and as individual doses at specified points in the vicinity (in rem per year of exposure). The commitments are 100 years for the population doses and 50 years for the individual doses. The conversion of these doses to health effects in Chapter 5 were made by the factors given in subsection F.3.2.

The translocation and airborne concentrations of radon gas and radioactive particulates removed from a contaminated area, such as buried or above-ground uranium-mill tailings, are estimated from theoretical and empirical wind-erosion equations according to wind speed and direction, particle size

distribution, surface roughness, and atmospheric stability class, and the mill tailings' radionuclide concentrations. A dispersion-deposition-resuspension model is used. This Gaussian plume model allows for source depletion as a result of deposition, radioactive decay, and in-growth of radon-daughter products. The average air concentration is calculated to be constant during each annual release period because of the use of annual average meteorological data and average radionuclide concentrations in the tailings. Surface contamination is estimated by including buildup from deposition, in-growth of radioactive daughters, and removal by radioactive decay, weathering, and other environmental processes. The deposition velocity is estimated on the basis of particle size, density, and physical and chemical environmental conditions that influence the behavior of the smaller particles.

The calculation of the individual organ doses and dose rates to populations and individuals is based on the International Commission on the Radiological Protection (ICRP) Task Group Model (ICRP, 1966). Estimates of the dose to the bronchial epithelium of the lung from inhalation of radon and its short-lived daughters are calculated based on a dose-conversion factor, which Weston modified to reflect the most recent accepted value (Harley and Pasternack, 1982). External radiation exposure includes radiation from airborne radionuclides, and exposure to radiation from contaminated ground. Individual dose commitments, population dose commitments, and environmental dose commitments can then be computed.

F.2.3 MILDOS inputs

The data inputs to MILDOS consist of the following:

1. Meteorological data concerning annual average wind speed and direction by atmospheric stability class for each site (refer to Section 4.3 and Appendix B.1).
2. The population distribution around each site for each ordinal direction in 0.5-kilometer (0.31 mile) increments out to a distance of 2 kilometers (1.24 miles) from the Burrell and Hanover sites and within 0.05, 0.5 to 1.0, 1.0 to 1.5, 1.5 to 2.0, and 2.0 to 3.0, etc. to 9.0 to 10.0 kilometers from the Canonsburg site (refer to Section 4.12, Figures G-6 and G-7, and Tables G-5, G-9, and G-11).
3. The average radionuclide release rates for the time periods of interest and the average radionuclide concentrations at each site in excess of the natural background.

Data required for conducting the radiological impact analysis by using the MILDOS computer program were collected in March 1983. The data collection task addressed population distribution, dairy farming, and agricultural activities within a 10-kilometer radius of the Canonsburg site. Specific information was obtained through letters, phone calls, and visits to municipal, county, and regional agencies.

The task began with the identification of those municipalities within a 10-kilometer radius of the Canonsburg site. This was done on official highway maps of Washington and Allegheny Counties. After identification of these municipalities, specific population and agricultural information was assembled for each of them. This information was placed on maps of the 10-kilometer radius area. The population data were located according to specific sector (1 of 16) and distance from the site. The dairy farms were identified according to coordinates from the Canonsburg site.

Specific sources of information used in this task were the following:

1. U.S. Bureau of Census Library, Philadelphia -- 1980 census data for the area municipalities.
2. Washington County Planning Commission -- detailed census tract maps of the Pittsburgh Standard Metropolitan Statistical Area.
3. Washington and Allegheny County Offices -- information on major land use activities including: number, size (acreage), and location of farms within each municipality.
4. U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service (ASCS) and the U.S. Soil Conservation Service -- comprehensive data on agricultural and dairy farming activities.
5. Pennsylvania Department of Agriculture, Crop Rotation Service -- county-level agricultural statistics.
6. Agricultural Extension Service, Washington County and Washington County ASCS Office -- location of dairy farms in area, and specific production information such as: number, density, and output of dairy animals.
7. Pennsylvania Department of Transportation, Bureau of Transportation Planning Statistics and U.S. Department of Transportation, Federal Highway Administration -- official highway maps.

Of these inputs, the site radioactivity data have the greatest inherent error because of the averaging process. Based on the number of results available for each site, the relative standard error has been statistically estimated at 20 percent. The inherent errors in the meteorological and population data are small and do not materially affect the overall data error. However, the overall accuracy of the MILDOS model (as with most mathematical models) is approximately a factor of 2. Thus, the calculated doses are within a factor of 2 of the upper limit doses that could be received by the general public and remedial-action workers at each site under each alternative. The total population and worker doses for each alternative were determined by summing the calculated doses at each site and adding to these sums the external gamma dose rates from buried materials. The specific input data used are described in the subsection that follows.

F.2.4 Specific input data

The population and meteorological data were specific for each site and alternative. The only inputs that changed among the alternatives were the radioactivity source terms. These radiological inputs are discussed in the following subsections on a site-by-site and alternative-by-alternative basis. The radon-release rates listed are the releases by diffusion out of the radium-bearing material; these are used as part of the input to the calculation of atmospheric dispersion of radioactivity. The radium- and uranium-release rates listed account for dust raised in loading and dumping contaminated materials; these rates are also used in the calculation of atmospheric dispersion. The radium and uranium concentrations listed are used in the calculations of resuspension. Thorium-230 and lead-210 inputs to the code were set equal to zero.

F.2.4.1 Canonsburg site

The Canonsburg site was divided into three area sources, Areas A, B, and C; one or more sources as a result of loading and unloading contaminated materials; and one or more sources for above-ground and in-ground tailings-pile storage during each of the remedial actions, as appropriate.

Alternative 1

Radioactivity	Canonsburg site		
	Area		
	A	B	C
Radon-222: curies per year	94.1	16.4	37.3
Radium-226: picocuries per gram	71.8	28.6	121
Uranium-238: picocuries per gram	42.7	13.6	6.8

Alternative 2

Radioactivity		Canonsburg site			Encapsulation ^a area
		Area			
		A	B	C	
Radon-222:	curies per 96 weeks	145	27.8	268	0 ^a
Radium-226 ^b :	curies per 96 weeks	1.11 E-6	0	2.21 E-5	2.46 E-5
Uranium-238 ^b :	curies per 96 weeks	6.52 E-7	0	1.26 E-6	1.69 E-6
Radium-226:	picocuries per gram	132	52.8	223	— ^c
Uranium-238:	picocuries per gram	78.8	25.1	12.6	— ^c

^aThe radon-222 release is 0 as that value is included in the Area A, B, and C values.

^bThese values are for loading and dumping contaminated materials.

^cDashes indicate that no input is required.

Alternative 3

Radioactivity		<u>Canonsburg site</u>			Encapsulation area
		<u>Area</u>			
		A	B	C	
Radon-222:	curies per 96 weeks	145	27.8	268	0 ^a
Radium-226 ^b :	curies per 96 weeks	1.11 E-6	0	2.21 E-5	2.34 E-5
Uranium-238 ^b :	curies per 96 weeks	6.52 E-7	0	1.26 E-6	1.52 E-6
Radium-226:	picocuries per gram	132	52.8	223	--- ^c
Uranium-238:	picocuries per gram	78.8	25.1	12.6	--- ^c

^aThe radon-222 release is 0 as that value is included in the Area A, B, and C values.

^bThese values are for loading and dumping contaminated materials.

^cDashes indicate that no input is required.

Alternatives 4 and 5

Radioactivity		<u>Canonsburg site</u>			<u>Pile</u>		
		<u>Area</u>			1	2	3
		A	B	C			
Radon-222:	curies per 96 weeks	123	27.3	248	0.55	4.63 E-2	7.64
Radium-226 ^a :	curies per 96 weeks	3.10 E-5	3.01 E-6	1.36 E-4	--- ^b	---	---
Uranium-238 ^a :	curies per 96 weeks	1.85 E-5	1.44 E-6	7.64 E-4	---	---	---
Radium-226:	picocuries per gram	93.8	47.4	206	38.7	3.31	51.5
Uranium-238:	picocuries per gram	55.9	22.7	45.0	23.0	1.58	11.2

^aThese values are for loading and dumping contaminated materials.

^bDashes indicate that no input is required.

After Alternatives 2 and 3

Radioactivity	Canonsburg site		
	Area		
	A	B	C
Radon-222: curies per year	26.2	11.5	6.18

F.2.4.2 Burrell site

The Burrell site was divided into two area sources, E (the eastern portion of the site) and W (the western portion of the site), and one pile for above-ground-tailings storage during Alternatives 2 and 4.

Alternative 1

Radioactivity	Burrell site	
	Area	
	E	W
Radon-222: curies per year	2.13	109
Radium-226: picocuries per gram	1.78	203
Uranium-238: picocuries per gram	0.76	21

Alternatives 2 and 4

Radioactivity		<u>Burrell site</u>		Pile
		<u>Area</u>		
		E	W	
Radon-222:	curies per 96 weeks	1.22	62.9	22.8
Radium-226 ^a :	curies per 96 weeks	1.53 E-7	1.74 E-5	1.76 E-5
Uranium-238 ^a :	curies per 96 weeks	2.94 E-8	8.08 E-7	8.37 E-7
Radium-226:	picocuries per gram	2.05	234	73.7
Uranium-238:	picocuries per gram	0.88	24.2	8.09

^aThese values are for loading and dumping contaminated materials.

Alternatives 3 and 5

Radioactivity		<u>Burrell site</u>	
		<u>Area</u>	
		E	W
Radon-222:	curies per 96 weeks	0.71	36.3
Radium-226:	picocuries per gram	0.59	67.7
Uranium-238:	picocuries per gram	0.25	7.0

After Alternatives 3 and 5

Radioactivity	Burrell site	
	Area	
	E	W
Radon-222: curies per year	21.3	10.7

F.2.4.3 Hanover site

The Hanover site is currently not contaminated with radioactive materials and is evaluated as a potential repository only under Alternatives 4 and 5. This site was considered to be a single area source.

Alternative 4

Radon-222:	curies per 96 weeks	1662
Radium-226 ^a :	curies per 96 weeks	1.47 E-3
Uranium-238 ^a :	curies per 96 weeks	1.51 E-4

^aThese values are for dumping contaminated materials.

Alternative 5

Radon-222:	curies per 96 weeks	788
Radium-226 ^a :	curies per 96 weeks	1.45 E-3
Uranium-238 ^a :	curies per 96 weeks	1.50 E-4

^aThese values are for dumping contaminated materials.

After Alternatives 4 and 5

Radon-222:	curies per year	25.2
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Appendix F.3
RADIOLOGICAL IMPACT ASSESSMENTS

RADIOLOGICAL IMPACT ASSESSMENTS

F.3.1 Exposure pathways

Potential exposure pathways by which people could be exposed to radioactive materials during this project are shown on Figure F.3-1. The pathways of concern are inhalation of radon gas and particulate radioactive materials, external exposure due to submersion in a radioactive cloud, and exposure to materials deposited on or already in the ground. Exposure of individuals to radioactive materials in surface water for the no-action alternative is insignificant. Based on a projected soil loss of 1.15 tons per year from Area C, the most contaminated area, into Chartiers Creek, the resultant increase in radionuclide concentrations would be approximately 0.3 picocurie per liter, essentially undetectable. This concentration is not expected to increase during any of the remedial-action alternatives and thus is not evaluated. Individuals may also be exposed to radioactivity by eating locally grown foodstuffs. However, since the closest farms are not very close to the site, the impacts along this pathway should be minimal.

During the remedial action there will be no planned releases of radioactive materials directly into surface waters or into ground-water systems. The only releases that could occur, under normal operating conditions, would be because of the unavoidable release of small amounts of radioactivity resulting from the remedial action. If an accident occurred, potentially greater amounts of radioactive materials could be introduced to surface or ground waters; however, since neither Chartiers Creek nor the Conemaugh River are drinking-water sources and since ground water from the sites enters these surface waters directly, this potential exposure pathway is not significant. Thus, while there is a slight possibility of radionuclide release, the amounts involved will be minimal, and the dilution factor high; therefore, the impacts from the waterborne-exposure pathway to the general public becomes insignificant for this radiological assessment.

In order to evaluate the effects of exposure via the pathways of concern, the radiation doses have been calculated, and the health effects based on these doses have been determined. In all dose calculations the average radioactivity levels, less the normal background levels, are used for impact evaluation. Thus, the excess radiation exposures and health effects that would occur as a result of remedial action on the Canonsburg and Burrell sites have been calculated. The specific evaluation techniques are summarized in the paragraphs that follow.

FIGURE F.3-1
POTENTIAL RADIATION EXPOSURE PATHWAYS
TO THE GENERAL PUBLIC AND
REMEDIAL ACTION WORKERS

The health effects from inhalation of radon-daughter products and other airborne radionuclides, direct external gamma radiation, and ingestion of locally grown foodstuffs are calculated by considering the measured or predicted dose and the size of the population exposed. The units for expressing these doses are the rem (where 1 rem is approximately equal to 1 roentgen) and the man-rem. The number of man-rem is determined by multiplying the dose in rems by the number of persons exposed.

F.3.2 Methods of impact assessment

Radiation doses to the general population and remedial-action workers were evaluated using the MILDOS computer program (U.S. NRC, 1980), which is described in Appendix F.2. The MILDOS program provides estimates of potential radiation exposure to individuals in the vicinity of a uranium-mill-tailings-disposal site. The inputs to this program consist of the following:

1. Population distribution data.
2. Meteorological data.
3. Radionuclide-emission-rate data.
4. Radionuclide-concentration data.

The meteorological and population data used are described in Appendices B.1 and G of this EIS, respectively.

The radionuclide-emission rates used were of several kinds: the emission of radon from the surface based on measured values; radon emissions from newly exposed radioactively contaminated materials; particulates made airborne by wind erosion; and particulates resulting from loading trucks. Radon-222 releases from newly exposed radioactively contaminated materials were inferred from radium-226 concentrations as reported by ORNL (Leggett et al., 1979a, b) using the relation, 1 picocurie per gram of radium-226 = 1 picocurie per square meter per second of radon-222.

The release of wind-eroded particulates depends on the areas of nuclide-containing material exposed during the remedial actions. These areas were obtained from the engineering plans for the alternatives outlined in Section 3.1. MILDOS contains wind-suspension factors based on experimental data. During truck loading of contaminated material, some contaminated particulates (dust) are picked up by the wind. This process and the amount of such dust are described in Section 5.3 and Appendix B.2. In estimating the amounts of airborne particulates, no credit was taken for the fugitive dust control techniques described in Section 5.21.

The outputs from this program thus include maximum probable estimates of the radiological doses from inhalation of radon-daughter products and other radionuclides, from external exposure to gamma radiation, and ingestion of locally produced foodstuffs.

In Alternatives 4 and 5, people are exposed to gamma radiation from passing trucks containing contaminated material from the Canonsburg site. This material contains a trace amount of radioactivity; the measured gamma levels on the Canonsburg site average 227 microroentgens per hour at a height of 3 feet (1 meter). At greater distances the levels will be less. The radiation dose commitment to the public from passing trucks has been calculated using equation F.3-1, assuming a population density of 2000 people per square mile and an average truck speed of 10 miles per hour.

$$D = \frac{2KP_d}{V} \int_d^{\infty} \frac{e^{-\mu r} B(r) dr}{r \sqrt{r^2 - d^2}} \quad (\text{F.3-1})$$

Where:

- D = Dose commitment.
- K = Dose rate factor (227 microroentgens).
- P_d = Population density (0.00076 people per square meter).
- V = Truck speed (10 mph).
- μ = Attenuation coefficient (0.0035 per meter).
- r = Distance from source.
- B(r) = Buildup factor (1).
- d = Minimum distance from source.

This dose commitment is about 0.01 man-microrem per loaded truck-mile. The dose commitment for truck drivers is about 22 man-microrems per loaded truck-mile.

Under Alternative 2 materials are brought from the Burrell site to the Canonsburg site. Using equation F.3-1 and a dose rate factor of 11 microroentgens, the population exposure is approximately 0.0005 man-microrem per loaded truck-mile and the dose commitment for the truck drivers is approximately 0.1 man-microrem per loaded truck-mile. Similarly under Alternative 4, the Burrell residues are transported to Hanover, and the population exposure is approximately 0.0002 man-microrem per loaded truck-mile based on a population density of 0.00036 people per square meter around the Burrell site. The truck driver dose commitment remains unchanged at 0.1 man-microrem per loaded truck-mile.

Excess cancer deaths due to radiation exposure were calculated using the following risk factors (National Academy of Sciences, 1980; Cohen, 1981; Evans, et al, 1981):

1. Lung cancer deaths = 20 per lifetime of the exposed population per from inhalation of 1,000,000 man-rems radon-daughter products
2. All cancer deaths = 120 per lifetime of the exposed population per from gamma 1,000,000 man-rems exposure

These risk factors are, in our opinion, realistic estimators of the true risk of lifetime cancer death. It should be pointed out, however, that literature values range from 13 to 102 lung cancer deaths due to inhalation of radon-daughter products, and from 50 to 621 cancer deaths due to gamma exposure (Cohen, 1981; Evans et al., 1981; Harley and Pasternack, 1982; National Academy of Sciences, 1980; National Academy of Sciences, 1972; United Nations, 1972; United Nations, 1977; United States Radiation Policy Council, 1980). Thus, the ultimate number of actual cancer deaths predicted in this Canonsburg FEIS are probably accurate to within a factor of 5. Since the same risk factors were used throughout this report, comparisons of radiological impacts under the different alternatives are valid, regardless of the accuracy.

Table F.3-1. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 1

Dose delivered to	Millirems per year, unless otherwise noted					Tracheo- bronchial system ^b
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	
Population within 10 kilometers ^c	11 ^d	21 ^d	62 ^d	10 ^d	10 ^d	530 ^d
Nearest building						
N	0.93	1.70	5.60	0.85	0.86	37
NNE	2.43	4.31	13.3	2.22	2.25	47
NE	5.69	10.2	31.8	5.20	5.26	133
ENE	10.5	18.7	55.6	9.55	9.65	265
E	15.8	28.1	79.2	14.4	14.6	393
ESE	12.5	21.5	57.5	11.5	11.6	129
SE	9.46	16.5	47.6	8.69	8.79	174
SSE	7.09	12.4	37.7	6.51	6.59	257
S	4.10	7.19	21.8	3.77	3.81	191
SSW	1.44	2.53	7.89	1.32	1.34	169
SW	0.45	0.79	2.43	0.42	0.42	88
WSW	0.29	0.50	1.47	0.27	0.27	23
W	0.14	0.24	0.77	0.12	0.13	64
WNW	0.72	1.27	3.74	0.66	0.67	45
NW	0.84	1.50	4.41	0.77	0.78	37
NNW	0.38	0.69	2.28	0.34	0.35	20
Canon-MacMillan High School	1.38	2.49	8.36	1.26	1.27	131
St. Patrick's Church and School	4.50	8.17	26.2	4.09	4.14	132

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c63,942 people.

^dMan-rem per year.

Table F.3-2. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 2

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo-bronchial system ^b
Population within 10 kilometers ^c	22 ^d	39 ^d	116 ^d	20 ^d	20 ^d	1858 ^d
Nearest building						
N	1.72	3.13	10.3	1.57	1.59	97
NNE	4.48	7.95	24.5	4.10	4.15	129
NE	10.5	18.8	58.7	9.59	9.70	313
ENE	19.3	34.5	103	17.6	17.8	980
E	29.3	52.1	147	26.8	27.0	1900
ESE	22.9	39.6	106	21.1	21.3	500
SE	17.4	30.3	87.7	16.1	16.2	826
SSE	13.1	23.0	69.5	12.1	12.2	1050
S	7.61	13.3	40.2	7.00	7.08	710
SSW	270	4.72	14.6	2.48	2.51	1010
SW	0.87	1.49	4.52	0.80	0.81	253
WSW	0.57	0.96	2.74	0.53	0.53	207
W	0.27	0.46	1.44	0.25	0.25	61
WNW	1.35	2.36	6.92	1.24	1.25	154
NW	1.57	2.78	8.15	1.44	1.45	127
NNW	0.70	1.28	4.21	0.64	0.72	54
Canon-MacMillan High School	2.64	4.67	15.5	2.41	2.44	434
St. Patrick's Church and School	8.30	15.1	48.4	7.56	7.65	385

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c63,942 people.

^dMan-rems per year.

Table F.3-3. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 3

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo-bronchial system ^b
Population within 10 kilometers ^c	22 ^d	39 ^d	116 ^d	20 ^d	20 ^d	1860 ^d
Nearest building						
N	1.72	3.13	10.3	1.57	1.59	97
NNE	4.48	7.95	24.5	4.10	4.15	129
NE	10.5	18.8	58.7	9.59	9.70	313
ENE	19.3	34.5	103	17.6	17.8	980
E	29.3	52.1	147	26.8	27.0	1900
ESE	22.9	39.6	106	21.1	21.3	500
SE	17.4	30.3	87.7	16.1	16.2	826
SSE	13.1	23.0	69.5	12.1	12.2	1050
S	7.61	13.3	40.2	7.00	7.08	710
SSW	2.70	4.72	14.6	2.48	2.51	1010
SW	0.87	1.49	4.52	0.80	0.81	253
WSW	0.57	0.96	2.74	0.53	0.53	207
W	0.27	0.46	1.44	0.25	0.25	61
WNW	1.35	2.36	6.92	1.24	1.25	154
NW	1.57	2.78	8.15	1.44	1.45	127
NNW	0.70	1.28	4.21	0.64	0.72	54
Canon-MacMillan High School	2.64	4.67	15.5	2.41	2.44	434
St. Patrick's Church and School	8.30	15.1	48.4	7.56	7.65	385

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c63,942 people.

^dMan-rem per year.

Table F.3-4. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternatives 4 and 5

Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)						
Dose delivered to	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo- bronchial system ^b
Population within 10 kilometers ^c	18 ^d	31 ^d	94 ^d	16 ^d	16 ^d	1720 ^d
Nearest building						
N	1.33	2.41	7.94	1.21	1.22	89
NNE	3.45	6.13	19.0	3.16	3.20	118
NE	8.42	15.0	47.1	7.69	7.79	290
ENE	16.0	28.6	86.9	14.6	14.8	914
E	25.2	44.8	130	23.0	23.2	1770
ESE	18.5	31.9	86.3	17.0	17.2	462
SE	13.2	23.0	66.6	12.1	12.3	766
SSE	9.56	16.7	50.5	8.79	8.89	972
S	5.55	9.68	29.3	5.10	5.16	661
SSW	1.99	3.47	10.7	1.83	1.85	474
SW	0.66	1.13	3.40	0.61	0.62	234
WSW	0.45	0.74	2.12	0.41	0.42	193
W	0.21	0.35	1.11	0.19	0.19	56
WNW	1.05	1.83	5.43	0.96	0.97	145
NW	1.27	2.25	6.72	1.16	1.17	120
NNW	0.55	1.01	3.34	0.50	0.51	50
Canon-MacMillan High School	2.06	3.62	12.0	1.89	1.92	400
St. Patrick's Church and School	6.72	12.2	39.5	6.12	6.10	357

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c63,942 people.

^dMan-rem per year.

Table F.3-5. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site after completion of Alternative 2 or 3

Dose delivered to	Millirems per year, unless otherwise noted					Tracheo-bronchial system ^b
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	
Population within 10 kilometers ^c	0.254 ^d	0.270 ^d	0.258 ^d	0.257 ^d	0.267 ^d	151 ^d
Nearest building						
N	1.54 E-3 ^e	1.54 E-3	1.54 E-3	1.54 E-3	1.54 E-3	11.6
NNE	1.49 E-3	1.49 E-3	1.49 E-3	1.49 E-3	1.49 E-3	15.5
NE	5.59 E-3	5.60 E-3	5.59 E-3	5.59 E-3	5.59 E-3	56.4
ENE	1.29 E-2	1.29 E-2	1.29 E-2	1.29 E-2	1.29 E-2	87.3
E	1.84 E-2	1.84 E-2	1.84 E-2	1.84 E-2	1.84 E-2	99.9
ESE	3.86 E-3	3.86 E-3	3.86 E-3	3.86 E-3	3.86 E-3	29.7
SE	7.18 E-3	7.18 E-3	7.18 E-3	7.18 E-3	7.18 E-3	51.8
SSE	1.18 E-2	1.18 E-2	1.18 E-2	1.18 E-2	1.18 E-2	74.7
S	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	57.2
SSW	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	51.4
SW	6.96 E-3	6.97 E-3	6.96 E-3	6.96 E-3	6.97 E-3	26.6
WSW	4.76 E-3	4.77 E-3	4.76 E-3	4.76 E-3	4.76 E-3	19.7
W	3.63 E-3	3.64 E-3	3.63 E-3	3.63 E-3	3.63 E-3	7.05
WNW	2.39 E-3	2.39 E-3	2.39 E-3	2.39 E-3	2.39 E-3	17.3
NW	1.39 E-3	1.39 E-3	1.39 E-3	1.39 E-3	1.39 E-3	14.2
NNW	1.16 E-3	1.16 E-3	1.16 E-3	1.16 E-3	1.16 E-3	6.32
Canon-MacMillan High School	2.64 E-2	2.65 E-2	2.64 E-2	2.64 E-2	2.65 E-2	35.8
St. Patrick's Church and School	1.17 E-2	1.17 E-2	1.17 E-2	1.17 E-2	1.17 E-2	44.0

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c63,942 people.

^dMan-rem^s per year.

^e1.54 E-3 = 0.00154.

Table F.3-6. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternative 1

Dose delivered to	Millirems per year, unless otherwise noted					Tracheo- bronchial system ^b
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	
Population within 2 kilometers ^c	0.0864 ^d	0.0876 ^d	0.0867 ^d	0.0867 ^d	0.0874 ^d	47.8 ^d
Nearest building						
N	2.90 E-3 ^e	2.91 E-3	2.90 E-3	2.90 E-3	2.91 E-3	15.6
NNE	2.44 E-3	2.45 E-3	2.44 E-3	2.44 E-3	2.45 E-3	8.87
NE	5.42 E-3	5.43 E-3	5.42 E-3	5.42 E-3	5.43 E-3	25.2
S	4.74 E-3	4.81 E-3	4.75 E-3	4.76 E-3	4.80 E-3	5.13
SSW	6.67 E-2	6.73 E-2	6.68 E-2	6.69 E-2	6.72 E-2	73.7
SW	6.54 E-2	6.57 E-2	6.55 E-2	6.55 E-2	6.57 E-2	134
NW	5.51 E-3	5.52 E-3	5.51 E-3	5.51 E-3	5.52 E-3	33.8
NNW	4.00 E-3	4.00 E-3	4.00 E-3	4.00 E-3	4.00 E-3	34.0

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c4,546 people.

^dMan-rem per year.

^e2.90 E-3 = 0.00290.

Table F.3-7. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternatives 2 and 4

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo- bronchial system ^b
Population within 2 kilometers ^c	9.34 0.0934 ^d	0.127 ^d	0.262 ^d	8.99 0.0899 ^d	9.06 0.0906 ^d	29.9 ^d
Nearest building						
N	2.08 E-2 ^e	5.71 E-2	9.87 E-2	1.90 E-2	1.90 E-2	8.88
NNE	3.11 E-2	5.60 E-2	0.155	2.84 E-2	2.84 E-2	5.96
NE	9.66 E-2	0.173	0.462	8.82 E-2	8.82 E-2	16.8
S	2.59 E-2	2.60 E-2	0.121	2.37 E-2	2.37 E-2	3.58
SSW	5.19 E-2	6.17 E-2	0.101	5.08 E-2	5.08 E-2	43.2
SW	4.40 E-2	4.99 E-2	7.45 E-2	4.33 E-2	4.33 E-2	71.3
NW	9.36 E-3	1.36 E-2	3.11 E-2	8.89 E-3	8.89 E-3	19.5
NNW	1.12 E-2	1.74 E-2	4.26 E-2	1.05 E-2	1.05 E-2	22.3

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c4,546 people.

^dMan-rems per year.

^e2.08 E-2 = 0.0208.

Table F.3-8. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternatives 3 and 5

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo- bronchial system ^b
Population within 2 kilometers ^c	0.0311 ^d	0.0423 ^d	0.0873 ^d	0.0300 ^d	0.0302 ^d	9.97 ^d
Nearest building						
N	6.93 E-3 ^e	1.90 E-2	3.29 E-2	6.33 E-3	6.33 E-3	2.96
NNE	1.04 E-2	1.87 E-2	5.17 E-2	9.47 E-3	9.47 E-3	1.99
NE	3.22 E-2	5.77 E-2	0.154	2.94 E-2	2.94 E-2	5.60
S	8.63 E-3	8.67 E-3	4.03 E-2	7.90 E-3	7.90 E-3	1.19
SSW	1.73 E-2	2.06 E-2	3.37 E-2	1.69 E-2	1.69 E-2	14.4
SW	1.47 E-2	1.66 E-2	2.48 E-2	1.44 E-2	1.44 E-2	23.8
NW	3.12 E-3	4.53 E-3	1.04 E-2	2.96 E-3	2.96 E-3	6.50
NNW	3.73 E-3	5.80 E-3	1.42 E-2	3.50 E-3	3.50 E-3	7.43

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c4,546 people.

^dMan-rems per year.

^e6.93 E-3 = 0.00693.

Table F.3-9. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site after completion of Alternative 3 or 5

Dose delivered to	Millirems per year, unless otherwise noted					Tracheo-bronchial system ^b
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	
Population within 2 kilometers ^c	2.33	2.36	2.34	2.34	2.36	
Nearest building	0.0233 ^d	0.0236 ^d	0.0234 ^d	0.0234 ^d	0.0236 ^d	11.5 ^d
N	1.04 E-3 ^e	1.04 E-3	1.04 E-3	1.04 E-3	1.04 E-3	3.90
NNE	8.39 E-4	8.38 E-4	8.39 E-5	8.39 E-4	8.39 E-4	2.66
NE	1.02 E-3	1.02 E-3	1.02 E-3	1.02 E-3	1.02 E-3	5.80
S	1.07 E-3	1.07 E-3	1.07 E-3	1.07 E-3	1.07 E-3	1.44
SSW	1.85 E-2	1.85 E-2	1.85 E-2	1.85 E-2	1.85 E-2	21.5
SW	1.53 E-2	1.53 E-2	1.53 E-2	1.53 E-2	1.53 E-2	29.9
NW	1.96 E-3	1.96 E-3	1.96 E-3	1.96 E-3	1.96 E-3	6.58
NNW	1.65 E-3	1.65 E-3	1.65 E-3	1.65 E-3	1.65 E-3	7.27

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c4,546 people.

^dMan-rems per year.

^e1.04 E-3 = 0.00104.

Table F.3-10. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site during Alternative 4

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo-bronchial system ^b
Population within 2 kilometers ^c	0.00889 ^d	0.0103 ^d	0.0169 ^d	0.00877 ^d	0.00881 ^d	10.3 ^d
Nearest building						
NNE	2.40 E-2 ^e	3.18 E-2	5.86 E-2	2.32 E-2	2.33 E-2	26.3
NE	6.45 E-2	8.81 E-2	1.72 E-1	6.19 E-2	6.22 E-2	91.2
SE	1.54 E-2	2.22 E-2	3.96 E-2	1.46 E-2	1.47 E-2	14.1
SSE	2.20 E-2	3.15 E-2	5.86 E-2	2.10 E-2	2.11 E-2	23.0
SSW	8.94 E-3	1.26 E-2	2.09 E-2	8.54 E-3	8.57 E-3	5.63
SW	1.19 E-2	1.63 E-2	2.66 E-2	1.15 E-2	1.15 E-2	8.34
WSW	5.80 E-2	8.85 E-2	1.31 E-1	5.49 E-2	5.51 E-2	8.35
WNW	1.99 E-2	2.77 E-2	4.36 E-2	1.91 E-2	1.92 E-2	11.1
NW	5.13 E-2	5.91 E-2	8.97 E-2	5.06 E-2	5.09 E-2	44.1

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c114 people.

^dMan-rems per year.

^e2.40 E-2 = 0.0240.

Table F.3-11. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site during Alternative 5

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo- bronchial system ^b
Population within 2 kilometers ^c	4.75 0.00475 ^d	6.05 0.00605 ^d	1.26 0.0126 ^d	4.62 0.00462 ^d	4.64 0.00464 ^d	4.88 ^d
Nearest building						
NNE	1.43 E-2 ^e	2.09 E-2	4.37 E-2	1.36 E-2	1.36 E-2	11.0
NE	4.71 E-2	7.09 E-2	0.156	4.45 E-2	4.47 E-2	44.5
SE	1.31 E-2	2.02 E-2	3.82 E-2	1.24 E-2	1.24 E-2	6.94
SSE	1.68 E-2	2.58 E-2	5.18 E-2	1.58 E-2	1.58 E-2	10.5
SSW	6.97 E-3	1.05 E-2	1.84 E-2	6.58 E-3	6.61 E-3	2.57
SW	9.41 E-3	1.38 E-2	2.42 E-2	8.92 E-3	8.96 E-3	4.06
WSW	5.97 E-2	9.16 E-2	0.137	5.61 E-2	5.63 E-2	4.14
WNW	1.41 E-2	2.07 E-2	3.50 E-2	1.34 E-2	1.34 E-2	5.25
NW	2.87 E-2	3.64 E-2	6.77 E-2	2.79 E-2	2.81 E-2	20.7

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c114 people.

^dMan-rem per year.

^e1.43 E-2 = 0.0146.

Table F.3-12. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site after completion of Alternatives 4 and 5

Dose delivered to	Millirems per year, unless otherwise noted					
	Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	Tracheo-bronchial system ^b
Population within 2 kilometers ^c	1.16	1.17	1.16	1.16	1.17	
Nearest building	0.000116 ^d	0.000117 ^d	0.000116 ^d	0.000116 ^d	0.000117 ^d	0.152 ^d
NNE	2.19 E-4 ^e	2.21 E-4	2.19 E-4	2.19 E-4	2.21 E-4	0.413
NE	5.14 E-4	5.16 E-4	5.14 E-4	5.14 E-4	5.16 E-4	1.42
SE	7.52 E-5	7.52 E-5	7.52 E-5	7.52 E-5	7.52 E-5	0.208
SSE	1.32 E-4	1.32 E-4	1.32 E-4	1.32 E-4	1.32 E-4	0.355
SSW	4.93 E-5	4.97 E-5	4.94 E-5	4.93 E-5	4.96 E-5	8.75 E-2
SW	8.10 E-5	8.14 E-5	8.11 E-5	8.11 E-5	8.14 E-5	0.127
WSW	5.44 E-5	5.44 E-5	5.44 E-5	5.44 E-5	5.44 E-5	0.126
WNW	1.06 E-5	1.07 E-5	1.06 E-5	1.06 E-5	1.07 E-5	0.162
NW	6.31 E-4	6.32 E-5	6.31 E-5	6.31 E-5	6.31 E-5	0.634

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

^c114 people.

^dMan-rem per year.

^e2.19 E-4 = 0.000219.

Table F.3-13. Excess radiation doses to the onsite workers during remedial action

Alternative	Site	Number of workers	Man-rem					Tracheo-bronchial system ^b
			Whole body ^a	Bone ^a	Lung ^a	Liver ^a	Kidney ^a	
2	Canonsburg	28	13.6	14.2	17.3	13.5	13.5	50.6
	Burrell	19	0.07	0.07	0.07	0.07	0.07	1.97
	Total	47	13.7	14.3	17.4	13.6	13.6	52.6
3	Canonsburg	28	13.6	14.2	17.3	13.5	13.5	50.6
	Burrell	15	0.006	0.006	0.006	0.006	0.006	0.50
	Total	43	13.6	14.2	17.3	13.5	13.5	51.1
4	Canonsburg	28	13.4	13.8	16.0	13.3	13.3	43.5
	Burrell	19	0.07	0.07	0.07	0.07	0.07	1.97
	Hanover	28	1.49	1.50	1.51	1.49	1.49	18.2
	Total	75	14.9	15.4	17.6	14.9	14.9	63.7
5	Canonsburg	28	13.3	13.8	16.0	13.3	13.3	43.5
	Burrell	15	0.006	0.006	0.006	0.006	0.006	0.50
	Hanover	29	1.07	1.07	1.09	1.06	1.06	11.3
	Total	72	14.4	14.9	17.1	14.4	14.4	55.3

^aMainly exposure to gamma radiation.

^bMainly inhalation of radon-daughter products.

Appendix F.4
RADIOLOGICAL MONITORING

Appendix F.4

RADIOLOGICAL MONITORING

F.4.1 Introduction

The monitoring program to be used during remedial action would consist of two components; i.e., environmental monitoring and occupational monitoring. The former would primarily measure and document the extent of construction-related radiological contaminants migrating off the site. The occupational monitoring would measure and record the exposures of the remedial-action workers to radiation in the work environment.

During the remedial action reports that present and discuss the results of the occupational and environmental monitoring programs and provide recommendations for modifications to the monitoring plan would be prepared. These reports and supporting documentation would be on file with the DOE and the Commonwealth, and would be available to the public.

F.4.2 Environmental monitoring

The monitoring program would include systems designed to detect minute levels of radioactivity that may be transported by air or water. The parameters to be monitored may include airborne particulates, radon gas, short-lived radon daughters, and radionuclides in surface and ground water. The samples may be analyzed for gross radioactivity levels and specific radionuclides of interest (e.g., Th-230, Ra-226, Ra-222, Pb-210, and Po-210).

Monitoring locations would be selected to fully characterize the site and surrounding environs during remedial action. It is anticipated that locations would be chosen that are representative of background and downwind (or downgradient) conditions, and are also representative of areas where exposures may be unusually elevated because of the proximity to the site. Other locations of particular concern to the local population, such as nearby schools, would also be monitored.

The details of the environmental monitoring program are under development (see Section 1.6) and would be subject to review and approval by the NRC and the Commonwealth, and would be available to the public.

F.4.3 Occupational monitoring

Although the potential hazards are very low, occupational monitoring would be employed to measure and record the exposure of workers to radiation in the work environment. Occasionally, excessive contamination could be detected and would have to be removed to prevent dispersal of radioactively contaminated

materials to uncontrolled areas, and to minimize radioactive exposure to all personnel. Therefore, employees who are in contact with tailings during their work shift must be monitored before leaving the restricted area.

In addition, as vehicles and equipment are used in the restricted area, radioactive material is expected to accumulate on all surfaces in contact with the wastes. Instrument surveys and decontamination procedures will ensure that radioactive materials are not transported to uncontrolled areas.

Protocols for monitoring personnel and equipment, and decontamination procedures are under preparation (see Section 1.6) and would be included in the remedial action plan. To be included in the protocols are provisions for the following:

1. Instrumentation.
2. Methods of monitoring.
3. Limits of contamination.
4. Decontamination procedures.
5. Emergency procedures.

F.4.4 Surveillance and maintenance program

The long-term surveillance and maintenance program would be designed to ensure that the final site remains undisturbed and continues to function as designed. At this time, it is anticipated that surveillance would be conducted on a specific schedule (e.g., annually) for the first 5 years post-construction and less frequently thereafter if no problems are encountered. Inspections would also be conducted immediately upon completion of maintenance activities. Surveillance could consist of a walkover with photographic documentation of the cover, fencing, placards, side slopes, and maintenance efforts. Emphasis would be placed on erosion-protection features, cover and fence integrity, and other engineered features (e.g., diversion channels and vegetation).

Ground water would also be sampled for a variety of constituents. The final location of the wells and the frequency of sampling would be selected to ensure the effectiveness of the design. Although worst-case analyses indicate that the most mobile radionuclide would not migrate through the cell for more than 1000 years and then only in low concentrations (see subsection 5.6.2 and Appendix D.2), it is anticipated that two monitoring well fields would be established. One field of shallow wells would be installed immediately upgradient (south and west) and downgradient (north and east) of the encapsulation cell. The second field would be installed (shallow and deep wells) on the expanded Canonsburg site along Chartiers Creek (northeast and east). Given the existing shallow ground-water flow in the vicinity of the encapsulation cell (west-to-east), the expected decrease in water-table elevations in Areas A and B, and the predicted rate of radionuclide migration, the described well fields would be able to monitor the effectiveness of the

disposal site and the encapsulation cell, as well as decreases in concentration of already-dissolved constituents in the ground water in Areas B and C.

Maintenance activities could consist primarily of the following:

1. Soil and rock replacement because of erosion, human intrusion, and cover disturbance (e.g., cracking, settlement, drying).
2. Vegetation maintenance such as mowing, reseeding, mulching, and the use of fertilizers or temporary irrigation.
3. Mechanical repairs to security fences, gates and locks, warning signs, and wells.

Reports and supporting documentation that discuss the results of the surveillance activities and recommend needed maintenance actions and future surveillance would be prepared and placed on file with the DOE, the NRC, and the Commonwealth. These documents would be available to the public.

Appendix F.5

RADIOLOGICAL SAFETY PLANNING

Appendix F.5

RADIOLOGICAL SAFETY PLANNING

F.5.1 Introduction

The radiation levels present on the Canonsburg site are relatively low and present no imminent hazard; however, in order to be conservative and protect the public, a health and safety plan for the protection of employees, subcontractor personnel, and the general public would be developed as part of the remedial action plan (see Section 1.6). This health and safety plan would include policies and procedures to ensure compliance with applicable state and Federal radiation protection criteria, regulations, and guidelines.

F.5.2 Employee training

The health and safety plan would initially require all personnel to attend an orientation session where they would be instructed in the following:

1. Potential hazards associated with the job.
2. Measures that could and would be taken to ameliorate these hazards.
3. Purpose and types of radiation monitoring that would be performed.
4. Individual and collective responsibilities in worker and radiation safety and accident prevention.
5. Specific safety procedures that would be followed include the following:
 - a. Description of the entry and exit procedures.
 - b. Dosimetry.
 - c. Special clothing.
 - d. Use of the employees' change facilities.

The purpose would be to instruct employees concerning potential hazards, to make them aware that safety procedures, although at times burdensome, have been established for their protection and that of the public, and that they should maximize the use of these procedures and minimize exposure. It would be impressed on all personnel that deviations from the health and safety plan are cause for their dismissal.

F.5.3 Safety equipment and exposure monitoring

In order to properly implement the health and safety plan, all workers would have to wear radiation dosimeters at all times when on the job site. This step would be necessary in order to evaluate any potential radiation exposure, which by design, would be kept as low as reasonably achievable. Personnel would also be required to adhere to all applicable protection criteria and guidelines in order to minimize potential accidents. Appropriate local, Commonwealth, and Federal officials would be notified if there was a significant accidental release of radioactively contaminated materials.

Personnel radiation exposure and accident potential on the job site would be minimized by having all employees report to the change facility where they would be issued appropriate protective clothing prior to entering the job site. They would then report to their specific job locations. Any time personnel leave the site, or at the end of the work day, they must report to the change facility, return all protective clothing, and be monitored for possible radiation contamination.

Radiation exposure of the offsite general public would be prevented by monitoring and cleaning all equipment prior to its leaving the job site. Exposure would also be prevented by conducting the operation in such a manner that mitigates the spread of contaminated materials off the site. This operation would include stopping all work or providing other mitigation measures under the environmental monitoring program or the personnel and workplace monitoring programs under adverse environmental conditions if levels of radioactivity in excess of specified limits were detected leaving the site.

REFERENCES FOR APPENDIX F

- Cohen, B. L., 1981. "Proposals on Use of the BEIR III Report in Environmental Assessments," Health Physics, 41: 769-774.
- Evans, R. D., J. H. Harley, W. Jacobi, A. S. McLean, W. A. Mills, and C. G. Stewart, 1981. "Estimate of Risk from Environmental Exposure to Radon-222 and its Decay Products," Nature, 290 (5802): 98-100.
- Harley, N. H., and B. S. Pasternack, 1982. "Environmental Radon Daughter Alpha Dose Factors in a Five-Lobed Human Lung," Health Physics, 42:789-799.
- ICRP (International Commission on Radiological Protection), 1966. "Deposition and Retention Models for Internal Dosimetry of the Respiratory Tract," Health Physics, 12:173-207.
- ICRP (International Commission on Radiological Protection), 1971. "Protection Against Ionizing Radiation from External Sources," ICRP Publications 15 and 21, Pergamon Press, New York.
- Leggett, R. W., D. J. Crawford, B. S. Ellis, F. F. Haywood, E. B. Wagner, E. T. Loy, W. D. Cottrell, D. L. Anderson, and W. H. Shinpaugh, 1979a. Formerly Utilized MED/AEC Sites Remedial Action Program, Radiological Survey of the Pennsylvania Railroad Landfill Site, Burrell Township, Pennsylvania, DOE/EV-0005/12, UC-70, Final Report, Prepared by the Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee for the U.S. Department of Energy, Washington, DC.
- Leggett, R. W., F. F. Haywood, C. J. Barton, W. D. Cottrell, P. T. Perdue, M. T. Ryan, J. E. Burden, D. R. Stone, R. E. Hamilton, D. L. Anderson, R. W. Doan, B. S. Ellis, W. F. Fox, W. M. Johnson, and W. H. Shinpaugh, 1979b. Formerly Utilized MED/AEC Sites Remedial Action Program, Radiological Survey of the Former Vitro Rare Metals Plant, Canonsburg, Pennsylvania, DOE/EV-0005/3 (Revised), UC-70, Final Report, Prepared by the Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee for the U.S. Department of Energy, Washington, DC.
- National Academy of Sciences, National Research Council, Advisory Committee on the Biological Effects of Ionizing Radiation, 1972. "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," BEIR I, Washington, DC.
- National Academy of Sciences, National Research Council, Advisory Committee on the Biological Effects of Ionizing Radiation, 1980. "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," BEIR III, Washington, DC.

United Nations, Scientific Committee on the Effects of Atomic Radiation, 1972.
"Ionizing Radiation: Levels and Effects," Volume II, Effects, New York.

United Nations, Scientific Committee on the Effects of Atomic Radiation, 1977.
"Sources and Effects of Ionizing Radiation," New York.

U.S. NRC (Nuclear Regulatory Commission), 1976. Decontamination Guidelines for Facilities and Equipment, Regulatory Guide 1.86, Washington, DC.

U.S. NRC (Nuclear Regulatory Commission), Fuel Processing and Fabrication Branch, 1978. Interim Land Cleanup Criteria for Decommissioning Uranium Mill Sites, Staff Technical Position, Washington, DC.

U.S. NRC (Nuclear Regulatory Commission), 1980. MILDOS Computer Code Users Manual, NUREG/CR-2011, Washington, DC.

U.S. Radiation Policy Council, 1980. "Report of the Task Force on Radon in Structures," Washington, DC.

Appendix G

LAND USE, POPULATION, AND SOCIOECONOMICS

Appendix G

LAND USE, POPULATION, AND SOCIOECONOMICS

G.1 INTRODUCTION

This appendix contains a description of the socioeconomic surveys performed in the Canonsburg, Burrell, and Hanover site areas, and survey results and baseline data used in preparing Sections 4.9, 4.11, and 4.12. This supporting material is presented in the order in which it is discussed in the main text.

G.2 SOCIOECONOMIC ELEMENT

G.2.1 Canonsburg site

The socioeconomic work element for this study was developed through the steps discussed in the paragraphs that follow.

G.2.1.1 Step 1: Data review -- baseline information gathering

Under this step the Canonsburg site and the communities within the 1-mile radius and the 5-mile radius of the Canonsburg site were identified on U.S. Geological Survey (USGS) quads. The municipalities within the 1-mile radius of the Canonsburg site and within Washington County, in which the Canonsburg site is located, were contacted by telephone calls, letters, and visits to the municipal and county offices and real-estate agencies to collect baseline information on socioeconomic, land-use, and transportation-related data. The information collected included the following:

1. Local and county land-use studies and comprehensive plans.
2. Local area population distribution and projections.
3. Employment locations.
4. Municipal zoning and subdivision regulations.
5. Recreational studies.
6. Traffic patterns and transportation networks.
7. Community facilities and utility services.
8. Tax structure and revenue sources.

Commonwealth and Federal agencies were contacted for transportation, population, and historical and archaeological information.

From a preliminary review of the available data, it was concluded that there was a need for a socioeconomic door-to-door survey covering the 1-mile radius area of the Canonsburg site, especially to estimate the current population, and their type of employment, outdoor activities, food habits, etc.

G.2.1.2 Step 2: Conduct detailed field surveys

The data collected under step 1 were updated or supplemented by conducting a windshield survey within the 1-mile radius analysis area of the Canonsburg site. This windshield survey helped in organizing the door-to-door socioeconomic survey conducted during the week of September 24, 1979.

In preparation for the door-to-door socioeconomic survey, a two-page questionnaire with 28 related items was prepared, and given approval by the DOE UMTRA Project Office. (A copy of this questionnaire follows.) Local municipalities were contacted by telephone and by letter requesting their cooperation with the survey team. The local residents were also informed of the survey through press releases to local newspapers.

The survey team consisted of four persons led by a Weston senior staff person (a certified planner). After a reconnaissance survey of the 1-mile radius area of the Canonsburg site, each team member took a different street, and visited every fourth house on either side of the street within the one-quarter-mile radius area of the Canonsburg site, every eighth house within the one-quarter to one-half-mile zone of the Canonsburg site, and every fifteenth house within the one-half to 1-mile zone of the Canonsburg site. The homes visited were identified on a master map; comparisons were made at regular intervals to avoid duplication of survey effort. The survey covered more than 10 percent of the households within the 1-mile radius area of the Canonsburg site. The major types of data obtained from the survey included the following:

1. Population living in each sector and within the three zones; up to one-quarter mile, one-half mile, and 1-mile from the Canonsburg site.
2. Age distribution.
3. Employment location.
4. Family income.
5. Time spent in outdoor activities.
6. Produce raised in vegetable gardens, and use of area wells.
7. Ethnic background of the population.

Contacts were made with local municipalities and regional, Commonwealth, and Federal agencies to supplement or update the data collected under step 1.

SOCIOECONOMIC SURVEY QUESTIONNAIRE

1. Street Address Municipality

2. Previous Address Municipality

3. Duration of stay at the Present Address (No. of years)
(A) 0-2 (B) 2-5 (C) 5-10 (D) 10-20 (E) >20

4. Type of Home:
(A) Single Family (B) Apartment (C) Town House (D) Duplex/Twin (E) Other

5. Number of persons presently living at this address

6. Age/Sex Distribution of Occupants:

	0-1	1-5	5-11	11-17	17-40	40-65	65 and >
Male							
Female							

7. Estimate of time (hours/day) spent at home:

Male							
Female							

8. Number of employed persons: (A) 1 (B) 2 (C) 3 (D) >3

9. Place of Employment:
(A) Canonsburg/Houston (B) North Strabane (C) Chartiers (D) Cicil/Peters
(E) South Strabane (F) Washington/Pittsburgh (G) Other

10. Distance to work (miles): (A) <1 (B) 1-2 (C) 2-5 (D) >5

11. Mode of Travel: (A) Car (B) Bus (C) Walk (D) Other

12. Type of Occupation (such as Teacher, Executive, Clerical, Coal Miner, etc.)

13. Duration of Work (Hours Per Week):
(A) 0-20 (B) 20-40 (C) 40-60 (D) 60-80 (E) >80

14. Number of Working Hours spent in the Open:
(A) None (B) 0-20 (C) 20-40 (D) 40-60 (E) 60-80 (F) >80
(Note: If response to Question 8 is other than (A), complete for (B) and (C) similar to that of (A)).

15. Did you ever work at Canon Industrial Park? (A) Yes (B) No

16. If yes, When? (A) At present, since 19 . . .
(B) During 19 . . . to 19 . . . Period

17. Annual family income (\$1,000):
(A) <5 (B) 5-10 (C) 10-15 (D) 15-25 (E) >25

Response

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SOCIOECONOMIC SURVEY
QUESTIONNAIRE (CONTINUED)

Response

18. Outdoor activities of members of household:
 (A) Hiking (B) Biking (C) Swimming (D) Gardening (E) Other 18
19. Use of Chartiers Creek for:
 (A) Fishing (B) Boating (C) Swimming (D) Other 19
20. Did/do your children play in/around Canon Industrial Park?
 (A) Yes (B) No 20
21. If yes, 1. When? (A) At present (B) Previously 21.1
 2. For how long? (hours/day)
 (A) <2 (B) 2-5 (C) >5 hours 21.2
22. Transient use of Canon Industrial Park and vicinity:
 (A) Regular (B) Occasional (C) Seldom 22
23. If (A) Regular, purpose of such use:
 (A) Drive thru (B) Hike (C) Walk (D) Other 23
24. Use of backyard/frontyard of your home:
 (A) Recreational (B) Vegetable garden (C) Other 24
25. If you have a vegetable garden,
 1. Type of products:
 (A) Leafy vegetables (lettuce, spinach, cabbage, 25.1
 (B) Root variety (carrots, beets, potatoes, onions, radishes,
 (C) Others (beans, cauliflower, tomato, peas,
 2. Use of garden products: (A) Home Consumption (B) Sale (C) Friends/Relatives 25.2
 3. Duration of consumption: (A) Seasonal (B) Year-round 25.3
 4. Vegetable produced from the garden and used for home consumption as percent
 of total required vegetable diet for the season/year.
 (A) <25 (B) 25-50 (C) 50-75 (D) 75-100 25.4
 5. If sold/given away, to: (A) Neighbor (B) General area (C) Outside 25.5
 6. Method of preservation, if applicable. 25.6
 7. Do you use surface or groundwater for your garden? (A) Yes (B) No 25.7
 8. If yes, which? (A) surface water (B) Groundwater (C) Other 25.8
 9. Is there any other home-grown products?
 (A) None (B) Milk (C) Egg (D) Meat (E) Fruit (F) Other 25.9
26. Do you have an on-site well? (A) Yes (B) No 26
27. If yes, 1. Depth of the well (ft.) 27.1
 2. Depth of the casing of the well (ft.) 27.2
28. Ethnic background of the household. 28

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G.2.1.3 Step 3: Baseline data documentation and impact assessment

The data collected in steps 1 and 2 were analyzed and documented in the format specified by the DOE (U.S. DOE, 1981). The impacts of the remedial-action alternatives on the socioeconomic setting of the Canonsburg site were determined and documented in accordance with the guidelines (U.S. DOE, 1981). The major items considered were the following:

1. Loss of employment at the Canon Industrial Park.
2. Temporary employment during the remedial action period.
3. Potential for new employment and economic growth after the cleanup effort is completed.
4. Changes in the tax base of the Canonsburg site and the vicinity properties, including their market values.
5. Effect on the residential communities in the vicinity of the Canonsburg site.
6. Effect on community services including schools, hospitals, utilities, police and fire, and recreation from changes in the number of users.
7. Effect on the local streets and their users during and after the completion of the project.

G.2.2 Burrell site

Except for the door-to-door socioeconomic survey, all of the steps used for the Canonsburg site were also used for the Burrell site to prepare the baseline socioeconomic setting and impact assessment. The study-area communities were determined and identified on the USGS quads using aerial photographs of the area obtained from the U.S. Army Corps of Engineers' (COE) office associated with the Conemaugh Reservoir project.

The 1-mile radius analysis area of the Burrell site included parts of Burrell Township and Blairsville Borough in Indiana County and Derry Township in Westmoreland County. Most of the baseline data were collected through contacts and visits to the respective municipal and county agencies. The local area population distribution and land-use data were collected through a series of windshield surveys conducted by Weston personnel and assisted by the local municipal authorities. In addition, meetings were held on several occasions with representatives of the associated municipalities and the Torrance State Hospital, located approximately 1 mile south of the Burrell site.

G.2.3 Hanover site

Much of the information on the Hanover site and its vicinity was obtained through a review of aerial photographs, and contacts with Washington County and Hanover and Jefferson Township officials. In addition, local real-estate agencies and Commonwealth and Federal agencies were contacted for data on the economic growth potential of the Hanover site and its vicinity, and the transportation network in the general area connecting the Hanover site with the Canonsburg and Burrell sites.

A field reconnaissance survey was conducted to identify the land uses and population distribution within the 1-mile radius of the Hanover site. The baseline information and impact assessment were documented in a manner similar to that done for the Canonsburg site.

Table G-1. Generalized land uses (1980) -- Canonsburg site vicinity

Land-use category	Distance from site (miles)							
	0 - 1/4		1/4 - 1/2		1/2 - 1		Total	
	% of		% of		% of		% of	
	Acres	Total	Acres	Total	Acres	Total	Acres	Total
Residential (excluding rural)	32	25.4	112	29.7	390	25.9	534	26.6
Commercial	9	7.1	19	5.0	20	1.3	48	2.4
Industrial	33	26.2	23	6.1	60	4.0	116	5.8
Public/semi-public	5	4.0	44	11.7	50	3.3	99	4.9
Recreational	4	3.2	14	3.7	40	2.7	58	2.9
Open, undeveloped	<u>43</u>	<u>34.1</u>	<u>165</u>	<u>43.8</u>	<u>947</u>	<u>62.8</u>	<u>1155</u>	<u>57.4</u>
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-1.
 Industrial -- Also includes quarries and strip-mining areas.
 Public/semi-public -- Includes government buildings, schools, churches, hospitals, and cemeteries.
 Recreational-(public or private) -- Parks, etc., including halls, clubs, bowling alleys, and open spaces.
 Open/undeveloped -- Agricultural, rural-residential, woods, water bodies, and transportation networks.

Sources: USGS quads; socioeconomic survey, September 1979; site visits, April and July 1981, January 1982; reviews of community data and reports.

Table G-2. Generalized land uses (1982) -- Burrell site vicinity

Land-use category	Distance from site (miles)							
	0 - 1/4		1/4 - 1/2		1/2 - 1		Total	
	Acres	% of Total	Acres	% of Total	Acres	% of Total	Acres	% of Total
Residential (excluding rural)	13	10.3	26	6.9	166	11.0	205	10.2
Commercial	1	0.8	2	0.5	77	5.1	80	4.0
Industrial	3	2.4	38	10.1	23	1.5	64	3.2
Public/semi-public	0	0	57	15.1	274	18.2	331	16.5
Recreational	1	0.8	2	0.5	112	7.4	115	5.7
Open, undeveloped	<u>108</u>	<u>85.7</u>	<u>252</u>	<u>66.9</u>	<u>855</u>	<u>56.8</u>	<u>1215</u>	<u>60.4</u>
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-4.
 Industrial -- Also includes quarries and strip-mining areas.
 Public/semi-public -- Includes government buildings, schools, churches, hospitals, and cemeteries.
 Recreational-(public or private) -- Parks, etc., including golf courses, halls, clubs, and open spaces.
 Open/undeveloped -- Agricultural, rural-residential, woods, water bodies, and transportation.

Sources: USGS quads; site visits, April and July 1981, January 1982; reviews of community data and reports; meetings with representatives of municipalities and institutions.

Table G-3. Generalized land uses (1982) -- Hanover site vicinity

Land-use category	Distance from site (miles)							
	0 - 1/4		1/4 - 1/2		1/2 - 1		Total	
	% of		% of		% of		% of	
	Acres	Total	Acres	Total	Acres	Total	Acres	Total
Residential (excluding rural)								
Commercial	0		2	0.5	0		2	0.1
Industrial	100	79.4	173	45.9	523	34.7	796	39.6
Public/semi-public	0		0		0		0	
Recreational	0		0		0		0	
Open, undeveloped	<u>26</u>	<u>20.6</u>	<u>202</u>	<u>53.6</u>	<u>984</u>	<u>65.3</u>	<u>1212</u>	<u>60.3</u>
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-5.
 Industrial -- Also includes quarries and strip-mining areas.
 Open/undeveloped also includes rural-residential, agricultural, water bodies, and transportation.

Sources: USGS quads; site visit, January 1982; review of community data and reports; and contact with representatives of county and municipal agencies.

Table G-4. Structures of historical interest located in the general vicinity of the sites

Structure/location	Date
<u>Canonsburg site</u>	
Black Horse Tavern North Central Avenue, Canonsburg A favorite rendezvous for the Whiskey Insurrectionists	1790
John Hegarty House Houston	1805
Hill Church Route 19, North Strabane Township	1776
Jefferson Academy (old Jefferson College Building) North Central Avenue, Canonsburg	1780
Pittsburgh National Bank Pike and Central Streets	1850
Polish National Church College Street	Early 20th century
Quail House Route 19, Canonsburg	1832
St. John's Russian Orthodox Church Vine Street, Canonsburg	1918
St. Michael's Byzantine Catholic Church East College Street	1949
Tenement House Pike Street, Canonsburg	1840
<u>Burrell site</u>	
None	
<u>Hanover site</u>	
Florence Academy Old Route 22	1833
Phillips House Route 538, Kings Creek Road	1820
Smith, Della House Route 352, Burgettstown	1820
Tucker Methodist Episcopal Church Route 22, 2 miles west of Florence	1824
Wallace House Route 18 North	

Source: Washington County Planning Commission (1979a).

Table G-5. Population distribution by direction (1980) --
Canonsburg site vicinity

Sector	Direction	Population at distance from site (miles)			Total
		0-1/4	1/4-1/2	1/2-1	
1	N	41	233	479	753
2	NNE	28	258	274	560
3	NE	28	376	650	1054
4	ENE	34	218	399	651
5	E	46	15	507	568
6	ESE	18	50	750	818
7	SE	85	9	245	339
8	SSE	89	57	125	271
9	S	81	191	15	287
10	SSW	65	212	28	305
11	SW	50	112	359	521
12	WSW	0	107	661	768
13	W	0	129	564	693
14	WNW	9	0	61	70
15	NW	16	22	0	38
16	NNW	<u>12</u>	<u>47</u>	<u>183</u>	<u>242</u>
	Total	602	2036	5300	7938

Sources: Socioeconomic survey, September 1979; U.S. Bureau of the Census, 1980 census advance counts.

Table G-6. Age and sex characteristics (1980) -- Canonsburg site vicinity

Age group	Percent distribution		
	Male	Female	Total
Less than 1 year	2.4	0.6	1.5
1 to 5 years	3.8	3.5	3.6
5 to 11	8.0	10.1	9.0
11 to 17	12.4	12.1	12.3
17 to 40	29.2	29.2	29.2
40 to 65	31.6	28.4	30.0
65 and over	<u>12.6</u>	<u>16.1</u>	<u>14.4</u>
Total	100.0	100.0	100.0

Source: Socioeconomic survey, September 1979; U.S. Bureau of the Census, 1980 census advance counts.

Table G-7. Historical and future populations of municipalities --
Canonsburg site vicinity

Municipality	Historical ^a			Projected ^b	
	1960	1970	1980	1990	2000
Canonsburg Borough	17,877	11,439	10,459	10,212	9,814
Houston Borough	1,865	1,812	1,568	1,502	1,411
North Strabane Township	7,332	7,578	8,490	9,422	9,534
Chartiers Township	7,225	7,324	7,715	8,606	8,840

Sources:

^aU.S. Bureau of the Census 1960 and 1970 censuses; 1980 census advance counts.

^bWashington County Planning Commission (1981).

Table G-8. Historical and projected population distribution
among municipalities within a 1-mile radius
of the Canonsburg site

Municipality	Historical (1980)			Projected (2000)	
	Popu- lation	Percent of total population	Land area (acres)	Population (persons/ acre)	Population
Canonsburg Borough	4481	56.4	794	5.64	4293
Houston Borough	1201	15.1	197	6.10	1081
North Strabane Township	1316	16.6	498	2.64	1478
Chartiers Township	<u>940</u>	<u>11.9</u>	<u>521</u>	<u>1.80</u>	<u>1077</u>
Total	7938	100.0	2010	3.95	7929

Sources: U.S. Bureau of the Census, 1980 census advance counts; Tables G-5 and G-7.

Table G-9. Population distribution by direction (1980) --
Burrell site vicinity

Sector	Direction	Population at distance from site (miles)			Total
		0-1/4	1/4-1/2	1/2-1	
1	N	9	67	104	180
2	NNE	3	38	157	198
3	NE	3	15	110	128
4	ENE	0	0	38	38
5	E	0	0	35	35
6	ESE	0	0	26	26
7	SE	0	0	0	0
8	SSE	0	0	9	9
9	S	0	3	15	18
10	SSW	0	12	3	15
11	SW	0	0	0	0
12	WSW	0	0	611	611
13	W	0	3	527	530
14	WNW	10	0	444	454
15	NW	3	0	14	17
16	NNW	<u>0</u>	<u>17</u>	<u>36</u>	<u>53</u>
	Total	28	155	2129	2312

Sources: Photo interpretation of 1974 COE aerial photographs; USGS quads for the area; U.S. Bureau of the Census, 1980 census advance counts; contacts with representatives of municipalities and institutions.

Table G-10. Historical and future populations of municipalities -
Burrell site vicinity

Municipality	Historical ^a			1980 population within 1-mile radius of site ^b		Projected ^c	
	1960	1970	1980	Popu- lation	Percent of total population	1990	2000
Blairsville Borough	4,930	4,411	4,166	1,636	70.8	4,126	4,640
Burrell Township	3,476	3,672	4,152	634	27.4	4,064	5,096
Derry Township	15,445	15,902	16,193	42	1.8	17,050	19,078
Total				2,312	100.0		

Sources:

^aU.S. Bureau of the Census, 1960 and 1970 censuses; 1980 census advance counts.

^bTable G-9, Figure G-7.

^cSoutheastern Pennsylvania Regional Planning Commission (1980).

Table G-11. Population distribution by direction (1982) -- Hanover site vicinity

Sector	Direction	Population at distance from site (miles)			Total
		0-1/4	1/4-1/2	1/2-1	
1	N	0	0	0	0
2	NNE	0	0	3	3
3	NE	0	0	6	6
4	ENE	0	0	0	0
5	E	0	0	0	0
6	ESE	0	0	0	0
7	SE	0	0	15	15
8	SSE	0	0	9	9
9	S	0	0	0	0
10	SSW	0	0	12	12
11	SW	0	0	12	12
12	WSW	0	9	0	9
13	W	0	0	0	0
14	WNW	0	0	6	6
15	NW	0	0	6	6
16	NNW	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Total	0	9	69	78

Sources: Site visit, January 1982; U.S. Bureau of the Census, 1980 census advance counts.

Table G-12. Historical and future populations of municipalities -
Hanover site vicinity

Municipality	Historical ^a			Projected ^b	
	1960	1970	1980	1990	2000
Burgettstown Township		2118	1867	1803	1653
Hanover Township	2456	3016	3275	3411	3340
Jefferson Township		1301	1369	1435	1397
Smith Township		5812	5583	5746	5790

^aU.S. Bureau of the Census, 1960 and 1970 censuses; 1980 census advance counts.

^bWashington County Planning Commission (1981).

G.3 ECONOMIC STRUCTURE

This subsection presents the characteristics of the economic structure of the Canonsburg, Burrell, and Hanover site areas. Also included here is the information available at the county, municipal, and local levels. This subsection focuses on the basic economic resources and sources of income in Washington and Indiana Counties, Pennsylvania.

G.3.1 Canonsburg site

Canonsburg Borough is geographically situated on Interstate Highway 79, which links Washington, the county seat of Washington County, with Pittsburgh. In addition, Canonsburg is located north of Interstate Route 70, which ties into the Pennsylvania Turnpike at New Stanton, Pennsylvania, east of Canonsburg. As a result, Washington County and Canonsburg are significantly influenced by the Pittsburgh economy, as demonstrated by the easterly concentration of population and industry in Washington County.

In terms of land use, forest land covers 35 percent of Washington County, and crop and pasture land covers an additional 47 percent. Washington County produces agricultural products valued at \$16 to 20 million annually (Washington County Planning Commission, 1979a). The dairy industry leads Washington County in agricultural sales, with earnings averaging more than \$10 million, followed by meat animals (\$3 million), poultry (\$1.6 million), and field crops (\$3.3 million). Most of the revenue produced by Washington County farms remains in the area as families purchase goods and services from local suppliers. In addition, there are more than 70 agriculture-related industries engaged in the manufacture of foods and associated products, with annual payrolls of more than \$4 million.

The major industries in Washington County are coal mining and manufacturing. The total value of industrial production was estimated at \$1.145 billion in 1976. Washington County leads all other counties in Pennsylvania in annual coal production and the amount of available coal reserves. More than 12.4 million tons of coal were mined during 1976; 11 million tons were taken from deep mines, and the remainder from strip mines. In 1976, 61 deep and strip mines were operating in Washington County with an average payroll estimated at more than \$80 million. The associated support industries producing mining machinery and equipment have an estimated average payroll of over \$12 million annually (Washington County Planning Commission, 1979a).

In 1976, manufacturing in Washington County was led by steel and primary metals with an annual payroll in excess of \$84 million. The manufacture of electrical machinery was second with an annual payroll of over \$45 million, and glass manufacturing equipment was third with a payroll of over \$35 million.

Canonsburg Borough is a significant location for industrial activity in Washington County. At one time, the Canonsburg area (Chartiers and North Strabane Townships) was active in coal mining. Today the area surrounding Canonsburg Borough has many abandoned strip- and deep-mine sites, and is reported to be underlain with mineable coal and natural gas reserves (Kohl and Briggs, 1976; Wagner and Lytle, 1976; Washington County Planning Commission, 1979b). It is believed that no economically recoverable coal deposits lie beneath the Canonsburg site.

The economy of Canonsburg Borough and the surrounding area is typical of Washington County, supporting agriculture, coal mining, and primary metals. Industries are engaged in manufacturing mining machinery, steel fabrication and distribution, and food preparation and distribution. Machine shops and light-manufacturing high-technology operations are also evident.

G.3.2 Burrell site

The Burrell site can be reached from Pittsburgh by U.S. Highway 22, and is characterized by commercial and light industrial development. Indiana, the largest city in Indiana County, is located 10 miles north of the Burrell site in the central part of Indiana County.

In 1977, Indiana County produced more than 10.5 million tons of coal and ranked second to Washington County in total coal production in the western Pennsylvania 27-county region. Indiana County, with 54 percent of its area in forest land, is the leading producer of forest and maple products in the Commonwealth. Indiana County annually harvests more than 20 million Christmas trees. Indiana County also has a substantial deer population and derives additional income from deer hunting.

In 1976, an estimated 1445 farms in the Indiana County produced cash crops worth nearly \$22.5 million. Approximately 71 percent of the total was derived from livestock products. The leading industry in Indiana County is manufacturing. The value of production during 1976 was \$203.9 million, when Indiana County ranked 46th among the Commonwealth's 67 counties. In 1977, the value of production increased to \$240.4 million, an increase of over 15 percent. The primary production activity in 1977 was in fabricated metal products, estimated at \$67 million (28 percent), and nonelectrical machinery, estimated at \$30.6 million (13 percent).

Indiana County offers numerous tourist attractions including four covered bridges, several museums, and state and local parks. In 1976, tourist-related revenue was estimated at \$14.3 million; the tourist-related payroll was approximately \$2.9 million.

Most of the industrial activity in Indiana County in 1977 was centered in Indiana Borough and White Township, located 15 miles north of Blairsville. There are 66 industrial establishments in Indiana County. Of these, 25 are located in Indiana Borough and White Township and in 1977 they accounted for 64 percent of Indiana County's wages and salaries, and 62 percent of its production value.

The area including Burrell Township and Blairsville is a secondary center of production and employment, as is Homer City. These centers are linked by U.S. Highways 119 and 22 and rail transportation to Indiana. These secondary centers account for the major portion of the remaining economic activity in Indiana County. There are three industrial firms in Burrell Township and nine in Blairsville. In 1977, these firms accounted for \$3.5 million in wages and salaries, \$24.0 million in production, and \$9.2 million in manufacturing (Pennsylvania Department of Commerce, 1978).

G.3.3 Hanover site

In addition to the local and Washington County economies, the Hanover site area is influenced by the nearby communities of Weirton, West Virginia, and Steubenville, Ohio, and the significant steel manufacturing activity in these areas. For example, in Weirton, West Virginia, Weirton Steel (a division of National Steel) employs 12,500 people, and Wheeling-Pittsburgh Steel Corporation in Steubenville employs over 1,000 people. In Toronto, Ohio, the Titanium Metals Company provides employment for 750 to 1000 people (Weirton, West Virginia and Steubenville, Ohio, 1982).

In the Pittsburgh SMSA, one out of every ten employed persons works in the primary metals industry (Pennsylvania Department of Labor and Industry, 1979). In Hanover Township, this ratio is probably higher. In addition to the primary metals industries, coal, oil, and gas resources are located in Hanover Township. As a result, major portions of Hanover Township are owned by coal companies (i.e., Starvaggi and Bologna) and have been strip mined. Today, Hanover Township has many unreclaimed and abandoned strip and deep mines, as well as abandoned oil wells. Hanover Township is reported to have moderate to major mine pollution problems (Washington County Planning Commission, 1979b). The local economy is characterized by small machine and metal shops and by trucking and coal-related facilities.

The communities nearest the Hanover site are Burgettstown in Smith Township, Pennsylvania and Weirton, West Virginia. Due to its undeveloped rural setting, the Hanover site area is suited for outdoor recreation (Hillman State Park and State Game Lands No. 117 are located in the Hanover site area), but strip mine and chemical dump wastes limit this potential.

G.4 WORK FORCE

G.4.1 Canonsburg site

The total employment in the Canonsburg area can be determined from data for the Pittsburgh SMSA (including Washington, Allegheny, Beaver, and Westmoreland Counties). The total employment in December 1981, including the nonagricultural manufacturing and nonmanufacturing work forces, was approximately 934,900 persons (Pennsylvania Department of Labor and Industry, 1982; Wilson, 1982). Over the preceding year, employment declined by 22,200 from 957,100 employees, reflecting the effects of the 1981 economic recession. The 1981 Pittsburgh SMSA data show the following breakdown by major employer: industrial manufacturing -- 225,700 employees; services -- 215,800 employees; retail trade -- 163,100 employees; transportation -- 55,400 employees; wholesale trade -- 52,400 employees; construction -- 43,600 employees; and finance -- 45,100 employees.

During 1981 declines were reported in all categories except wholesale trade and construction.

In Washington County 336 industries and businesses were reported in 1980 (Washington County Board of County Commissioners, 1980). These firms employed 27,878 people. In December 1981, Washington County's resident civilian labor force was approximately 96,200 people (Pennsylvania Department of Labor and Industry, 1982; Wilson, 1982) with 87,700 employed, and approximately 60,000 working in firms located in Washington County. By category, the major employers in 1980 were: mining -- 5845 employees; steel -- 3956 employees; electronics -- 3323 employees; glass equipment -- 2385 employees; trucking -- 628 employees; and machine/job shops -- 1089 employees.

Steel manufacturing in Washington County and in West Virginia (e.g., Weirton Steel Co.) also provides major employment opportunities for Washington County residents. Between 1978 and 1980 industrial opportunities were fairly stable. The 1980 Industrial Directory of Washington County (Washington County Board of County Commissioners, 1980) lists 30 industries or businesses not listed in 1978, and deletes 30 industries or businesses that consolidated under a new name, went out of business, or moved.

In 1979, Washington County as a whole had a labor-force-participation rate of 41.8 percent (ratio of number of persons in the labor force to total population) in a total estimated population of 215,519 persons. Within the 1-mile radius of the Canonsburg site, however, the labor-force-participation rate was much lower because of the larger proportion of persons aged 65 years and over compared to that of the Pittsburgh SMSA. The high percentage of households remaining in their present locations for at least 20 years has indirectly contributed to the lowering of the labor-force-participation rate. Assuming a lower labor-force-participation rate (38.9 percent) for the Canonsburg site area, based on the Commonwealth's estimate of population and labor force for Washington County, the Canonsburg site area had a total labor force of 3088 people. By the year 2000, Washington County's labor-force-participation rate should be 40.9 percent, and the projected labor force within the 1-mile radius of the Canonsburg site should be 4107 people.

Employment data collected from the socioeconomic survey in September 1979 showed that about 34.4 percent of the total population in the Canonsburg site area were employed on either a full-time or part-time basis (equivalent to 2730 persons employed out of the total population of 7938 persons). Thus, the Canonsburg site area had an unemployment rate of nearly 11.6 percent (ratio of number of persons unemployed to the total labor force). For comparison, the unemployment rate for the Pittsburgh labor market area (Allegheny, Beaver, Washington, and Westmoreland Counties combined) in December 1981 was 8.2 percent (8.8 percent adjusted seasonally) (Pennsylvania Department of Labor and Industry, 1982) and 5.7 percent in 1978.

Between 1973 and 1980 mining employment experienced major growth in Washington County. Over this period mining employment increased from 3966 to 5845 people. This 47-percent increase reflects the expanded economic interest in western Pennsylvania coal, oil, and gas resources. The ten largest employers in Washington County in 1980 are given in Table G-13.

Table G-13. Ten largest employers in Washington County (1980)

Company	Municipal location	Employment
Wheeling-Pittsburgh Steel Co.	Allenport	2361
McGraw Edison Power Systems Division ^a	Canonsburg	2296
Bethlehem Mines Corp.	Eighty-four sites	1826
Consolidated Coal Co. ^a	Washington	1646
Corning Glass Works	Charleroi	1135
RCA Corp. ^{a, b}	Meadowlands	1001
U.S. Steel Co.	New Eagle	934
(Frick Distributors Coal Operation)		
Jessop Steel Co. ^a	Washington	920
Brockway Glass Co. ^a	Washington	900
Washington Steel Co. ^a	Washington	675

^aWithin the vicinity of the project sites.

^bFacility under new ownership.

Source: Washington County Board of County Commissioners (1980).

The manufacturing employment statistics show that the 21 industries in Canonsburg employed 2828 persons. The major manufacturing employer was the McGraw-Edison Power Systems Division, employing 2296 persons. The nine industries in Houston employed 255 manufacturing workers. The industrial employment in North Strabane Township was 255 (seven firms), and the industrial employment in Chartiers Township was 1428 (11 firms). The most recent employment counts of major industrial firms are given in Table G-14. Employment in Canonsburg firms with more than 15 employees accounted for 3626 workers in 1980, and five firms in Houston with more than 15 employees accounted for 141 workers. The majority of the firms in the Canonsburg area employ either 15 to 30 people or 100 to 300 people. Historically, these firms expand and decline with the general economic conditions. Between 1978 and 1980 six firms listed in Table G-14 increased their levels of employment and six declined. These changes resulted in a net increase of 66 employees in the firms listed.

In 1978, 15 firms were operating in the Canon Industrial Park, employing approximately 70 persons. The firms included a truck-freight terminal, a metal-work operation, machine shops, climate-control equipment services, a laundry terminal, and various warehouses. In October 1982 six firms operated in the Park; Crile Metallizing Co. -- 20 employees; A.P.A. Transport Co. -- 10 employees; Controlled Climate Systems -- 7 employees; Coyne Laundry -- 8 employees; Lunardini, Inc. -- 10 employees; and Harley, Weaver and Haynes -- 5 employees (Brown, 1982). As of April 1983 there were two firms employing a total of approximately 11 persons still occupying the Canonsburg site (Yusko, 1983). Both of these firms will vacate the Canonsburg site by October 1983.

Major employment centers within the one-quarter mile radius of the Canonsburg site are the RAX Restaurant (31 employees), and the Woodcraft Company (20 employees), both located on Pike Street. The total number of employees within the one-quarter mile radius of the Canonsburg site ranges between 200 and 220 persons, most of whom live in the general Canonsburg site area, and work a minimum of 40 hours a week. In addition, there are a number of private clubs in the Canonsburg site area that employ local residents. These are: VFW on Pike Street; AFU No. 149 on Selwyn Street; Strabane International Ballroom on Chartiers Street; SNPJ Hall and Bowling Alley on Latimer Avenue; and Moose Lodge on West Pike Street.

The establishments in the immediate vicinity of the Canonsburg site include bars, gasoline and service stations, repair and service shops, and grocery and eating places. The Alexander Cooperative Market on Latimer Avenue is the closest establishment that is frequented by a large number of customers from within the 1-mile radius of the Canonsburg site.

A survey conducted in the Canonsburg site area revealed that 8.6 percent of the households have a family member who had worked at the Canon Industrial Park at one time. A large percentage of the persons who worked at the Canon Industrial Park are in the 65 years and over age group. The 1974 employment statistics for the municipalities in the immediate vicinity of the Canonsburg site are presented in Table G-15.

Table G-14. Industrial employment (1980) -- Canonsburg site vicinity

Establishment	Location	Product	Number of employees
All-Clad Metalcrafters, Inc.	R.D. 2	Cookware	25
American Specialty Foods	R.D. 1	Potato chips, etc.	60
Canon Tool Company	Valley Road	Nuclear components	35
Canonsburg General Woodcrafting Co.	W. Pike Street	Cabinets, vanities	20
Canonsburg Milling Co.	N. Central Avenue	Animal/poultry feeds	22
Clad Metals, Inc.	R.D. 2	Speciality clad metals	62
Controlled Climate Systems, Inc.	Canon Industrial Park	Heating/air conditioning	17
Crile Metallizing Co.	Canon Industrial Park	Manufacturing operations	18
Donaldson Supply and Equipment	Murdock Street	Builders supplies	18
Forbes Steel Corporation	Iron Street	Steel fabricating	150
Fort Pitt Bridge Division	Meadow Lane	Fabricated steel structures	305
Hankison Corporation	Philadelphia Street	Air dryers, metal products	148
Joy Manufacturing Company	Meadowlands	Warehousing	114
Michael J. Lunardini, Inc.	Canon Industrial Park	Equipment supplies	5
Mac Plastics, Inc.	Murdock Street	Plastics	162
McGraw-Edison Power Systems Div.	Canonsburg	Electrical power equipment	2296
Quasitronics, Inc.	W. Water Street	Electrical control systems	19
Ram Construction Company	R.D. 2	Heavy/highway construction	150
Canon Plastics	Plum Run Road	Plastics	50
Fort Pitt Fixture Company	W. Pike Street	Store fixtures	29
J & F Tire	Route 519	Tire retreading	20
Superior Concrete Products Co.	Johnson Road	Concrete block	20
Swanson Analysis Systems	Johnson Road	Structural analysis	22

Note: Industries with less than 15 employees are excluded from this list.

Source: Washington County Board of County Commissioners (1980).

Table G-15. Industrial classification of persons employed in municipalities (1974 and 2000) -- Canonsburg site vicinity

Category	Municipality							
	Canonsburg		Houston		North Strabane		Chartiers	
	<u>Borough</u>		<u>Borough</u>		<u>Township</u>		<u>Township</u>	
	1974	2000	1974	2000	1974	2000	1974	2000
Agriculture	12	7	0	0	45	24	59	31
Mining	132	280	0	0	0	0	0	0
Construction	50	47	64	51	304	379	70	117
Transportation, utilities, communications	75	141	22	22	27	47	129	206
Wholesale trade	60	80	0	2	71	177	69	193
Retail trade	438	445	180	181	391	600	65	203
Finance, insurance, real estate	123	185	14	20	13	20	16	36
Services	787	1424	132	141	447	523	647	916
Government	182	173	22	21	19	18	185	176
Manufacturing	<u>3734</u>	<u>3958</u>	<u>164</u>	<u>159</u>	<u>260</u>	<u>295</u>	<u>2823</u>	<u>3222</u>
Total	5593	6740	598	597	1577	2083	4063	5100

Source: Southeastern Pennsylvania Regional Planning Commission (1980).

About one-half of all the employees in the Canonsburg site area work within 2 miles of their homes, and more than one-third work at least 5 miles away, as seen in Table G-16.

Table G-16. Distances people travel to work -- Canonsburg site vicinity

Distance from place of residence	Percent of total employees in area
Less than 1 mile	13.7
1 to 2 miles	34.8
2 to 5 miles	14.1
More than 5 miles	<u>37.4</u>
	100.0

Source: Socioeconomic survey, September 1979.

The December 1981 unemployment rate in the Pittsburgh SMSA (including Washington, Allegheny, Beaver, and Westmoreland Counties) was estimated at 8.2 percent (unadjusted) and 8.8 percent (seasonally adjusted). In Washington County employment trends are depressed (decrease of 13,800 employees) below December 1980 levels, and unemployment rates are 8.5 percent and 8.8 percent (seasonally adjusted). The major losses are: primary metals industry (i.e., steel) -- decrease of 5200 people; fabricated metals industry -- decrease of 800 people; machinery -- decrease of 1100 people; electrical machinery -- decrease of 100 people; and transportation equipment -- decrease of 4100 people.

Similar losses have also affected nonmanufacturing industries with decreases in Commonwealth and local government employment (4900 employees), transportation (3700 employees), and services (1800 employees).

The per capita income in Washington County was estimated at \$8,362 in 1976. This compares with other counties in the Pittsburgh SMSA: Allegheny County -- \$9,704; Beaver County -- \$8,331; and Westmoreland County -- \$8,321. The Commonwealth average per capita income was \$8,558.

Recent income data at the municipal level (socioeconomic survey, September 1979) show that more than 33 percent of all of the families within the 1-mile radius of the Canonsburg site earned more than \$15,000 annually, and 10.7 percent of the families within a 1-mile radius of the Canonsburg site had an annual income of less than \$5,000. The income distribution among families is given in Table G-17.

Table G-17. Annual family income (1979) -- Canonsburg site vicinity

Annual family income (in 1979 dollars)	Percent of total number of families
Less than \$ 5,000	10.7
\$5,000 - \$10,000	24.5
\$10,001 - \$15,000	29.3
\$15,001 - \$25,000	27.6
More than \$25,000	<u>7.9</u>
	100.0

Source: Socioeconomic survey, September 1979.

G.4.2 Burrell site

In December 1981, the total employment in Indiana County, in the manufacturing and nonmanufacturing industries, was 32,200 persons (an increase of 800 over 1980), out of a total civilian labor force of 43,400. Approximately 26,900 employees worked in nonmanufacturing jobs; the remaining 5,300 employees were employed in manufacturing positions. The number of people unemployed was 3700, or 8.5 percent (Pennsylvania Department of Labor and Industry, 1982).

In 1977, according to the industrial census, the total employment in the 66 manufacturing industries in Indiana County was 5658, of which 4107 were production and related workers. There are four Standard Industrial Classification (SIC) categories that are significant employers in Indiana County, and represent 75 percent of the total manufacturing employment. The categories are given in Table G-18.

Table G-18. Manufacturing employment (1977) -- Indiana County

SIC	Total employment	Percent of county employment
Rubber	566	10
Fabricated metals	1575	28
Machinery	823	14
Measuring/analyzing	1333	23

Source: Pennsylvania Department of Commerce (1978).

In 1977, there were 12 manufacturing firms employing 385 people in Burrell Township and Blairsville Borough (Table G-19).

The major employer in the Burrell site area makes transportation equipment; more than 50 percent of the industrial employment in the Burrell site area was reported by this single manufacturer of tanks and tank components. The second largest employer (60 employees) manufactured wearing apparel, followed by an employer who produced fabricated metals with 43 employees.

Nonmanufacturing employment in Indiana County was estimated at 26,900 in December 1981, an increase of 600 employees over December 1980 data (Pennsylvania Department of Labor and Industry, 1982). The 1981 nonmanufacturing employment was primarily in mining (5600 employees), wholesale and retail trade (6100 employees), and service and miscellaneous categories (4200 employees). Smaller components of the nonmanufacturing work force included transportation (2200 employees), finance (800 employees), and construction (800 employees). Over the period 1980 to 1981 employment varied slightly with employment increases in wholesale and retail trade (200 employees), and services (400 employees). Declines in employment were reported in transportation (200 employees), while mining, contract construction, and finance were unchanged (Wilson, 1982). Nonmanufacturing work-force estimates were not available at the local level.

Table G-19. Industrial employment (1977) -- Burrell site vicinity

Municipality	Category	Number of businesses	Number of employees
Blairsville Borough	Apparel	1	60
	Lumber	1	8
	Printing	1	5
	Stone/clay	1	32
	Fabricated metals	2	36
	Machinery	2	12
	Transportation	1	206
Burrell Township	Lumber	1	2
	Fabricated metals	1	7
	Electrical	<u>1</u>	<u>17</u>
Total		12	385

Source: Pennsylvania Department of Commerce (1978).

The per-capita income in Indiana County was estimated at \$7,312 in 1976. This compares with other counties in the nearby Pittsburgh SMSA as follows: Allegheny County -- \$9,704; Beaver -- \$8,331; and Westmoreland -- \$8,321. The Commonwealth average per-capita income was \$8,558 in 1976.

G.4.3 Hanover site

The Hanover site area is influenced primarily by the steel and primary metals industries in nearby Weirton, West Virginia, and Steubenville and Toronto, Ohio. The employment statistics for Hanover Township identify one machinery firm with eight employees. Burgettstown, which is approximately 5 miles east of the Hanover site, reports 67 employees; 5 employees in newspapers, and 62 employees in mining machinery (Pennsylvania Department of Commerce, 1980). Detailed information on the employment, income, and unemployment situations in Washington County, in which the Hanover site is located, are given in subsection G.4.1.

Table G-20. Number of housing units in the municipalities
in the vicinity of the sites

Municipality	1970	1980	Percent change
<u>Canonsburg site</u>			
Canonsburg Borough	3,857	4,228	9.6
Chartiers Township	2,202	2,678	21.6
Houston Borough	655	668	2.0
North Strabane Township	<u>2,345</u>	<u>2,972</u>	26.7
Total	9,059	10,546	
<u>Burrell site</u>			
Blairsville Borough	1,610	1,765	9.6
Burrell Township	1,129	1,452	28.6
Derry Township	<u>4,386</u>	<u>5,487</u>	25.1
Total	7,125	8,704	
<u>Hanover site</u>			
Hanover Township	888	1,082	21.8
Burgettstown Township	680	725	6.6
Jefferson Township	373	461	23.6
Smith Township	<u>1,849</u>	<u>2,001</u>	8.2
Total	3,790	4,269	

Source: U.S. Bureau of the Census, 1980 census advance counts.

Table G-21. Asking prices of dwelling units (1980) --
Canonsburg site vicinity

Municipality/location	Description	Price (\$)
Canonsburg Borough		
Marple Avenue	Two story, 1 bedroom, frame	22,900
W. College Avenue	Two story, 2 bedroom, stucco	31,000
Ridge Avenue	Two story, 2 bedroom, frame	38,500
Duquesne Avenue	Ranch, 3 bedroom	38,900
N. Central Avenue	Two story, townhouse, 2 bedroom, brick	45,900
W. College Avenue	Two story, 4 bedroom, stone	52,000
Hutchinson Avenue	Semi-colonial, 3 bedroom, brick	55,000
W. College Avenue	Two story, brick and frame	70,700
Houston Borough		
N. Maine Street	Two story, duplex, 3 bedroom, frame	37,500
Reed Avenue	Two story, 3 bedroom, brick	46,500
Meadow Oaks Development	Split entry, 3 bedroom, brick and aluminum	87,900
Chartiers Township		
Washington Avenue	Ranch, 3 bedroom	49,500
Ridgeview Way	Ranch, 3 bedroom, brick	59,900
Washington Avenue	Two story, 4 bedroom, brick	138,000
North Strabane Township		
Latimer Avenue	One story, 2 bedroom	29,900
Dicio Street	Cape Cod, 4 bedroom, brick	56,900
Old Meadow Court	Colonial, 3 bedroom	59,900
Mansfield Road	Ranch, 3 bedroom, brick	64,500
Pearl Drive	Two story, 4 bedroom, brick	79,900

Note: The variations in prices reflect the accessories, age, and location of the building.

Source: Local real estate listings from area realtors.

Table G-22. Financial statistics of municipalities (1978) -- Canonsburg site vicinity

Municipality	Revenues					Expenditures		
	Total revenues	Total taxes collected	Real estate			Total Act 511	Total expend- itures	Total O&M
			Assumed valuation	Tax rate (mills)	Real estate taxes			
Canonsburg Borough	\$1,631,594	\$ 729,923	\$11,854,000	39.25	\$469,873	\$260,050	\$1,754,342	\$1,696,007
Chartiers Township	\$ 838,376	\$ 379,229	\$10,221,000	12.00	\$122,969	\$256,260	\$ 626,594	\$ 626,594
Houston Borough	\$ 155,845	\$ 81,663	\$ 1,626,000	23.00	\$ 36,457	\$ 43,631	\$ 134,927	\$ 125,047
North Strabane Township	<u>\$ 893,719</u>	<u>\$ 509,214</u>	<u>\$15,249,000</u>	13.00	<u>\$200,528</u>	<u>\$308,686</u>	<u>\$1,117,441</u>	<u>\$ 731,947</u>
Total	\$3,519,534	\$1,700,029	\$38,950,000		\$829,827	\$868,627	\$3,633,304	\$3,179,595
Percent of county	15	15	14		17	14	14	15

Source: Pennsylvania Department of Community Affairs (1981).

Table G-23. Assessed values, market values, and tax rates for municipalities (1982) -- Canonsburg site vicinity

	Assessed valuation ^a (million \$)	Market value ^a (million \$)	Tax rate ^{a,b}	
			Munic- ipality (mills)	School (mills)
Canonsburg Borough	12.890	143.2	41.25	99
Chartiers Township	12.963	144.0	14.0	119
Houston Borough	1.800	20.0	23.0	119
North Strabane Township	18.332	203.7	27.0	99

^aWashington County Tax Assessors Office, 1982 original charts.

^bWashington County Tax Assessors Office, 1981-1982.

Table G-24. Financial statistics of municipalities (1978) --
Burrell site vicinity

Municipality	1978 fiscal statistics	
Burrell Township		
Total revenue		\$ 324,778
Real estate tax	\$ 21,851	
Act 511 tax	\$ 85,770	
Total taxes collected	\$108,238	
Total expenditures		\$ 583,218
Total O&M	\$493,912	
Assessed valuation		\$5,383,000
Tax rate (mills)		4
Blairsville Borough		
Total revenues		\$ 774,928
Real estate tax	\$107,808	
Act 511 tax	\$117,852	
Total taxes collected	\$225,660	
Total expenditures		\$ 767,180
Total O&M	\$756,190	
Assessed valuation		\$7,351,000
Tax rate (mills)		15

Source: Pennsylvania Department of Community Affairs (1981).

Table G-25. Tax rates for municipalities -- Burrell site vicinity

Municipality	1980 ^a				1981 ^a			
	County	School district	Muni-cipal	Total	County	School district	Muni-cipal	Total
Burrell Township	16	73.9	3	92.9	19	84	5	108
Blairsville Borough	16	73.9	14.75	104.65	19	84	19	122

Source: Indiana County Tax Assessment Office (1982).

^aFigures in mills (tax per \$1,000 market value).

Table G-26. Financial statistics (1979) -- Hanover Township

Item	1979 fiscal statistics ^a
Total revenue	\$ 237,987 ^b
Real estate tax	\$ 25,686
Act 511 tax	\$ 87,429
Total taxes collected	\$113,115
Total expenditures	\$ 270,407
Total operations and maintenance	\$218,567
Assessed valuation of real estate	\$3,517,000

^aPennsylvania Department of Community Affairs (1982).

^bIncludes total taxes collected in 1979 and miscellaneous revenues from sources such as the issuance of licenses and permits, fines and forfeits, state and Federal grants, and surcharges for current services rendered by municipal departments.

G.5 COMMUNITY SERVICES

G.5.1 Canonsburg site

G.5.1.1 Community services

The Canonsburg site area is served by the Canon-McMillan and Chartiers-Houston School Districts. The Canon-McMillan Senior High School, bounded by Hitchman Street, Boone Avenue and Interstate I-79, is within one-half mile of the Canonsburg site. Most of the school traffic uses Strabane Avenue and passes through the Canonsburg site. The school closest to the Canonsburg site is St. Patrick's School at Hutchinson Avenue, one-quarter mile from the Canonsburg site. Other nearby schools are: Hawthorne School (elementary) on Hawthorne Street, Canonsburg; South Central Elementary School, South Central Avenue, Canonsburg; Houston Elementary School, Cherry Avenue, Houston; Canon-McMillan Junior High School, Canonsburg; and First Street School, Canonsburg.

The population of the Canonsburg site area and the surrounding region is served by the Canonsburg General Hospital located on Barr Street within one-half mile of the Canonsburg site. Primary access to the Canonsburg General Hospital from the Canonsburg site is via Strabane Avenue (Chartiers Street to Boone Avenue and Elm Street). For the surrounding communities, the I-79 Canonsburg or Houston exits are the primary access to Canonsburg General Hospital. Washington Hospital is the next closest facility to the Canonsburg site with a 500-bed capacity. In addition, St. Clair Hospital and numerous other medical centers located between Washington and Pittsburgh are available for the health-care needs of the area's population.

The municipalities in the Canonsburg site area have their individual police forces and patrol cars providing 24-hour protection. There are a number of call boxes located throughout Canonsburg, providing a direct communication link for the residents with the police-station emergency-communication system.

The Canonsburg site area is protected by volunteer fire organizations located in the boroughs and the townships. The various fire companies operating in these and adjacent municipalities have a reciprocal relationship for emergencies, thus providing greater fire protection than the capabilities of a single fire company.

The sanitary sewerage system of the Canonsburg-Houston Joint Authority provides offsite disposal facilities for the Houston and Canonsburg Boroughs, Strabane Village of North Strabane Township, and along the southeastern and eastern portions of Chartiers Township. The treatment plant is being renovated to provide increased capacity and tertiary treatment. Chartiers Creek is the receiving stream for the treatment facility.

The municipalities are served by public water provided by the Western Pennsylvania Water Company (Chnupa, 1983). Rural areas of North Strabane and Chartiers Townships use onsite sources, primarily wells, for their water supply.

Solid wastes, including garbage, rubbish, and inorganic wastes, are collected once a week from residences in the Canonsburg site area by an independent hauler (Table G-27).

Table G-27. Landfills -- Canonsburg site vicinity

Landfill	Location
Arden Landfill site	Chartiers Township
South Hills site	North Strabane Township
Pittsburgh Coal Company site	Chartiers and Mt. Pleasant Townships
Pittsburgh Coal Company site	Cecil Township

Source: Washington County Planning Commission (1979b).

Electricity for the Canonsburg site area is provided by West Penn Power Company, while natural gas used as heating fuel is furnished by three companies: Columbia Gas of Pennsylvania, Equitable Gas Company, and People's Natural Gas Company.

G.5.1.2 Recreational activities

The major recreational locations within a 1-mile radius of the Canonsburg site are identified on the existing land-use map (Figure G-1, Table G-28). The closest location to the Canonsburg site for recreational activities was Area C (3.1 acres) of the Canonsburg site, located east of Strabane Avenue, where a ball diamond had been placed over filled ground. For the past two years, however, the ballfield has been fenced and unavailable for public use because of the presence of radioactively contaminated materials. The ballfield was used by 6 percent of the Canonsburg site area population until it was fenced.

Table G-28. Public recreational facilities -- Canonsburg site vicinity

Location	Area (acres)	Facilities, comments
<u>Borough of Canonsburg^a</u>		
Borough Park	38.0	Swimming pool, bathhouse, wading pool, sun deck, three pavilions, picnic areas, children's play area, tennis courts, basketball courts, volleyball area.
Cecil Street (Valley View Road)	0.34	Swings, slides, teeter-totter.
Gladden Avenue (Cecil Township)	11	
School site recreational facilities		
- Hawthorne Elementary, Canonsburg Memorial Stadium, and baseball field		
- Glenn Avenue area		
- South Central Avenue Elementary Senior High		
- Junior High		
- First Street Elementary		
- Perry Como Playground		
<u>Borough of Houston</u>		
Borough of Houston recreational area between East McNutt Street and the Pennsylvania Railroad, on either side of Chartiers Creek.		
<u>North Strabane Township^b</u>		
Alexander Parkette	0.5	Facilities for children and teenagers.
Canon-McMillan Senior High School	2.2	Play areas and tennis courts.
Lindley Mine Park	70	Area was originally strip mined, and needs reforestation to provide a setting for active and passive recreational facilities.
<u>Chartiers Township^c</u>		
No designated recreational areas exist within the 1-mile radius, except open fields and the private cemetery properties often used for recreational purposes.		
In addition, there are a number of regional recreational facilities in the general site area, including:		
Canonsburg Lake located off Route 19		Facilities primarily for fishing (Pennsylvania Fish Commission site).
Mingo Creek County Park, located off Route 88	2,500 (approx.)	Designed to preserve its natural state and provide picnic areas, trails, a swimming pool, and camping, as well as game areas and facilities for winter sports.
Cross Creek Park located off Route 50	3,000	Man-made lake for swimming, fishing, boating, and flood control.
Allegheny County -- Regional Park No. 7, South Park, and Regional Park No. 6		

^aCanonsburg Borough Planning Commission (1971).

^bNorth Strabane Township Planning Commission (1977).

^cSelck Minnerly Group (1974).

Although 5 percent of the population uses Chartiers Creek for recreational purposes, fishing success is minimal. The SNPJ Hall and Bowling Alley on Latimer Avenue is the closest place of recreational and cultural activities to the Canonsburg site. This facility is a private club catering to the cultural and recreational needs of the local community.

G.5.2 Burrell site

G.5.2.1 Community services

The Burrell site area is served by two school districts: the Blairsville-Saltsburg School District for the Indiana County portion of the Burrell site area; and the Derry Area School District for the portion of the Burrell site area in Westmoreland County.

The Blairsville Borough Water Authority serves all of the Town of Blairsville and a limited area outside of and adjacent to Blairsville (Chnupa, 1983). The town's sewer system has a 1-mgd capacity, and is designed to serve a population of 7500 persons. It serves all of the present water users in the town and parts of adjacent areas.

The Burrell Township water supply is administered by the Lower Indiana County Municipal Authority. The Central Pennsylvania Water Supply Company also serves areas near the Burrell site (Chnupa, 1983). There are also a number of individual wells in Burrell Township. Burrell Township does not have a public-sewer system (Bartos, 1982).

There are a number of private water-supply companies in the Derry Township portion of the Burrell site area. In parts of Derry Township people also depend on privately owned wells for their water supply. There is no public sewage system in Derry Township; however, Derry Township is in the process of joining the Latrobe Borough sewer system. Torrance State Hospital operates and maintains its own collection system and disposal plant on McGee Run (Bolinger, 1979). Torrance State Hospital also has an impounding dam on Shirey Run and a water treatment plant and an open finished water reservoir located on the hospital grounds (Chnupa, 1983).

Fire stations close to the Burrell site are in Blairsville and Black Lick. Police protection for the Burrell site area is provided by the Pennsylvania State Police. The nearest hospital to the Burrell site is in Blairsville.

G.5.2.2 Recreational activities

The immediate Burrell site vicinity, between the ConRail tracks and the Conemaugh River, is occasionally used for hunting. The U.S. Army Corps of

Engineers (Corps) permits limited recreational use of the Conemaugh River reservoir area for hunting, picnicking, and other recreational activities but not use of the river itself due to its polluted condition (U.S. Army Corps of Engineers, 1974). Under a license agreement with the Corps, the Town of Blairsville maintains two ballfields in the reservoir area (Bellante and Clauss, Inc., 1967). There are a number of major parks and recreational attractions outside the 1-mile radius of the Burrell site, such as Keystone State Park, Laurel Highlands, the Latrobe Elks Club south of the Conemaugh River, and Mannito Country Club north of Strangford (Baker, 1970).

G.5.3 Hanover site

G.5.3.1 Community services

There are no community facilities located within the 1-mile radius of the Hanover site. The closest community facility to the Hanover site is the Hanover Township School located on old U.S. Route 22, more than 2 miles north of the Hanover site. The closest community services to the Hanover site are in Burgettstown, about 4 miles east of the Hanover site, and Weirton Heights on Route 22 in West Virginia. In fact, the local economy near the Hanover site is very dependent on the industrial firms located in Weirton County, West Virginia.

G.5.3.2 Recreational activities

There are no recreational facilities located within the 1-mile radius of the Hanover site. The State Game Lands No. 117 (4919 acres), located in Smith Township, provides hunting opportunities. The undeveloped Hillman State Park (3654 acres) is located north of State Game Lands No. 117 in Hanover Township.

There are three privately owned and operated paid fishing lakes in Hanover Township, all located along SR 18; i.e., Star Lake, Lake Suzanne, and Bennett Lake. The Pennsylvania Fish Commission has designated Aunt Clara Fork in Hanover Township as "approved trout waters" for a length of 4.0 miles (Weirich, 1982).

Devil's Dam, located north of Paris in Hanover Township, is one of the 11 natural areas in Washington County accessible to the public for entertainment, and is a geological and ecological resource.

Table G-29. Traffic counts (1980)

Location	Average daily traffic (ADT)
<u>Canonsburg Borough</u>	
Route I-79 (between Meadowlands and Houston)	25,800
U.S. Route 19 (just north of Pennsylvania Route 519 intersection)	15,000
Pennsylvania Route 519 (near Boone Avenue intersection)	10,000
Pennsylvania Route 980 (Adams Avenue)	12,500
West Pike Street (west of Strabane Avenue)	12,500
West Pike Street (between Strabane and Central Avenues)	10,600
East Pike Street (between Central and Adams Avenue)	12,900
Strabane Avenue (south of Pike Street)	3,150
South Central Avenue (south of Pike Street)	8,400
North Central Avenue (north of Pike Street)	4,300
Chartiers Street (near Boone Avenue)	3,600
<u>Burrell Township</u>	
U.S. Route 22 (crossing Conemaugh River and before Blairsville)	17,200
U.S. Route 22 (near LR 32006)	17,100
Pennsylvania Route 217 (at the bridge over Conemaugh River)	7,300
Pennsylvania Route 217 (south of LR 64059)	5,200
Pennsylvania Route 217 (just before LR 32179 in Blairsville)	11,000
LR 32006 (near intersection with township road 784)	125
LR 32179 (in Blairsville at township line)	5,500
LR 64059 (east of intersection with Pennsylvania Route 217)	2,500
<u>Hanover Township</u>	
U.S. Route 22 (old)	7,000
U.S. Route 22 (new)	4,000
Pennsylvania Route 18	6,500
LR 62017	550
LR 62122	225

Source: Pennsylvania Department of Transportation (1982).

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
WILLIAM PENN MEMORIAL MUSEUM AND ARCHIVES BUILDING
BOX 1026
HARRISBURG, PENNSYLVANIA 17120

March 17, 1982

Mr. Korah T. Mani, AICP
Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

Re: W.O. 2143-01-01
Historic & archeological site findings within
and in the immediate vicinity of two sites in
Washington County and one site in Indiana
County, Pa. associated with the disposal of
radiation-contaminated waste materials.
File No. ER 82-042M-0114

Dear Mr. Mani:

The above named project has been reviewed by the Bureau for Historic Preservation in accordance with Section 106 of the National Historic Preservation Act of 1966, Executive Order 11593 and the regulations of the Advisory Council on Historic Preservation (36 CFR 800).

To our best knowledge, there are no eligible or listed historic or archeological properties in the area of this proposed project and therefore, this project should have no effect upon such resources. Should the applicant become aware, from any source, that historic or archeological resources are located at or near the project site, please contact the Division of Planning & Protection, Bureau for Historic Preservation, Pennsylvania Historical & Museum Commission, Box 1026, Harrisburg 17120 or call (717) 783-8947.

Sincerely,

Greg Ramsey, Chief
Division of Planning & Protection
Bureau for Historic Preservation
(717) 783-8947

REFERENCES FOR APPENDIX G

- Baker, M., Jr., Inc., 1970. Comprehensive Plan, Derry Township, Indiana County, Pennsylvania.
- Bartos, C., 1982. Certified Sewage Enforcement Officer, Blairsville, Burrell Township, Pennsylvania. Telephone conversation with Mr. K. T. Mani, Roy F. Weston, Inc., West Chester, Pennsylvania, February 10, 1982.
- Bellante and Clauss, Inc., Planning Consultants, 1967. Future Land Use Plan, Prepared for Indiana County Planning Commission, Indiana, Pennsylvania.
- Bolinger, M., 1979. Director of Personnel, Torrance State Hospital, Blairsville, Pennsylvania, Meeting with Mr. K. T. Mani, Roy F. Weston, Inc., West Chester, Pennsylvania, December 20, 1979.
- Canonsburg Borough Planning Commission, 1971. Canonsburg Recreation and Open Space Plan.
- Chnupa, J. W., 1983. Sanitarian Regional Manager, Pennsylvania Department of Environmental Resources, Bureau of Community Environmental Control, Letter to T. R. Fabian, Regional Environmental Protection Director, Pennsylvania Department of Environmental Resources, Southwestern Regional Office, Pittsburgh, Pennsylvania, May 10, 1983.
- Indiana County Tax Assessment Office, 1982. Millage Rates for 1980 and 1981.
- Kohl, W. R., and R. P. Briggs, 1976. Summary Map of Mined Areas and Areas of Potential Coal Mining in Southwestern Pennsylvania, U.S. Department of Interior, Geological Survey, Washington, DC.
- North Strabane Township Planning Commission, 1977. North Strabane Township Park and Recreation Plan.
- Pennsylvania Department of Commerce, Bureau of Statistics, Research and Planning, 1978. Industrial Census Series Release No. M-5-77, Indiana County, Pennsylvania.
- Pennsylvania Department of Commerce, Bureau of Statistics, Research and Planning, 1980. Industrial Census Series Release No. M-5-78, Indiana County, Pennsylvania.
- Pennsylvania Department of Community Affairs, 1981. Local Government Financial Statistics, 1978, Release No. 65, August.
- Pennsylvania Department of Community Affairs, 1982. Local Government Financial Statistics, 1979, March.

Pennsylvania Department of Labor and Industry, Bureau of Employment Security, 1979. Labor Market Letter, February 6, 1979.

Pennsylvania Department of Labor and Industry, Bureau of Employment Security, Indiana Labor Market Area, Pittsburgh, Pennsylvania, 1982, Labor Market Letter, December 1981 (released February 9, 1982).

Pennsylvania Department of Transportation, 1982. District 12 Traffic Counts, 1980 road log.

Selck Minnerly Group, 1974. Chartiers Township Master Plan.

Southeastern Pennsylvania Regional Planning Commission, 1980. 208 Study, Chapter VIII, "Projected Future Conditions," Pittsburgh, Pennsylvania.

U.S. Army Corps of Engineers, Pittsburgh, Pennsylvania District, 1974. Conemaugh Dam Project Map (Scale 1:9600), April 16, 1974.

U.S. DOE (Department of Energy), Uranium Mill Tailings Remedial Action Project Office, Albuquerque Operations Office, 1981. "Contents of Environmental Impact Statements Prepared for the Uranium Mill Tailings Remedial Action Project," UMTRA-DOE/ALO-5, Albuquerque, New Mexico.

Wagner, W. R., and W. S. Lytle, 1976. Greater Pittsburgh Region Revised Surface Structure and its Relationship to Oil and Gas Fields, Infor. Circ. 80, Pennsylvania Department of Environmental Resources, Bur. Topogr., Geol. Survey, Harrisburg, Pennsylvania.

Washington County Board of County Commissioners, 1980. Industrial Directory of Washington County, Washington, Pennsylvania.

Washington County Planning Commission, 1979a. Washington County Profile and Report, Washington, Pennsylvania.

Washington County Planning Commission, 1979b. Environmental Planning Manual, Washington County Overview, Maps 29, 32, 34, 39, 41, 42, Washington, Pennsylvania.

Washington County Planning Commission, 1981. Cycle III Projections (unofficial), Prepared for Southeastern Pennsylvania Regional Planning Commission.

Weirich, C. B., 1982. Area Fisheries Manager, Area 8, Pennsylvania Fish Commission, Somerset, Pennsylvania, Telephone conversation with Ms. E. Carfioli, Roy F. Weston, Inc., West Chester, Pennsylvania, February 9, 1982.

Weirton, West Virginia and Steubenville, Ohio, 1982. Telephone conversations with officials in the Chambers of Commerce with Mr. K. T. Mani, Roy F. Weston, Inc., West Chester, Pennsylvania, on February 18, 1982.

Wilson, R. G., 1982. Pennsylvania Department of Labor and Industry, Bureau of Employment Security, Pittsburgh, Telephone conversation with Mr. K. T. Mani, Roy F. Weston, Inc., West Chester, Pennsylvania, on February 22, 1982.

Yusko, J., 1983. Western area health physicist, Pennsylvania Department of Environmental Resources, Bureau of Radiation Protection, Division of Radiation Control, Pittsburgh, Pennsylvania, Telephone conversation with Dr. M. V. Mellinger, Roy F. Weston, Inc., West Chester, Pennsylvania, April 11, 1983.

Appendix H

**ACOUSTICAL SURVEY RESULTS AT THE
CANONSBURG SITE**

APPENDIX H

ACOUSTICAL SURVEY RESULTS AT THE CANONSBURG SITE

The Franklin Research Center, a division of the Franklin Institute, located in Philadelphia, Pennsylvania, performed an acoustical survey (Hargens, 1979) at the Canonsburg site on 13 September 1979. This appendix presents the results of the measurements and the assessment of the baseline noise levels in the Canonsburg site area (National Research Council, 1977).

The Hargens (1979) report also included a brief assessment of potential noise levels that might be experienced in the area due to remedial action at the Canonsburg site. This evaluation was made before the development of the engineering design plans for the remedial action, and only presented a single noise level for any activity at the Canonsburg site. Because it is not based on any of the engineering designs that are presently being developed, and does not discriminate between any of the alternative remedial actions, this impact assessment is not included in this appendix. Such an assessment cannot be conducted until the final engineering design is completed.

The data from the Hargens (1979) study was gathered to provide a comprehensive study of the Canonsburg site as well as of the surrounding community. The survey points were positioned to include specific sound-producing areas such as the nearby rail lines (see Figure H-1). In addition to the sound-level measurements, tape recordings were made at each sampling point for future reference. Table H-1 summarizes the A-weighted background noise levels for the Canonsburg site survey points.

Nearly all of the background sounds at the various locations were steady within several dB except for passing aircraft or land vehicles which were discounted in the normal way. Because the sources had minimal diurnal variation, it was reasonable to compute an equivalent day-night average sound level, L_{dn} (see Table H-2).

Remedial action at the expanded Canonsburg site may involve a variety of equipment. Figure H-2 gives average noise levels for typical construction equipment. Operation of several pieces simultaneously, can increase the individual noise level by as much as 6 to 10 dB.

Table H-1. Recorded sound levels

Location/measurement	Equipment
Canonsburg Area A	GR 1933 Slm + Nagra recorder
<u>Location 1 -- Property line</u>	
Building 15 (see Figure H-1)	GR 1933 set on 40-50-60 dB scale
Background: 55 dBA	Modulometer: - 15 dB
Manufacturing pulses: +1 to 2 dB	
No particular sound source.	Nagra reference: -6 dB
<u>Location 2 -- Near residential properties 300-500 feet south of indicated property corner</u>	
No manufacturing activity.	
Aircraft overflight only sound: 60 dBA.	
Background: 47 dBA	
<u>Location 3 -- South-north mid-property line</u>	
Workers - painting, etc.	
Background: 45 dBA	
<u>Location 4 -- Northwest corner</u>	
Residences 200 feet away.	
Background: 45 dBA	
Aircraft overflights: 60 - 70 dBA, 5-10 minutes apart.	
Forklifts, occasional sounds associated with trucking operations.	
<u>Location 5 -- Areas A and B (including nearby residences)</u>	
Highway to north.	
Background: 55 dBA average	
<u>Location 6 -- Areas A and C</u>	
Background: 52 dBA -- cars and trucks passing naturally drive this level upward.	
<u>Location 7 -- Areas B and C (near bridge over Chartiers Creek)</u>	
Background: 55 dBA -- aircraft and cricket sound sources.	
<u>Location 8 -- Area C</u>	
Background: 50 dBA -- aircraft, waterfall, and insect sound sources.	
<u>Location 9 -- Area B</u>	
Background: 57 dBA -- mostly acceptable natural sounds, rapids in stream, and insect sound sources.	
Highway on other side of water.	
Populated area experiences background similar to this and location 7.	

Table H-2. Present day-night average sound levels (L_{dn})^a

Location	L_{dn} (dB)
1	61
2	53
3	51
4	51
5	61
6	58
7	61
8	56
9	<u>63</u>
Average = 57	

^aCharacterization of average sound levels in residential areas throughout the day and night, L_{dn} .

$$L_{dn} = 10 \log_{10} \left[\frac{1}{24} \left(\int_{0000}^{0700} 10^{[L_A(t) + 10]/10} dt + \int_{0700}^{2200} 10^{L_A(t)/10} dt + \int_{2200}^{2400} 10^{[L_A(t) + 10]/10} dt \right) \right]$$

**EQUIPMENT POWERED BY
INTERNAL COMBUSTION ENGINES**

EARTH-MOVING

COMPACTORS (ROLLERS)

FRONT LOADERS

BACKHOES

TRACTORS

SCRAPERS GRADERS

PAVERS

TRUCKS

MATERIALS HANDLING

CRANES (MOVABLE)

CRANES (DERRICK)

STATIONARY

PUMPS

GENERATORS

COMPRESSORS

IMPACT EQUIPMENT

PNEUMATIC WRENCHES

JACK HAMMERS/ROCK DRILLS

PILE DRIVERS (PEAK)

OTHER

VIBRATOR

SAWS

NOTE

BASED ON LIMITED AVAILABLE DATA SAMPLES

SOURCE US EPA, 1971 a, b

**FIGURE H-2
EXAMPLES OF NOISE LEVELS
FROM CONSTRUCTION EQUIPMENT**

REFERENCES FOR APPENDIX H

- Hargens, C. W., 1979. "Acoustical Survey and Environmental Impact Projection for Operations at Canonsburg, Pennsylvania," Report No. C5240-01, Franklin Research Center, The Franklin Institute, Philadelphia, Pennsylvania.
- National Research Council, National Academy of Sciences, 1977. "Guidelines for Preparing Environmental Impact Statements on Noise," Report of Working Group 69 on Evaluation of Environmental Impact of Noise, Committee on Hearing, Bioacoustics, and Biomechanics (CHABA), Washington, DC.
- U. S. EPA (U. S. Environmental Protection Agency), 1971a. "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances," Report PB 206717, Washington, DC.
- U. S. EPA (U. S. Environmental Protection Agency), 1971b. "Transportation Noise and Noise from Equipment Powered by Internal Combustion Engines," Report NTID 300.13, Washington DC.

Appendix I

**TRANSPORTATION OF URANIUM-MILL TAILINGS
FROM SELECTED SITES**

TRANSPORATION OF
URANIUM MILL TAILINGS
FROM SELECTED SITES

SEPTEMBER 13, 1982

Transportation and Distribution Associates, Inc.
600 N. Jackson Street
Media, PA 19063
215-565-0238

A subsidiary of Day & Zimmermann, Inc. Telex: 845192 Cable: DAYZIM

September 16, 1982

Mr. Jack C. Newell, P.E.
Vice President
Program Department
Weston
Weston Way
West Chester, PA 19380

Dear Mr. Newell:

Transportation and Distribution Associates, Inc. (TAD) is pleased to submit this final report pertaining to the movement of uranium mill tailings from selected sites.

Very truly yours,

Alan B. Buchan
Vice President

ABB/sb
0110/282900/1370

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Appendix A - Rail Equipment Data

Appendix B - Bureau of Explosives Tariff 6000-A

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I INTRODUCTION

BACKGROUND

In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) acknowledging the potential health hazards associated with uranium-mill tailings. Under this act the U.S. Environmental Protection Agency (EPA) was charged with establishing standards for these sites and the U.S. Department of Energy (DOE) was authorized to work with affected states and Indian tribal governments to clean up these sites. The UMTRCA specifically listed the Canonsburg, Pennsylvania site as one of the sites requiring cleanup. Included with Canonsburg is a site in Burrell Township which contains material previously imported from Canonsburg. The DOE and the Commonwealth of Pennsylvania entered into a cooperative agreement on September 5, 1980 to perform remedial work at the site.

In 1980 the Commonwealth of Pennsylvania studied a number of potential disposal sites for the Canonsburg material to be used if the site was to be decontaminated. This study resulted in the selection of a property in Hanover Township, Pennsylvania, as the best available site. This property (the Hanover site) is located in Washington County, approximately 16 miles northwest of Canonsburg. The site is basically a long, dry trench that was formed by strip-mining activities on a ridgetop.

OBJECTIVE

The objective of this report is to provide costs for various transportation alternatives and discuss the impact of moving the uranium mill tailings by truck versus by rail.

SCOPE

The scope of work is as outlined below.

1. Determine the cost to rehabilitate/construct rail loading/unloading facilities at the Canonsburg, Burrell, and Hanover sites (this task is confined to the costing of track additions/modifications only).

2. Determine the cost to transport the contaminated material from staging piles adjacent to the railroad side track at each site via rail to unload at a point adjacent to the receiving railroad side track.

As part of the cost to ship via rail, develop equipment requirements based on various types of rail cars, i.e., hoppers, gondolas, or box cars, etc., including issues involved in the tainting of railcars.

3. Determine the cost to transport clean fill via rail from borrow pits (specified by Weston) to the contaminated sites.
4. Report on the highway network from borrow pit locations to state highways based on ground reconnaissance including a review of bridges, traffic density, grades, and built-up areas.
5. Report on the highway network from contaminated sites to state highways based on ground reconnaissance similar to item 4.
6. While in the Pittsburgh area, determine the availability of trucking firms and equipment and hauling costs.
7. Develop a discussion of the feasibility and impacts of moving the contaminated material by truck versus by rail from the engineering and safety standpoints.

II RAIL ALTERNATIVE

FACILITY REQUIREMENTS

Burrell Township

Present facilities for loading rail cars at the Burrell Township site are non-existent. Based on the present triweekly frequency of local freight service on the adjacent rail line, the lading capacity of appropriate freight equipment and the project duration, sufficient track capacity to load and store 20 rail cars of 60-foot overall length each will be required. It is recommended that this be accomplished by constructing two 1,200-foot stub-end tracks connected to the Conrail main track with a 200-foot lead. Construction of rail spurs will present no unusual problems as the ground is presently properly graded and follows the grade of the adjacent right-of-way (ROW).

Canonsburg

Facilities for loading rail cars at the Canonsburg site presently exist in the form of two yard tracks north of the Conrail Washington Branch main track. Based on the present triweekly frequency of local freight service on this branch, the lading capacity of appropriate freight equipment, and the project duration, sufficient track capacity to store 20 rail cars of 60-foot overall length each will be required. Sufficient yard track presently exists to meet this requirement but some rehabilitation (primarily in the form of tie renewal) should be undertaken to reduce the probability of any derailments. Also, a crossover should be installed just west of Strabane Ave. In order to load the cars while standing on these yard tracks it will be necessary for the contractor to lease the tracks for the duration of the project. Conrail presently stores some flat cars on the west end of these yard tracks; however it is believed that storage room for these flat cars can be found elsewhere within the Canonsburg area.

Hanover Township

The Hanover Township site at one time had a spur track extending about one mile from the Conrail main track and which terminated within 4,000 feet of the proposed trench in Area 7. This spur has been abandoned for years as evidenced by the growth of trees up to four inches in diameter within the ROW. Most of the ROW is intact and reconstruction of the spur would require only minor clearing, limited regrading, reconstruction of two culverts, partial bank restoration, and track installation. Two open deck steel plate girder bridges over Hanover Creek and Legislative Route (LR) 62122 are in good condition and need only new timber decks. Some erosion of soil around the header walls was observed but is not believed to be a problem. About 50% of the rail required to reopen the spur is on-site and could be used; however, ownership of both the ROW and rail is unknown. In addition to the spur a two-track, stub-end yard with capacity to hold 20 cars would be required at the end of the line. This assumes that the Burrell and Canonsburg sites would be worked sequentially rather than concurrently. If the Burrell and Canonsburg sites were worked concurrently and rail was used from both sites the yard capacity would need to be expanded to accommodate 40 cars.

EQUIPMENT

The feasibility of utilizing various railcar designs is governed by tradeoffs among material handling ease, security, decontamination, etc. It is readily apparent that most types of rail equipment are not specifically designed to match all expected requirements for waste hauling. Further, the scope of the project in terms of carloads and time will require the dedication of carrier equipment or the purchase or lease of private cars.

In general two types of cars can be considered, bulk-handling cars and open or closed cars for various palletized or packaged commodities. Examples of these types have been abstracted from The Car and Locomotive Cyclopedia 1980 Edition, Simmons Boardman, Omaha, NE and are shown in Appendix A.

Bulk handling cars include open and covered hoppers, high- and low-side gondolas, and side dump cars.

Open Top Hoppers

Hopper cars transport loadings varying from heavy ores to lighter materials such as coal. Although hopper cars could be easily loaded at the cleanup sites, major constraints on the use of hoppers are: bottom unloading capabilities such as trestles would be desirable to facilitate unloading; lumpy or cohesive materials such as soils may pack in the pockets, impeding unloading; and, in some cases, cubic capacities are so great that weight limits may be exceeded if completely filled with dense commodities.

Covered Hoppers

Covered hoppers are designed for less-dense, free-flowing commodities, such as grains, chemicals, and pelletized plastics requiring protection from the elements. Security is greatly enhanced in such cars at the expense of loading ease through top hatches. Furthermore, unloading gates would be more likely to be plugged by soils and cubic capacities are generally well above requirements.

Gondolas

High-side gondolas are solid-floor cars of capacities similar to hoppers. While bottom unloading problems are eliminated, specialized unloading facilities such as rotary dumpers are required for unloading and cubic capacities may greatly exceed load limits imposed by soils.

Low-side or conventional gondolas are smaller capacity designs commonly used in hauling steel mill products and high-density loadings. They are ideally suited to moving soils in terms of weight and cubic capacity limits but unloading could be tedious.

Side Dump Cars

Side dump cars are a specialized type of gondola designed for handling of railway construction materials. The car body can be tilted to either side by pneumatic cylinders allowing rapid discharge of the load in less than 10 seconds at trackside. While they are ideally suited in capacities and loading and unloading characteristics, availability could be limited since they are dedicated to railway maintenance of way usage.

Open or closed cars for various palletized or packaged commodities include box cars and flat cars.

Box Cars

Box car designs accommodate very light lading densities such as appliances, packaged foods, etc. They afford excellent containment but impose more laborious loading and unloading techniques.

Flat Cars

Flat cars deserve consideration only if wastes can be containerized. While this allows flexibility in material-handling concepts, net weights transported are reduced by the tare weights of both the rail car and the containers used. Some flat cars are specifically designed to accept standardized containers or trailers but load limits of these cars are on the order of 70 tons to match highway loading limits on trailers.

LADING DENSITY

Quantitative evaluations of lading densities, cubic capacities, and weight limits have been developed as follows:

- Typical lading density values were derived for each car type using the ratio of load limits to cubic capacities. This tabulation demonstrates that, except for gondolas and some aggregate cars, most cars are designed

for loadings of lower density than the wastes.

- Next, car volumes were tabulated in cubic feet and cubic yards, along with maximum weights in tons to permit calculation of allowable loads.
- Maximum loads in cubic yards were then calculated, applying a soil density of 1.21 tons per cubic yard¹. In most cars, the load limits were reached before the cars could be filled to maximum cubic capacities, which implies that special monitoring would be essential at loading sites to preclude overloading. Several designs were well suited; namely, the side dump car and the gondola in that cubic capacities nearly equal the volumes of maximum loads.

EQUIPMENT APPLICATIONS

From an applications viewpoint, a variety of factors were assessed by assigning qualitative scores ranging from 1 to 4 implying poor to excellent characteristics, against weighted objectives (ranging from 0 to 3) defined as follows:

- 1) Loading ease considers the placement of excavated soil in cars by means of front-end loaders, clamshell buckets, or conveyor belt and is weighted at 2.0.
- 2) Unloading ease considers removal by bottom dumping, side dumping, clam shell bucket, or container handling to facilitate transfer to the

¹ Standard Handbook for Civil Engineers Pg. 7-58, 1968 Edition, McGraw-Hill, New York, NY.

disposal site and is weighted at 3.0 as the most critical factor.

- 3) Spill prevention considers the packaging (car body) integrity in preventing contamination of transfer points and rights of way due to leakage and is weighted at 1.0. For example, hopper doors and pockets generally allow leakage and would require patching, special linings or sealing gaskets to eliminate such problems.
- 4) Security enroute considers public access to the wastes based on the package type. This is both a psychological factor, i.e., the reaction of people to the knowledge that a hazardous waste is nearby in a given container type, and also a physical factor, i.e., the prospect of tampering by trespassers and is weighted at 1.0.
- 5) Overload prevention considers matching the weight and volume limits along with the likelihood of greatly exceeding load limits if cubic capacities are too large. This factor can be controlled by loading monitors and is thus weighted at 0.5.
- 6) Decontamination and reuse aspects consider the ease of cleaning the equipment and the risks, both real and esthetic, that subsequent use of the cars could impact on food chains. These are important aspects weighted at 2.0.

A detailed assessment of each applicable car type follows, ranking the various car types for suitability to the clean-up project based on the evaluations shown in Exhibit II-1. However, additional factors such as regulations, availability, and costs (carrier supplied versus purchased or leased cars), must also be considered.

Open top hoppers attained a score of 28.0 out of a possible 38.0. For these cars, loading ease is excellent.

EQUIPMENT REQUIREMENTS FOR RAIL TRANSPORT

EQUIPMENT REQUIREMENTS FOR RAIL TRANSPORT

EQUIPMENT CHARACTERISTICS

EQUIPMENT APPLICATIONS ASPECTS⁴ (Qualitative Estimates)

CAR LOAD REQUIRED PER ALTERNATIVE

R* E F.	Car Type	Lading Density Range	1 Capacity		Max. Load	2 Max. Load	3 Loading Ease	Unloading Ease	Spill Prevention	Security Enroute	Overload Prevention	Decontam- ination 6	Score	#2 80K cu.yd.	#3 N/A	#4 330K cu.yd.	#5 250K cu.yd. ⁷
		lb/cu.ft.	cu.ft.	cu.yd.	(tons)	(cu.yd.)	F=2.0	F=1.0	F=1.0	F=1.0	F=0.5	F=2.0		272K cu.yd.	323K cu.yd.	471K cu.yd.	493 cu.yd. ⁸
A	Coal Hoppers	50/65	3420	127	100	82.6	4	2	2	3	2	4	28.0	970	0	4000	3030
B	Ballast	82	2400	89	96	79.3	4	2	2	3	3	4	28.5	1070	0	4170	3160
C	H780717	100	2000	74	100	82.6	4	2	2	3	4	4	29.0	970	0	4000	3030
U	Aggregate	91	2200	81	100	82.6	4	2	2	3	4	4	29.0	970	0	4000	3030
E	Gons	89	2244	83	100	82.6	4	2	3	3	4	4	30.0	970	0	4000	3030
F	HS Gons	50	4240	157	106	87.6	4	1	3	3	2	4	25.0	920	0	3800	2880
J	Cov Hop	70	2980	110	104	86	2	1	3	4	1	1	16.5	930	0	3840	2910
H	Cov Hop	70	2917	108	102	84.3	2	1	3	4	1	1	16.5	950	0	3920	2970
I	Cov Hop	70	3000	111	105.5	87.2	2	1	3	4	1	1	16.5	920	0	3800	2880
J	Box	27	6540	242	89	73.5	1	1	4	4	1	1	14.5	1090	0	4500	3410
K	Box	29	5277	195	77.3	63.9	1	1	4	4	1	1	14.5	1260	0	5160	3910
L	Box	33	5277	195	86.3	71.3	1	1	4	4	1	1	14.5	1120	0	4620	3500
M	Side Dump (Specialized M of W Cars)	135/140	1480	55	94	77.7	4	4	2	3	4	4	35.0	1460	0	6000	4550
					72.6	60.0							1340		0	5500	4170
N	Flat	Variable			77												
N	20ft. Cont.	29	1250	46.3	18	12	4	3	3	4	2	3	31.0	1450		5990	4540
	@ 4/car		5000	185.2	67 ⁹	55.4											
N	40ft. Cont.	29	2500	92.6	27	18	4	3	3	4	2	3	31.0	1800		7430	5630
	@ 2/car		5000	185.2	54	44.6											

NOTES:

1 Struck
Capacities for
for Hoppers, and
Gondolas, and
Side Cars

2 Soil Density
Loose: 90lb./cu.ft.
= 1.21-tons/cu.yd.

3 Relative merit factor = F

4 1 = Poor, 2 = Acceptable

3 = Good, 4 = Excellent

5 Assumes tarpaulins over loads in open top cars

6 Calc by waste cu.yd. + cu.yd.
21 tons car loads

7 Waste material exported

8 Fill material imported

Not included in car loads estimate

9 Less 500 lbs. per container.

10 At struck capacity

11 At heaped capacity

* See Appendix A

EXHIBIT II-1

II-7

Unloading could be troublesome if facilities are not upgraded and if soils tend to cohere and hamper bottom dumping. Spill prevention was classed acceptable provided that pockets and doors are capable of being sealed to prevent leakage. If loads are covered with tarpaulins, security enroute was rated good. Overload prevention was rated acceptable, but since these cars would have about 40 cubic yards of excess capacity, test loads would have to be run over a track scale and stripes painted on each car to indicate the allowable load height. Decontamination/reuse aspects were rated excellent since washing and wipe tests should eliminate any residual radioactivity and the normal assignments of these cars do not involve food chains.

Three variations of hopper cars were also evaluated leading to slightly higher scoring. All of the above comments apply except that the cars with lesser cubic capacities were less likely to be overloaded thus increasing ratings for this factor.

Gondola cars were judged excellent for loading ease but poor for unloading. The unloading problems could be eliminated by using containers since removing soil by clam shell bucket would be inefficient. Spill prevention is improved for gondolas since they have flat solid bottoms eliminating enroute leakage. Security enroute was rated good if tarpaulins are used. Gondolas are also available with covers, normally in three sections and a crane is required for removal. Overload protection was considered excellent as were decontamination/reuse aspects leading to an overall score of 32.0.

High side gondolas were rated lower since they are of similar capacity to open top hoppers and typically have internal diagonal braces which would greatly complicate unloadings.

Several types of covered hoppers were evaluated leading to similar low scores. Both loading and unloading would be troublesome due to the configuration of top hatches and pocket gates. Some penalty is associated with this car type

since reuse for grain service or other food processing industries would be compromised.

Box cars were found to have similar characteristics as covered hoppers except that loading would be even more awkward; consequently, their scores were even lower.

Side dump cars were found to provide a nearly ideal match to project requirements. Special attention could be required to the side seals to prevent leakage while underway and afford adequate security but all other application factors were judged excellent. Provided that sufficient cars are available for assignment to this project, car-cycle times would be greatly improved and unloading site upgrading costs minimized.

Finally, flat cars got a high score if provisions could be made to containerize the wastes. If dumping capabilities were included in container design criteria, considerable savings at the unloading site would be possible. Containers could also be loaded into gondola cars to permit transport of greater weights. This approach would allow a load limit of 100 tons per car rather than the 77 tons typical of intermodal flat car designs and could also minimize some tie down problems.

In summary, the equipment rankings at this stage indicate that side dump cars are preferred, followed by containerized loads in gondolas, and, lastly, bulk in gondolas.

REGULATORY AND TARIFF CONSIDERATIONS

The feasibility of rail transport is also governed by various regulations of federal and state agencies along with any rates and constraints imposed by Conrail.

The attached abstracts from BOE Tariff 6000-A, Hazardous Material Regulations, define Low Specific Activity (LSA) wastes as less than .001 milliCuries/gram or $1\mu\text{C}/\text{gm}$. In contrast, the wastes at the two sites range from 5 to over 100 picoCuries/gram. Since one pC is $10^{-6}\mu\text{C}$, the materials involved are on the order of $1 \times 10^{-4}\mu\text{C}/\text{gm}$. ($100\text{pC} = 100 \times 10^{-6}\mu\text{C} = 1 \times 10^{-4}\mu\text{C}$).

A further limit for shipment is that surface radiation from carloads must not exceed 10 millirem/hour at any point 2 meters (about 6 feet) from vertical planes projected from the outer edges of the vehicle. Open carloads would develop a gross activity of approximately 9 milliCuries; thus radiation levels in rem/hr should be surveyed or estimated for such lading configurations to assure compliance. It has been called to our attention by Mr. D. McDonald of the Pennsylvania Bureau of Radiation Protection and Toxicology, Harrisburg, PA that some "hot spots" may exist in a former lagoon zone at Canonsburg at which specific activities considerably exceed 100pC/gm but it was not known whether they exceed 1pC/gm.

The recent Resource Conservation and Recovery (RCR) Act stipulates manifest requirements for generators, transporters, and disposers of hazardous wastes. Conrail's Safety and Environmental Control Departments would be involved in technical evaluations arising from these regulations. In the Conrail Safety Department, Mr. James McNally at 215-893-6505 would evaluate transportation aspects, while Mr. Tom Pendergast at 215-893-6542 would rule on compliance with Conrail's environmental controls and manifesting aspects.

During transport, spillage and fugitive dust aspects must be considered. Open top equipment would necessitate use of tarpaulins to cover loads or possibly treatment with dust control agents such as are supplied for coal transfer and storage sites. The state regulators (Mr. E. Sajeski of the Pennsylvania Department of Transportation, Harrisburg) have indicated that their regulations simply parallel the U.S. Department of Transportation regulations previously referred to.

RAIL OPERATION AND FLEET SIZE

Duration of Project

Given the expected duration of the project at Canonsburg (104 weeks), Burrell (81 weeks), and Hanover (120 weeks), it is assumed that all of the contaminated material should be

removed from Canonsburg in one and one-half years or 75 weeks, leaving the remaining time for site restoration. This will require removal of approximately 700 cubic yards of contaminated material per day or about 850 tons per day, assuming 1.21 tons per cubic yard. Assuming the same rate of removal the duration of the Burrell removal is 24 weeks.

If Canonsburg and Burrell are progressed sequentially, 21 weeks would be available at Hanover for finishing operations. Approximate elapsed times for each task are as follows:

Move in Canonsburg material	75 weeks
Move in Burrell material	24 weeks
Available for Finishing and Cleaning	<u>21</u> weeks
Allocated time for Hanover	120 weeks

A sequential loading operation will permit the use of the same rail equipment at each loading site, minimizing track construction requirements at Hanover and reducing the rail car fleet requirements.

Existing Rail Services

Existing rail service at the Burrell site is by a triweekly turnaround local on Monday, Wednesday, and Friday by a train originating at Kiskiminetas Junction yard located near Freeport.

Existing local rail service at Canonsburg is by a train originating at Canonsburg five days per week. On Monday, Wednesday, and Friday this train works north to Scully near Carnegie where it connects with through trains. Contaminated material moving to Hanover would move on these days. On Tuesdays and Thursdays this train operates to Washington and return.

Existing local rail service at the Hanover site is by a train operating from Conway to Weirton and Mingo Junction seven days a week.

See Exhibit II-2 for rail network diagram.

Fleet Size

In developing a fleet size for the movement of contaminated material, it is necessary to determine an equipment cycle time which is based on the connections of these local trains plus the other trains required for road moves. This is done by sequentially following a set of cars through loading, movement to Hanover, unloading, and return to loading site to be loaded again. Care must be taken to assure that sufficient sets of equipment exist for loading each day. This is especially critical where train service is triweekly because a failure to place or pull cars could mean the loss of two days' loadings and bring some of the activities at the site to a standstill.

The maximum number of equipment sets to support rail movement, based on present Conrail operating plans, are as follows:

Burrell to Hanover	6 sets of 10 cars each
Canonsburg to Hanover	5 sets of 10 cars each
Burrell to Canonsburg	6 sets of 10 cars each

It is expected, therefore, that 60 rail cars will be required to adequately support the movement of these materials.

Unloading Operations

Based on the previously discussed evaluation, the car types in order of preference are side dump cars and gondolas. Side dump cars are not immediately available, especially while maintenance of way activities are in full operation on the railroad, usually April to October. Purchase of such cars would be prohibitively expensive and a canvassing of car leasing companies reveals these cars are generally not available for leasing. Therefore, it is expected gondolas will be used.

In unloading gondolas a clamshell bucket would be utilized. The maximum load that a 30-ton crane can lift when equipped with clamshell and with a 40-, 50-, or 60-foot boom is

RAIL NETWORK DIAGRAM

EXHIBIT II-2

II-14

10,300 pounds.¹ The largest bucket that can be handled is 1.5 cubic yards (the 2-cubic yard bucket exceeds to the crane's capacity by 531 pounds).

<u>Bucket Size</u> <u>(Cubic Yards)</u>	<u>Capacity in²</u> <u>Cubic Feet</u> <u>at Plate-Line</u>	<u>Bucket Weight</u> <u>Pounds</u>	<u>Lading</u> <u>Weight³</u>	<u>Total</u> <u>Weight</u>
1 1/4	37.6	4,980	3,384	8,364
1 1/2	43.7	6,000	3,933	9,933
2	51.5	6,206	4,635	10,841

The crane and bucket must be capable of unloading 20 rail cars per day (two days' loadings). With an expected unloading cycle of about 30 seconds⁴, 146 cubic yards can be unloaded and placed into trucks for disposal in a 45-minute hour. This results in 90 cycles per hour.

Twenty carloads are the equivalent of 1,400 cubic yards which would be handled with an expected unloading time of 9.59 hours. If production could be pushed to 100 cycles per hour, i.e., 50 productive minutes per hour, the unloading time would still exceed eight hours by 28 minutes.

In the case of cars from Burrell, the overtime could be avoided by modifying Conrail's operating plan as only ten cars per day would need to be unloaded. Not only will this plan eliminate the overtime, but it will reduce the fleet size by ten cars. However, to achieve this plan operationally, Conrail would have to give absolute cooperation which we believe could be difficult over a sustained period of 24 weeks. Should the

¹R.L. Penrifoy, Construction Planning, Equipment, and Methods, McGraw-Hill, 1979 (page 236).

²Ibid, page 243.

³At 90 lbs. per cubic foot.

⁴Ibid, page 245.

material be moved from Burrell to Hanover by rail under a modified operating plan it is recommended that the fleet of rail cars be held at 60. This would permit some slippage on Conrail's part without jeopardizing production. It will also give the unloading contractor the ability to get out of trouble by working overtime. He would not have this ability when overtime is planned into the schedule.

In the case of the movement of material from Canonsburg to Hanover, the use of a 60-car fleet requires unloading of only ten cars per day.

In addition to the crane and clamshell, a group of four or five laborers with hand shovels will have to clean each gondola because the bucket is not able to clean the corners or along the edges of the car. These men would be subject to breathing dust because they would be working in a confined area where wind would not readily carry away the dust.

Use of Containers to Facilitate Unloading Operations

Youngstown Steel Door provides a 200 cubic yard container which was widely used in the steel mill operations. Eleven of these containers will fit into a standard 52-foot 6-inch gondola. The containers have a bottom unloading door which will permit discharge directly into trucks.

Because of the heavy weight of the material being handled only 178 cubic feet (eight tons) of each container's capacity is usable.

In unloading operations a crane moving adjacent to the rail cars can affix a sling to the container, lift and swing the container over a waiting truck, discharge the contents into the truck, and return the container to the car. Using this method 240 containers (21 carloads) can be unloaded per day. This daily productivity is sufficient to unload two day's loadings without overtime. No men will be required to clean the interior of the car. No movement of rail cars will be necessary once placed by Conrail.

Loading Operations

Without containerization, a tractor loader or crane would be used to load the gondola cars. A tractor loader with a 2.5-ton bucket will handle about 95 cubic yards of material per hour and load 700 cubic yards of material in 7.37 hours.

A 30-ton crane with a 1.5-cubic yard clamshell bucket will be able to load 700 cubic yards in 4.8 hours. In either case a Trackmobile will move and spot the rail cars at the loading location.

In a containerized operation, a Trackmobile would move cars to a surge bin equipped with a loading chute similar to that used in grain loading. A 30-ton crane with a 1.5-cubic yard clamshell bucket will place exactly four buckets (eight tons) into the surge bin which will then be unloaded into the container on the rail car. As the Trackmobile is positioning the next container, the crane is recharging the surge bin. It is estimated that a container can be loaded every four minutes.

Loading and Unloading Costs

The cost of loading rail cars at each loading site is assumed to be the same. The costs were developed for movements with and without the use of containers.

The operation consists of:

- A 30-ton crawler crane with clamshell bucket
- A Trackmobile capable of moving ten loaded cars
- Equipment operators and helpers
- Clean up laborers

The projected cost per ton is \$1.31 using containers and \$1.45 not using containers.

The cost of unloading rail cars is assumed to be the same at each location. As with loading, the costs were developed with and without the use of containers.

The operation consists of:

- A 30-ton crane with a clamshell bucket for use without containers or with a sling for use with containers
- Equipment operators and helpers
- Clean up laborers.

The projected cost per ton is \$0.88 using containers and \$1.44 not using containers.

Cost Advantage In Using Containers

As can be seen from the previous discussion, the use of containers lowers the costs of loading and unloading. The estimated cost for a new container is \$2,750 and it is assumed that upon completion of the project the containers would be scrapped. If all contaminated material (330,000 cubic yards) was outloaded in containers the cost of using containers is \$4.28 per ton. It is therefore assumed that containers would not be used if the rail option were selected.

The resulting cost differential is \$3.58 in favor of not using containers as shown in Exhibit II-3.

RAIL LOADING/UNLOADING COST/TON

<u>Operation</u>	<u>Cost Per Ton</u>	
	<u>With Containers</u>	<u>Without Containers</u>
Loading	\$1.31	\$1.45
Unloading	0.88	1.44
Container Purchase	\$4.28*	-
	\$6.47	\$2.89

* Assumes maximum use of 330,000 cubic yards

EXHIBIT II-3

COST

Facilities

The cost to rehabilitate/construct the necessary rail facilities at each site is estimated below, including expected salvage (scrap) value, all in 1982 dollars.

Burrell Township

Installation 1400' side track and two turnouts - \$220,000
Expected Salvage value - \$10,800.

Canonsburg

Renew 1600 yard ties, renew 1 set switch timber and
Install one crossover - \$63,050
Expected salvage value - \$902

Hanover

Install two turnouts, construct 5250' track,
Rehabilitate 2850' track and install two timber
Bridge decks - \$498,000.

(Not including purchase of ROW and assuming rail presently at site would be left there upon project completion)

Expected salvage value - \$15,500

Equipment

Costs to Use Carrier-Supplied Cars

Conrail's Open Top Hopper Business Group, has indicated that LSA wastes can be hauled in hopper or gondola cars at a rate of \$.75 per hundred weight (from Canonsburg) to \$1.15 per hundred weight (cwt) (from Burrell) for loads of 90 tons or more. For shipments in 100 ton open top cars this amounts to \$1900 per carload. Further, if special trains are run, a surcharge of \$2200 per train is imposed. This information is published in Conrail's Tariff 4426B, Schedule D, and is included in Appendix C. Conrail has also indicated that rates are negotiable depending on the volumes of waste, daily carloading estimates, and their adaptability to existing freight schedules. In other words, rates in the tariff basically consider movements of one to a few carloads; since several thousand carloads could be

generated by the clean up project, lower rates could be negotiated.

Costs to Lease Cars

Of five inquiries, two lessors have responded with estimated costs so far. PLM indicates that 4000-cubic-foot capacity, three-pocket hopper cars can be leased on a full lessor maintenance basis for \$400 per car-month. Evans Railcar indicates that lower capacity gondolas or hoppers can be leased for \$300 to \$400 per car-month depending on type, age, availability etc. All lessors are sensitive to the radioactivity aspects and would require clauses to assign liabilities for contamination of equipment to the lessee.

The cost to lease a fleet of 60 cars has been estimated to be \$432,000 to \$960,000.

It must be recognized that leasing arrangements are seldom straightforward, simple contracts since the railroads also influence operating costs. In some instances, the railroads allow rebates on a car mile basis for leased cars since their own cars do not experience wear and tear. The lessors interviewed would not venture estimates of what rebates, in cents per car mile, might be negotiated. Further they indicated that no rebates might be available presently; in fact, surcharges might even be imposed in some circumstances. Since Conrail now has many cars idle, it is not too likely that they would welcome use of a leased fleet for this project.

Costs to Buy and Operate Cars

Given the current low levels of traffic and utilization, it is likely that older but suitable cars could be purchased from either railroads or lessors and scrapped upon completion of the project. Prices for new open top cars are in the \$45,000 range; however, cars 30 or so years old could be acquired at prices not exceeding \$8,000 each, leading to the following estimate:

Purchase 60 open top cars	= \$480,000
Maintenance at 5¢/car-mile	= 22,000
Scrap credit at \$40 per ton	= <u>72,000</u>
Total Estimated Cost	\$574,000

Recommendation

Based on the above evaluation the use of carrier supplied cars is recommended.

Transportation of Contaminated Material

Burrell to Hanover - 80,000 cubic yards	
Burrell to Canonsburg - 80,000 cubic yards	
Loading @\$1.45/ton	\$ 141,520
Over-the-road @\$1.15/cwt	1,840,000
Unloading @\$1.44/ton	<u>140,544</u>
	\$2,122,064

Canonsburg to Hanover - 250,000 cubic yards	
Loading @\$1.45/ton	\$ 442,250
Over-the-road @\$0.75/cwt	3,750,000
Unloading @\$1.44/ton	<u>439,200</u>
	\$4,631,450

Transportation of Fill Material

While specific borrow pit locations were not identified it was assumed that when the project begins sufficient borrow pits will be located within 10 to 20 miles of each site. With the borrow pits in such close proximity to the site, coupled with the double handling required if moved by rail the moving of land fill by rail was disregarded as too costly and as presenting too much of a logistical problem, especially if rail was to be used to move out contaminated material.

COST SUMMARY*Contaminated Material Burrell to Hanover (Aternative 4)

Facilities	\$ 718,000
Movement out	2,122,064
Expected salvage	<u>(26,300)</u>
Net	\$2,813,764

Contaminated Material Burrell to Canonsburg (Alternative 2)

Facilities	\$ 283,050
Movement out	2,122,064
Expected salvage	<u>(11,700)</u>
	\$2,393,414

Contaminated Material Canonsburg to Hanover (Alternative 4)

If material from Burrell was moved by rail to

Hanover:

Facilities	\$ 63,050
Movement out	4,631,450
Expected salvage	<u>(900)</u>
	\$4,693,600

If material from Burrell was not moved by rail (ie. truck) to Hanover:

Facilities	\$ 561,050
Movement out	4,631,450
Expected salvage	<u>(16,400)</u>
	\$5,176,100

Contaminated Material Canonsburg to Hanover (Alternative 5)

Facilities	\$ 561,050
Movement out	4,631,450
Expected salvavage	<u>(16,400)</u>
	\$5,176,100

*Does not include movement of fill material to each site.

III TRUCK ALTERNATIVE

SITE ACCESS

Burrell Township

Present access to the Burrell Township Site from public roads is fair at best. Access for evacuation of contaminated material from its present location to existing public roads will require the following:

- Construction of 1,350-foot two-lane gravel and dirt access road from loading areas to the Conrail ROW property line.
- Rehabilitation of a two-lane private gravel grade crossing over the Conrail three-track main line. A Conrail flagman will also be required at the crossing during all hours of use.
- Rehabilitation of a two-lane 2,800-foot cinder access road adjacent to the Conrail tracks to a point of junction with Strangford Road.

Strangford Road, LR 32004, is the only available public road from the site and is deemed to be inadequate to support a sustained operation of a fleet of dump trucks (about 4,500 round trips are involved; approximately 4.6 trucks in each direction per hour, eight hours per day, five days per week for 24 weeks) to and from the site.

The road has a 15-ton load limit with asphalt paving which ranges from 12 to 15 feet wide with inadequate shoulders. The grade of the road varies and is moderately steep for short distances. The road traverses a sparse to medium density residential area for a distance of about 4,500 feet where it connects with old Route US 22, LR 32179 (Old 22), a two-lane, uncontrolled-access highway with a 45 to 50 mph speed limit and no special weight restrictions. The intersection of Strangford Road and Old 22 will prove to be extremely hazardous because of inadequate sight distance from Strangford Road to observe

oncoming eastward traffic on Old 22, because of the Old 22 speed limits, and because of an inadequate turning radius for trucks to turn off Strangford Road eastward to Old 22. Improvement of sight distance by vegetation removal and regrading would, by itself, be inadequate. A speed restriction to 30 mph would be required for 1,500 feet on both sides of the intersection on Old 22, installation of "Caution-Turning Truck" signs, and quite possibly Caution/Stop flashers at the intersection. Improvement of the turning radius requires relocation of an existing two-story, single-family, frame dwelling about 300 feet. Property exists for such a relocation. An alternative would be to relocate the Strangford/Old 22 intersection about 300 feet to the east, thus improving the sight distance and the turning radius. This can be accomplished with minimal disruption as the present property is only a cut grass field. From this point the access to the present US 22 (Blairsville By-Pass) is adequate.

Canonsburg

Present access to the Canonsburg site is via Strabane Avenue, to West Pike Street, to PA 519, and to I-79.

Strabane Avenue north of Chartiers Creek is essentially lined with single family dwellings for about 400 feet. The intersection with West Pike Street is controlled by a traffic light. While the turning radius at this intersection is small it is alleviated to some degree by the set back of the stop lines. The turning radius could be further improved by setting the stop lines further back for the eastward traffic on West Pike Street. West Pike Street is heavily settled, mixed residential, commercial, and light industrial for about 5,600 feet to its intersection with PA 519 in the Borough of Houston. This intersection is also controlled by traffic signals. While the turning radius is better than the Strabane Avenue intersection, traffic stop lines will have to be relocated back from the lights to facilitate a larger turning radius. PA 519 is essentially commercially developed, with development decreasing as I-79 is approached. PA 519 will be travelled for 2,500 feet to the intersection of I-79.

While this route is capable of supporting a truck traffic density of about 14,000 round trips (approximately 4.7 trucks in each direction per hour, eight hours per day, five days per week for 75 weeks), portions of the road will no doubt require resurfacing on completion of the project. While not specifically part of the scope of this report it is believed that local public opinion will make this an undesirable route even if the inhabitants realize that the contaminated material is being removed.

An alternative exists in that an access road can be constructed to the south of and adjacent to the Conrail branch line between Strabane Avenue and PA 519. A railroad access road exists for most of the distance now and could be extended by eliminating the Conrail stub-end track west of Strabane Avenue. There is no apparent reason for Conrail to resist removal of this track. If that is not possible, a similar route could be accomplished either via Strabane Avenue, south to Latimer Avenue, and then west to PA 519; or, alternatively, via Strabane Avenue, south to Boone Avenue, and then west to PA 519.

Hanover Township

The only present access to the Hanover Township site which could be found during a ground reconnaissance without traversing private roads was via LR 62122 which parallels the Conrail mainline and Harmon Creek westward from PA 18, then via coal-haul roads. LR 62122 traverses the heart of Burgettstown and any volume of truck movement through the town would be virtually impossible. Access revealed through a map reconnaissance indicates a possibility of using T647 westward from PA 18; this route does not traverse any built-up areas. Also, Old US 22 west from the vicinity of Florence could be used to enter the site from the north.

OVER THE ROAD OPERATIONS

Burrell to Hanover

US 22 is essentially a three-lane, paved, unlimited-access highway for 26.5 miles providing a lane for each

direction with the third (middle) lane designated for turning or passing as appropriate. Portions of this section are four-lane primarily at intersections with major cross roads. Most intersections are not grade-separated. The grades are moderate and the road is lined with commercial establishments with the density of occupation increasing close to Pittsburgh. The last three miles just prior to merging with I-376 is four-lane, heavily built-up, and congested.

I-376/US 22 is primarily a four-lane, paved, limited-access highway with at least two lanes in each direction for 15 miles. The grades are moderate and the route traverses a one mile tunnel at Squirrel Hill. Reconstruction of portions of this route are presently under way, permitting only one lane of traffic in each direction. This portion of the route passes through downtown Pittsburgh, generally following the north bank of the Monongahela River.

At the end of I-376/US 22, the route becomes I-279/US 22 and turns south over the Monongahela River and into the Fort Pitt tunnel. This section is a paved four-lane, limited-access highway with moderate grades for five miles to the junction with I-79. At this point the route designation is US 22/US 30. This section is a four-lane, paved, limited-access highway with moderate to heavy grades for 18 miles. Reconstruction is presently underway on portions of this section, allowing only one lane traffic in some stretches. This route ends at the grade-separated intersection with PA 18 which would be used for immediate access to the Hanover site.

This is a rather long route over roads that during the peak commutation periods are heavily utilized. Traffic in the downtown Pittsburgh area near the intersection of I-376 and I-279 can be heavy and congested even during off-peak periods. Truck hauls on this route would be limited to two round trips per eight-hour day with the probability of operation back to the starting site requiring more than an eight-hour day. See Exhibit III-1.

HIGHWAY NETWORK DIAGRAM

I-32

NOT TO SCALE

III-5

EXHIBIT III-1

Burrell to Canonsburg

The same route as previously described for Burrell to Hanover would be used except that, at the junction of I-79, traffic would turn onto I-79 south for 15 miles to PA 519. I-79 is a four-lane, paved, limited-access highway with flat to moderate grades. PA 519 would be used for immediate access to the Hanover site. This route is essentially the same length as the Burrell to Hanover route and truck operation would be limited to two trips per eight-hour day with the probability of a frequent occurrence of operation beyond eight hours. See Exhibit III-1.

Canonsburg to Hanover

Essentially there are three available routes between Canonsburg and Hanover, as shown in Exhibit III-2.

EXHIBIT III-2

Route 1 - via I-79 and US 22. This is a paved, four-lane, limited-access highway route of 33 miles and offers the best route from the standpoints of capacity, grades, and avoidance of populated areas.

Route 2 - via PA 519, PA 50, and PA 18. This is a paved, two-lane, unlimited-access highway route of 19 miles with moderate grades and limited capacity and it traverses several built up areas including the Borough of Houston and the small towns of Westland, Hickory, and Atlasburg; it bypasses the outskirts of Burgettstown on a limited-access, four-lane bypass.

Route 3 - via I-79, I-70, and PA 18. This is a paved route with six miles of four-lane Interstate and 24 miles of two-lane PA 18 with moderate grades, limited capacity, and traversing two built up areas including downtown Washington which resembles West Pike Street in Canonsburg.

EQUIPMENT

For highway transport of the wastes, two types of dump trucks can be considered: Triaxle trucks which can handle 16 to 18 cubic yards and tractor trailer types with dump bodies which can handle 18 to 20 cubic yards while remaining within gross highway load limits of 73,280 lbs. The movement of such vehicles on the routes previously discussed should present no operating or weight problems.

The cleanup project will require dedication of a fleet of trucks to haul both wastes and fill. Two contractors in the Pittsburgh area, (D. Tesone - 412-781-4551 and Sciaretti - 412-462-1233) appear capable of meeting project requirements, with heavy fleets of 96 to 150 trucks. Also, at least one is familiar with hazardous waste hauling regulations of the U.S. DOT and state Department of Environmental Resources.

COST

Based on discussions with two trucking companies in the area the following round-trip truck transportation rates are provided based on the one-way distances shown and assuming 18 cubic yards per truckload:

10 miles	\$43.20 - \$2.40/cubic yard
20 miles	\$75.60 - \$4.20/cubic yard
50 miles	\$135.00 - \$7.50/cubic yard
70 miles	\$156.60 - \$8.70/cubic yard

The above rates do not include cost for excavating and loading nor do they include the cost for the fill material.

Cost for fill material can vary from \$1 to \$6 per cubic yard depending on the quality of soil and the owners need to get rid of the material.

Based on the rates shown above the over the road truck transportation costs are estimated below:

Contaminated Material

Burrell to Hanover	
80,000 cubic yards	- \$696,000
Burrell to Canonsburg	
80,000 cubic yards	- \$696,000
Canonsburg to Hanover	
250,000 cubic yards	- \$1,050,000

Fill Material (with borrow pits assumed to be within 10 miles)

At Burrell (Alternatives 2 and 4)	
16,000 cubic yards	- \$38,500
At Burrell (Alternatives 3 and 5)	
72,000 cubic yards	- \$172,800
At Canonsburg (Alternatives 3, 4, and 5)	
251,000 cubic yards	- \$602,600
At Canonsburg (Alternative 2)	
256,000 cubic yards	- \$614,300
At Hanover (Alternative 4)	
204,000 cubic yards	- \$481,600
At Hanover (Alternative 5)	
170,000 cubic yards	- \$408,000

Discussion with the company that hauled clean fill for the Conrail chloroform spill at Midway, M&M Equipment Sales, indicated that the cost per cubic yard of fill for that job was about \$19 which included a good grade of soil, excavation, loading and hauling on a 20 mile round trip.

IV DISCUSSION OF ALTERNATIVES

It is quite obvious from a cost standpoint that the use of trucks is the preferred method of transportation for all alternatives.

It appears that adequate trucks will be available to handle the quantities involved.

Based on the route reconnaissance conducted there are no unusual highway design or safety hazards which will preclude the use of trucks, except those specifically pointed out in the discussion of site access.

The only potential problems associated with the use of trucks are the length of haul from the Burrell Township site and the exposure of this traffic between Squirrel Hill and Carnegie, in the downtown Pittsburgh area.

APPENDIX A
RAIL CAR DESCRIPTIONS

Conrail 100-Ton Triple Hopper Car.

Inside length 45 ft. 2 in., inside width 9 ft. 9 in., length over pulling face coupler 48 ft. 8 in. Extreme width 10 ft. 7 in., extreme height 12 ft. 2 in., rated capacity 200,000 lbs. or 3420 cu. ft. Built by Greenville Steel Car Co., 1979.

GREENVILLE STEEL CAR COMPANY

H-770804**Southern 100-Ton Ballast Car**

Rated capacity is 192,000 lbs or 2400 cubic feet
 End floor slope sheets are 45° Built by PORTEC,
 INC , Railcar Division, 1979.

It has a rated capacity of 200,000 lbs. or 2,000 cubic feet. Built by PORTEC, INC., Railcar Division, 1979.

Portec inc. Railcar Division

SANTA FE RAILROAD RAPID DISCHARGE® CAR. BUILT BY ORTNER FREIGHT CAR CO.

Five-pocket, fully-automated 100-ton Rapid Discharge® coal car. Cars are used in shuttle train operations in Arizona and New Mexico.

Coupled length	57'7"
	17.53 meters
Length between truck centers	45'1"
	13.72 meters
Inside length	49'11"
	15.24 meters
Inside width	9'10"
	2.97 meters

FLORIDA EAST COAST RAILROAD RAPID DISCHARGE® AGGREGATE CAR. BUILT BY ORTNER FREIGHT CAR CO.

This three-pocket, 100-ton aggregate car was built in 1979. These cars are being used to haul limestone out of the Miami area.

Cubic Capacity	2200 cu. ft.
	62.3 cu. meters
Length over truck centers	31'3½"
	9.54 meters
Inside length	29'3"
	8.91 meters
Inside width	9'10"
	3 meters

ORTNER FREIGHT CAR CO.

Denver & Rio Grande Gondola.
Solid Bottom Gondola Car.
Class GS.
52'6" Inside Length.
4'6" Inside Height.
100-Ton Capacity.
Continuous Bar Type Lading Band Anchors.
Collapsible Stake Pockets.
Used in Steel Service.
Built by International Car Co., 1978.

PACIFIC CAR AND FOUNDRY COMPANY

I-43

REFERENCE F

100-Ton Coalveyor™ Gondola built by ACF Industries

The car's basic reinforced circular bottom configuration provides a lighter car weight dramatically increasing coal payload. It can carry more than 106 tons of coal per car. Inside length 48 ft 0 in., capacity 4240 cu ft., lightweight 50 700 lbs., load limit 212,300 lbs.

REFERENCE G

Two-Compartment 2980 CENTER FLOW 100-Ton Covered Hopper

Designed to transport very high density dry bulk ladings (70 to over 100 lbs per cu ft) Inside length 38 ft Rated capacity is 2980 cu ft or 208,000 lbs Built in 1977 by ACF

Three-Compartment 4650 CENTER FLOW 100-Ton Covered Hopper

Designed to transport intermediate weight dry bulk ladings (42 to 50 lbs per cu ft) Inside length 48 ft 9 in Rated capacity is 4650 cu ft or 198,000 lbs Built in 1979 by ACF

REFERENCE H

North American Car 100-Ton Twin Covered Hopper Car.

Inside length 37 ft., inside width 9 ft 11 in, extreme width 10 ft 8 in, extreme height 14 ft 9 in, length between pulling face coupler 43 ft. 10 in. Rated capacity 200,000 lbs or 2917 cu. ft. Equipped with six 2 ft 6 in dia loading hatches and four 13 in x 24 in sliding type discharge doors. Built by Greenville Steel Car Co., 1977.

GREENVILLE STEEL CAR COMPANY

Capacity 208,000 lbs., cubic capacity 3000 cu. ft. Twin hoppers and gravity, side discharge arrangement. Equipped with 30" round hatches. Built for cement service or other heavy bulk commodity lading. See general arrangement diagram for dimensions. Built by Pullman Standard, 1978.

PULLMAN STANDARD

THE CAR AND LOCOMOTIVE CYCLOPEDIA

Pullman Standard 3000 cu. ft. Covered Hopper Car.

REFERENCE J

AUTO PARTS CAR

• 100 Ton Box Car XL • Built By
FGE Co 1980 • 60'9" Inside Length •
9'6 1/2" Inside Width • 11'4" Inside
Height • Nominal Lt Wt 85,000 lbs
• 16'4" Clear Door Opening

20 Travel Sliding Sill • 1 1/4" Nailable
Steel Floor • 12 Belt Rails • 3 Steel
Rub Rails Full Length

$$(60.75)(9.5)(11.33) = 6540 \text{ ft}^3$$

$$\begin{array}{r} 263000 \\ 85000 \\ \hline 178000 \text{ MAX LD} \end{array}$$

Builder: FGE, Alexandria, Virginia 22314

REFERENCE K

GENERAL PURPOSE CAR

• 70 Ton Box Car XF • Built By FGE
Co 1979 • 50'6" Inside Length •
9'6 1/2" Inside Width • 11'0" Inside
Height • Nominal Lt Wt 62,600 •
10'0" Clear Door Opening

• 10" EOC Hydraulic Cushioning •
1 1/4" Nailable Steel Floors • FDA
White Epoxy Interior

$$\frac{157400}{(50.5)(9.5)(11.0)} = 293$$

$$\frac{5277}{27} = 195 \text{ yd}^3$$

Builder: FGE, Alexandria, Virginia 22314

THE CAR AND LOCOMOTIVE CYCLOPEDIA

Southern Pacific Box Car.
 Steel sheath box car
 Class XL
 60'11" inside length.
 13'1" inside height
 100 ton capacity
 Cross bar type loader side rails
 20" travel sliding sill underframe
 Used in auto parts service
 Built by Pacific Car and Foundry Co , 1978

$$(50.5)(9.5)(160) = 5277 \text{ ft}^3$$

$$195 \text{ yd}^3$$

172 700 MAX WT =

PACIFIC CAR AND FOUNDRY COMPANY

Consolidated Rail Maintenance of Way Car.
Air side dump.
Class M.W.D.
38'1" inside length.
3'9" inside height.
100 ton capacity. ? 55 yd³ NOMINAL
Built by Pacific Car and Foundry Co., 1978.

STENCILLED
187,800 LB
LD 1MT

$$\frac{187,800}{(30)(27)} = 140 \frac{1}{2} \text{ yd}^3 \text{ max}$$

$$\frac{200,000}{(54.2)(27)} = 137 \frac{1}{4} \text{ yd}^3$$

$$\frac{187,800}{(2000)(1.21)} = 77.6 \text{ yd}^3 \text{ heaped}$$

PACIFIC CAR AND FOUNDRY COMPANY

GENERAL SPECIFICATION

FOR

89' - 4" STANDARD DECK FLAT CARS

GENERAL DIMENSIONS

Length Over End Sills	89' - 4"
Over Strikers	90' - 0"
Over Pulling Faces of Free Couplers	93' - 10"
Truck Centers	66' - 0"
Center of Truck to Striker Face	12' - 0"
Width Over Side Sill	9' - 0"
Height Rail to Top of Side Sill	3' - 5-1/16"
Rail to Top of Floor	3' - 5-7/16"
Rail to Centerline of Coupler	2' - 10-1/2"
Side Bearing Centers	4' - 2"

BETHLEHEM STEEL CORPORATION

APPENDIX B

ABSTRACTED HAZARDOUS MATERIALS REGULATIONS
FOR WASTE TRANSPORT

Ala P S C No 17
A C C No 15
Ark T C No 22
C T C No 20
Conn P U C No 19
F P S C No 11
I P U C No 18
Ia C C No 16
Ill C C No 8
I R C No 18
P S C I No TR-16
K R C No 18

P S C Md No 34
M D P U No 19
M P S C No 22
Minn P S C No 18
Miss P S C No 11
Mont R C No 18
N P S C No 16
P U C N J No 18
N M S C C No 11
D O T-N Y No 15
D O T-N Y MT No 15
P U C O No 18

Pa P U C No 33
R I P U A No 18
P U C S D No 16
R C T No 18
P S C U No 11
Vt P S B No 18
V C C No 18
P S C W Va No 18
P S C Wis No 16
Wyo P S C No 16

I. C. C. No. BOE—6000-A
Cancels I C C No BOE—6000

F. M. C. F. No. 29
Cancels F M C F No 28

⌘ Applicable except where it conflicts with State statutes

Bureau of Explosives'

(Thomas A Phemister, Agent)
(Elizabeth P Rabben, Alternate Agent)

TARIFF No. BOE—6000—A

(Cancels Tariff No. BOE—6000)

PUBLISHING

Hazardous Materials Regulations of the Department of Transportation

BY

AIR, RAIL, HIGHWAY, WATER

AND

MILITARY EXPLOSIVES BY WATER

INCLUDING

SPECIFICATIONS FOR SHIPPING CONTAINERS

(Regulations for Transportation of Explosives and Other Dangerous Articles in Rail Express and Rail Baggage services
are also included herein for information)

Prescribed under the Act of September 6, 1970 (74 Stat 808 18 U S C 831-835)

AND RESTRICTIONS COVERING THE ACCEPTANCE AND TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS
ARTICLES BY CARRIERS PARTIES TO THIS TARIFF

ISSUED November 18, 1980

EFFECTIVE December 18, 1980

Rule 1 of Tariff Circular waived I C C Permission No SP 78-3113
Published under authority of Federal Maritime Commission Special Permission No 6177

The provisions published herein will, if effective, not result
in an effect on the quality of the human environment

Issued by Thomas A Phemister, Agent
Elizabeth P Rabben, Alternate Agent
Association of American Railroads
Bureau of Explosives
1920 "L" St N W,
Washington, D C 20036
Telephone 202-293-4048

Element ¹	Radionuclide ²	Transport group						
		I	II	III	IV	V	VI	VII
Aadium (88)	Ra-223		X					
	Ra-224		X					
	Ra-226	X						
	Ra-228	X						
Radon (86)	Rn-220				X			
	Rn-222		X					
Rhenium (75)	Re-183				X			
	Re-186				X			
	Re-187				X			
	Re-188				X			
Rhodium (45)	Rh Natural				X			
	Rh-103m				X			
Rhodium (45)	Rh-105				X			
	Rb-86				X			
Rubidium (37)	Rb-87				X			
	Rb Natural				X			
Ruthenium (44)	Ru-97				X			
	Ru-103				X			
	Ru-105				X			
	Ru-106				X			
Samarium (62)	Sm-145			X				
	Sm-147			X				
	Sm-151				X			
	Sm-153				X			
Scandium (21)	Sc-46			X				
	Sc-47				X			
	Sc-48				X			
	Se-75				X			
Selenium (34)	Si-31				X			
Silver (47)	Ag-105				X			
	Ag-110m			X				
Sodium (11)	Ag-111				X			
	Na-22			X				
Strontium (38)	Na-24				X			
	Sr-85m				X			
Sulphur (16)	Sr-85				X			
	Sr-89			X				
	Sr-90				X			
	Sr-91			X				
Tantalum (73)	Sr-92				X			
	S-35				X			
Technetium (43)	Ta-182			X				
	Tc-96m				X			
	Tc-96				X			
	Tc-97m				X			
Tellurium (52)	Tc-97				X			
	Tc-99m				X			
	Tc-99				X			
	Te-125m				X			
Terbium (65)	Te-127m				X			
	Te-127				X			
	Te-129m			X				
	Te-129				X			
Thallium (81)	Te-131m			X				
	Te-132				X			
	Tb-160			X				
	Tl-200				X			
Thorium (90)	Tl-201				X			
	Tl-202				X			
	Tl-204			X				
	Th-227		X					
Thulium (69)	Th-228	X						
	Th-230	X						
	Th-231	X						
	Th-232			X				
Tin (50)	Th-234		X					
	Th Natural			X				
	Tm-168			X				
	Tm-170			X				
Tritium (1)	Tm-171				X			
	Sn-113				X			
	Sn-117m			X				
	Sn-121			X				
Tungsten (74)	Sn-125				X			
	H-3				X			
	H-3 (as a gas as luminous paint or absorbed on solid material)				X			
	W-181				X			
Uranium (92)	W-185				X			
	W-187				X			
	U-230		X					
	U-232	X						
Vanadium (23)	U-233 ⁴		X					
	U-234		X					
	U-235 ⁴			X				
	U-236		X					
	U-238			X				
	U Natural			X				
	U Enriched ⁴			X				
	U Depleted			X				
	V-48				X			
	V-49			X				

Notes See footnotes at end of tables

Element ¹	Radionuclide ²	Transport group						
		I	II	III	IV	V	VI	VII
Xenon (54)	Xe-125			X				
	Xe-131m			X				
	Xe-131m (uncompressed) ²					X		
	Xe-133			X				
Ytterbium (70)	Xe-133 (uncompressed) ²						X	
	Xe-135		X					
	Xe-135 (uncompressed) ²					X		
	Yb-175				X			
Yttrium (39)	Y-88			X				
	Y-90				X			
	Y-91m			X				
	Y-91			X				
Zinc (30)	Y-92				X			
	Y-93				X			
	Zn-65				X			
	Zn-69m				X			
Zirconium (40)	Zn-69				X			
	Zr-93				X			
	Zr-95		X					
	Zr-97				X			

¹ Atomic number shown in parentheses² Uncompressed means at a pressure not exceeding 14.7 p.s.i. (absolute)³ Atomic weight shown after the radionuclide symbol⁴ Fissile radioactive material

(b) Any radionuclide not listed in the above table shall be assigned to one of the groups in accordance with the following table

Radionuclide	Radioactive half-life		
	0-1,000 days	1,000 days to 10 ⁵ years	Over 10 ⁵ years
Atomic number 1-81	Group III	Group II	Group III
Atomic number 82 and over	Group I	Group I	Group III

Note 1 No unlisted radionuclides shall be assigned to Groups IV, V, VI, or VII

(c) For mixtures of radionuclides the following shall apply

(1) If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum, for all groups present, of the ratio between the total activity for each group to the permissible activity for each group will not be greater than unity

(2) If the groups of the radionuclides are known but the amount in each group cannot be reasonably determined, the mixture shall be assigned to the most restrictive group present

(3) If the identity of all or some of the radionuclides cannot be reasonably determined, each of those unidentified radionuclides shall be considered as belonging to the most restrictive group which cannot be positively excluded

(4) Mixtures consisting of a single radioactivity decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide. The group and activity shall be that of the first member present in the chain, except if a radionuclide "x" has a half-life longer than that of that first member and an activity greater than that of any other member including the first at any time during transportation, in that case, the transport group of the nuclide "x" and the activity of the mixture shall be the maximum activity of that nuclide "x" during transportation

§ 173.391 Limited quantities of radioactive materials and radioactive devices. (a) Limited quantities of radioactive materials in normal form not exceeding 0.01 millicurie of Group I radionuclides, 0.1 millicurie of Group II radionuclides, 1 millicurie of Groups III, IV, V, or VI radionuclides, 25 curies of Group VII radionuclides, tritium oxide in aqueous solution with a concentration not exceeding 0.5 millicuries per milliliter and with a total activity per package of not more than 3 curies, or 1 millicurie of radioactive material in special form, and not containing more than 15 grams of uranium-235 are excepted from specification packaging, marking, and labeling and are excepted from the provisions of § 173.393, if the following conditions are met

(1) The materials are packaged in strong tight packages such that there will be no leakage of radioactive materials under conditions normally incident to transportation

(2) The package must be such that the radiation dose rate at any point on the external surface of the package does not exceed 0.5 millirem per hour

(3) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397)

(4) The outside of the inner container must bear the marking "Radioactive"

(b) Manufactured articles such as instruments, clocks, electronic tubes or apparatus, or other similar devices, having limited quantities of radioactive materials (other than liquids) in a nondispersible form, and component part, are excepted from specification packaging, marking, and labeling, and are excepted from the provisions of § 173.393, if the following conditions are met

Note 1 For radioactive gases the requirement for the radioactive material to be in a nondispersible form does not apply

(1) Radioactive materials are securely contained within the devices or are securely packaged in strong, tight packages so that there will be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The radiation dose rate at four inches from any unpackaged device does not exceed 10 millirem per hour.

(3) The radiation dose rate at any point on the external surface of the outside of the package may not exceed 0.5 millirem per hour. However, for exclusive use shipments only, the radiation at the external surface of the package or the item may exceed 0.5 millirem per hour but must not exceed 2 millirem per hour.

(4) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397).

(5) The total radioactivity content of a package containing radioactive devices must not exceed the quantities shown in the following table:

Transport group	Quantity in curies	
	Per device	Per package
I	0.0001	0.001
II	0.001	0.05
III	0.01	3
IV	0.05	3
V or VI	1	1
VII	25	200
Special form	0.05	20

(6) No package may contain more than 15 grams of fissile material.

(c) A manufactured article, other than a reactor fuel element, in which the only radioactive material is metallic natural or depleted uranium or natural thorium or alloys thereof, is excepted from specification packaging, marking, and labeling, and is excepted from the provisions of § 173.393, if the following conditions are met:

(1) The radiation dose rate at any point on the external surface of the outside container does not exceed 0.5 millirem per hour.

(2) There must be no significant radioactive surface contamination on the exterior of the package. To determine whether "significant," the standard in § 173.397 must be used.

(3) The total radioactivity content of each article must not exceed 3 curies.

(4) The outer surface of the uranium or thorium is enclosed in a non-radioactive, sealed, metallic sheath.

Note: Such articles may be packaged for the transportation of radioactive materials.

(d) Shipments made under this section for transportation are not subject to Subpart F of Part 172 of this subchapter, to Part 174 of this subchapter except § 174.24 and to Part 177 of this subchapter except § 177.817.

§ 173.392 Low specific activity radioactive material. (a) Low specific activity (LSA) radioactive materials, other than materials consigned as exclusive use, are exempt from the provisions of § 173.393(a) through (e) and (g). However, they must be packaged in accordance with the requirements of § 173.395 and must be marked and labeled as required in §§ 172.300 and 172.400 of this subchapter.

(b) LSA radioactive materials which are transported in a transport vehicle (except aircraft) and consigned as exclusive use are exempt from specification packaging, marking, and labeling provided the shipment meets the requirements of paragraph (c) or (d) of this section.

(c) Packaged shipments of low specific activity materials transported in transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Materials must be packaged in strong, tight packages so that there will be no leakage of radioactive material under conditions normally incident to transportation.

(2) Packages must not have significant removable surface contamination (see § 173.397).

(3) External radiation levels must comply with § 173.393(j).

(4) Shipments must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.

(5) There must be no loose radioactive material in the car or vehicle.

(6) Shipment must be braced so as to prevent leakage or shift of lading under conditions normally incident to transportation.

(7) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 172.500 of this subchapter, as appropriate.

(8) The outside of each outside package must be stencilled or otherwise marked "Radioactive—LSA."

(9) Specific instructions for maintenance of exclusive use (sole use) shipment controls must be provided by the shipper to the carrier. Such instructions must be included with the shipping paper information.

Unpackaged (bulk) shipments of low specific activity materials transported in closed transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Authorized materials are limited to the following:

(i) Uranium or thorium ores and physical or chemical concentrates of those ores.

(ii) Uranium metal or natural thorium metal, or alloys of these materials or

(iii) Materials of low radioactive concentration, if the average estimated radioactivity concentration does not exceed 0.001 millicurie per gram and the contribution from Group I material does not exceed one percent of the total radioactivity.

(iv) Objects of nonradioactive material externally contaminated with radioactive material, if the radioactive material is not readily dispersible and the surface contamination, when averaged over one square meter, does not exceed 0.0001 millicurie per square centimeter of Group I radionuclides or 0.001 millicurie per square centimeter of other radionuclides. Such objects must be suitably wrapped or enclosed.

(2) Bulk liquids must be transported in the following:

(i) Specification 103CW, 111A60W7 (§§ 179.200, 179.201, 179.202 of this subchapter) tank cars. Bottom openings in tanks prohibited.

(ii) Spec MC 310, MC 311, MC 312, or MC 331 (§ 178.330, § 178.331, § 178.337, or § 178.343 of this subchapter) cargo tanks. Authorized only where the radioactivity concentration does not exceed 10 percent of the specified low specific activity levels (see § 173.389(c)). The requirements of § 173.393(g) do not apply to these cargo tanks. Bottom fittings and valves are not authorized. Trailer-on-flat-car service is not authorized.

(3) External radiation levels must comply with subparagraphs (2), (3), and (4) of § 173.393(j).

(4) Shipments must be loaded by the consignor, and unloaded by the consignee from the transport vehicles in which originally loaded.

(5) Except for shipments of uranium or thorium ores unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 172.500 of this subchapter, as appropriate.

(6) There must be no leakage of radioactive materials from the vehicle.

(7) Specific instructions for maintenance of exclusive use (sole use) shipment controls must be provided by the shipper to the carrier. Such instructions must be included with the shipping paper information.

§ 173.393 General packaging and shipment requirements. (a) Unless otherwise specified, all shipments of radioactive materials must meet all requirements of this section, and must be packaged as prescribed in §§ 173.391 through 173.396.

(b) The outside of each package must incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that the package has not been illicitly opened.

(c) The smallest outside dimension of any package must be 4 inches or greater.

(d) Each radioactive material must be packaged in a packaging which has been designed to maintain shielding efficiency and leak tightness, so that, under conditions normally incident to transportation, there will be no release of radioactive material. If necessary, additional suitable inside packaging must be used. Each package must be capable of meeting the standards in §§ 173.398(b) and 173.24.

(1) Internal bracing or cushioning, where used, must be adequate to assure that, under the conditions normally incident to transportation, the distance from the inner container or radioactive material to the outside wall of the package remains within the limits for which the package design was based, and the radiation dose rate external to the package does not exceed the transport index number shown on the label. Inner shield closures must be positively secured to prevent loss of the contents.

(e) The packaging must be designed, constructed, and loaded so that during transport:

(1) The heat generated within the package because of the radioactive materials present will not, at any time during transportation, affect the efficiency of the package under the conditions normally incident to transportation, and

(2) The temperature of the accessible external surfaces of the package will not exceed 122° F in the shade when fully loaded, assuming still air at ambient temperature. If the package is transported in a transport vehicle consigned for the sole use of the consignor, the maximum accessible external surface temperature shall be 180° F.

(f) Pyrophoric materials, in addition to the packaging prescribed in this subpart, must also meet the packaging requirements of § 173.134 or § 173.154. Pyrophoric radioactive liquids may not be shipped by air.

(g) Liquid radioactive material in Type A quantities must be packaged in or within a leak-resistant and corrosion-resistant inner containment vessel. In addition:

(1) The packaging must be adequate to prevent loss or dispersal of the radioactive contents from the inner containment vessel if the package were subjected to the 9 meter (30-foot) drop test prescribed in § 173.398(c)(2)(i), or either

(2) Enough absorbent material must be provided to absorb at least twice the volume of radioactive liquid contents. The absorbent material may be located outside the radiation shield only if it can be shown that

if the radioactive liquid contents were taken up by the absorbent material the resultant dose rate at the surface of the package would not exceed 1,000 millirem per hour, or

(3) A secondary leak-resistant and corrosion-resistant containment vessel must be provided to retain the radioactive contents under the normal conditions of transport as prescribed in § 173.398(b), assuming the failure of the inner primary containment vessel

(h) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397)

(i) Except for shipments described in paragraph (j) of this section, all radioactive materials must be packaged in suitable packaging (shielded, if necessary) so that at any time during the normal conditions incident to transportation the radiation dose rate does not exceed 200 millirem per hour at any point on the external surface of the package, and the transport index does not exceed 10

(j) Packages for which the radiation dose rate exceeds the limits specified in paragraph (i) of this section, but does not exceed at any time during transportation any of the limits specified in paragraphs (k)(1) through (4) of this section may be transported in a transport vehicle which has been consigned as exclusive use (except aircraft) Specific instructions for maintenance of the exclusive use (sole use) shipment controls must be provided by the shipper to the carrier. Such instructions must be included with the shipping paper information

(1) 1,000 millirem per hour at 3 feet from the external surface of the package (closed transport vehicle only),

(2) 200 millirem per hour at any point on the external surface of the car or vehicle (closed transport vehicle only),

(3) Ten millirem per hour at any point 2 meters (six feet) from the vertical planes projected by the outer lateral surface of the car or vehicle, or if the load is transported in an open transport vehicle, at any point 2 meters (six feet) from the vertical planes projected from the outer edges of the vehicle

(4) 2 millirem per hour in any normally occupied position in the car or vehicle, except that this provision does not apply to private motor carriers

(k) [Reserved]

(l) Packages consigned for export are also subject to the regulations of the foreign governments involved in the shipment. See §§ 173.8, 173.9, and 173.393b (The regulations of the International Atomic Energy Agency (IAEA) are used by most foreign governments)

(m) Prior to the first shipment of any package, the shipper shall determine by examination or appropriate test that

(1) The packaging meets the specified quality of design and construction, and

(2) The effectiveness of the shielding and containment, and, where necessary, the heat transfer characteristics of the package are within the limits applicable to or specified for the package design

(n) Prior to each shipment of any package, the shipper shall insure by examination or appropriate test that

(1) The package is proper for the contents to be shipped,

(2) The packaging is in unimpaired physical condition except for superficial marks,

(3) Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects,

(4) For a fissile material, any moderator and neutron absorber, if required, is present in proper condition,

(5) Any special instructions for filling, closing, and preparation of the package for shipment have been followed,

(6) Each closure, valve, and any other opening of the containment system through which the radioactive content might escape is properly closed and sealed,

(7) Each package containing liquid in excess of a Type A quantity and destined for air shipment is tested to demonstrate that it is leak tight under an ambient atmospheric pressure differential of at least 0.5 atmosphere (absolute) (7.3 p.s.i.a. or 0.5 kg/cm²), the test may be conducted on the entire containment system or on any receptacle or vessel within the containment system, as appropriate to determine compliance with the requirement,

(8) If the maximum normal operating pressure of a package is likely to exceed 0.35 kg/cm² (gauge), the internal pressure of the containment system will not exceed the design pressure during transportation, and

(9) External radiation and contamination levels are within the allowable limits

(o) No person may offer for transportation a package of radioactive materials until the temperature of the packaging system has reached equilibrium (see also paragraph (e) of this section) unless, for the specific contents, he has ascertained that the maximum applicable surface temperature limits cannot be exceeded

(p) No person may offer for transportation aboard a passenger carrying aircraft any radioactive material unless that material is intended for use in, or incident to, research, or medical diagnosis or treatment, or is excepted under the provisions of § 175.10 of this subchapter

(q) No person may offer for transportation aboard a passenger-carrying aircraft any single package with a transport index greater than 3.0 nor an overpack with a transport index greater than 3.0

(r) If an overpack is used to consolidate individual packages of radioactive materials, the packages must comply with the packaging, marking, and labeling requirements of this subchapter, and the following conditions must be met

(1) The overpack must be labeled as prescribed in § 172.403 of this subchapter except as follows

(i) The "contents" entry on the label may state "mixed" unless the inside package contains the same radionuclide(s)

(ii) The "number of cures" entry on the label must be determined by adding together the number of cures of the radioactive materials packages contained therein

(iii) For a non-rigid overpack, the required label together with required package markings must be affixed to the overpack by means of a securely attached, durable tag. The transport index must be determined by adding together the transport indexes of the radioactive materials packages contained therein

(iv) For a rigid overpack, the transport index must be determined by—

(A) Adding together the transport indexes of the radioactive materials packages contained in the overpack, or

(B) Except for fissile radioactive materials, direct measurements as prescribed in § 173.389(i)(1) which have been taken by the person initially offering the packages contained within the overpack for shipment

(2) The overpack must be marked as prescribed in Subpart D of Part 172 of this subchapter and § 173.25(a)

(3) The transport index of the overpack may not exceed 3.0 for passenger-carrying aircraft shipments, nor 10.0 for cargo-only aircraft shipments

§ 173.393a U.S. Atomic Energy Commission approved packages; standard requirements and conditions. (a) In addition to the applicable requirements of the USAEC approval and Parts 170–189 of this subchapter, each shipper of a package containing radioactive material, which has been approved by the U.S. Atomic Energy Commission in accordance with § 173.394(b)(3), (c)(2), § 173.395(b)(2), (c)(2), § 173.396(b)(4), or § 173.396(c)(3), also shall comply with the following

(1) Before the first shipment in a package approved by the U.S. Atomic Energy Commission for use by another person, each shipper shall register in writing with the USAEC, Division of Materials Licensing, his name and address, the name of the person to whom the USAEC approval was issued, and the approval number assigned to the package. Each shipper shall have a copy of the USAEC approval and the document referred to in the approval in his possession. Each shipment must be made in compliance with the terms and conditions of the approval

(2) The outside of each package must be durably and legibly marked with the package identification marking indicated in the USAEC approval,

(3) Each shipping paper related to the shipment of this package must bear a notation of the package identification marking indicated in the USAEC approval,

(4) Before the first export shipment of the package, the shipper shall submit a copy of the applicable competent authority certificate applying to that package design to the competent national authority of each country into or through which the package will be transported, unless a copy has already been furnished to this party by another person (Detailed requirements for the issuance and content of competent authority certificates are provided in marginal C-6 of the IAEA "Regulations for the Safe Transport of Radioactive Materials, safety series No. 6, 1967 edition," hereinafter referred to as the "IAEA Regulations." A list of the national competent authorities of each country is published annually by the IAEA.)

(5) Each package of fissile radioactive material must be marked with the numerical value for the transport index if the shipment is fissile class II. Any vehicle limitation indicated in the USAEC approval applies if the shipment is fissile class III, and

(6) For a fissile class III shipment the statement prescribed in § 172.203(d)(1)(vi) of this subchapter must be included with the shipping papers

§ 173.393b International shipments and foreign-made packages; standard requirements and conditions. (a) In addition to the other applicable requirements of Parts 170–189 of this subchapter, each shipper of a package containing radioactive material, for which a foreign competent authority certificate has been issued and revalidated pursuant to the IAEA regulations and § 173.394(b)(4), § 173.394(c)(3), § 173.395(b)(3), § 173.395(c)(3), § 173.396(b)(5), or § 173.396(c)(4), also shall comply with the following

(1) Before the first shipment of the package, each shipper shall register in writing his name and type of package with the Office of Hazardous Materials Regulation, U.S. Department of Transportation, Washington, D.C. 20590. A copy of the foreign certificate or revalidation thereof shall be submitted to that package, unless a copy has already been furnished by another person.

SUBPART J

DETAILED REQUIREMENTS FOR POISONOUS MATERIALS

§ 174.600 **Special handling requirements for Poison A materials.** A tank car containing Poison A may not be transported by rail unless it is originally consigned or subsequently reconsigned to a party having a private track on which it is to be delivered and unloaded (see § 171.8) or to a party using railroad siding facilities which are equipped for piping the liquid or gas from the tank car to permanent storage tanks or sufficient capacity to receive the entire contents of the car.

§ 174.615 **Cleaning cars.** (a) A rail car which has contained arsenic, arsenate of lead, sodium arsenate, calcium arsenate, Paris green, calcium cyanide, potassium cyanide, sodium cyanide or other

poisonous materials which show any evidence of leakage from packages must be thoroughly cleaned after unloading before the car is returned to service.

(b) After poisonous materials are unloaded from a rail car, that car must be thoroughly cleaned unless the car is used exclusively in the carriage of poisonous materials.

§ 174.680 **Poisons with foodstuffs.** A carrier may not transport any package of material bearing a poison label in the same car with material which is marked as or known to be foodstuffs feed or any other edible material intended for consumption by humans or animals.

SUBPART K

DETAILED REQUIREMENTS FOR RADIOACTIVE MATERIALS

§ 174.700 **Special handling requirements for radioactive materials.** (a) Each rail shipment of low specific activity materials as defined in § 173.389(c) of this subchapter must be loaded so as to avoid spillage and scattering of loose material. Loading restrictions are prescribed in § 173.392 of this subchapter.

(b) The number of packages of radioactive materials that may be transported in any rail car or stored at any single location is limited to that number which does not make a total transport index number (as defined in § 173.389(j) of this subchapter, and determined by adding together the transport index numbers on the labels of the individual packages) of more than 50. This provision does not apply to exclusive use shipments as described in §§ 173.389(o) and 173.392, 173.393(j), or 173.396(f).

(c) Each package of radioactive material bearing **RADIOACTIVE YELLOW-II** or **RADIOACTIVE YELLOW-III** labels when being placed in a rail car, depot, or other place may not be placed closer than three feet to an area (or dividing partition between areas) which may be continuously occupied by any passenger, rail employee, or shipment of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked). If more than one package of radioactive materials is present, the distance must be computed from the table below on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom.

Total transport index	Minimum separation distance in feet to nearest undeveloped film ¹	Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of a combination car ²
None	0	0
0.1 to 10.0	15	3
10.1 to 30.0	22	4
30.1 to 200.0	29	5
30.1 to 40.0	33	6
40.1 to 50.0	36	7

¹ In feet to nearest undeveloped film.

² In feet to area of persons or minimum distance in feet from dividing partition of a combination car.

Note.—The distance in the table must be measured from the nearest point on the packages of radioactive materials.

(d) Each fissile Class III radioactive material shipment (as defined in § 173.389(a)(3) of this subchapter) must be transported in accordance with one of the methods prescribed in § 173.396(g) of this subchapter. The transport controls must be adequate to assure that no fissile Class III shipment is transported in the same rail car with any other fissile radioactive material shipment. In loading and storage areas each fissile Class III shipment must be segregated by a distance of at least 20 feet from other packages required to bear one of the "radioactive" labels described in Part 172 of this subchapter.

(e) A flatcar may be used to transport radioactive materials in a

container weighing 15 000 pounds or more. A gondola car (other than a drop bottom car) may be used to transport any of the following:

(1) Radioactive materials in containers weighing 5 000 pounds or more,

(2) Strong wooden boxes with inside containers of solid radioactive material, securely braced and cushioned, or

(3) Radioactive material in concrete-filled metal drums or in concrete vaults weighing 700 pounds or more.

(f) A person may not remain unnecessarily in a rail car containing radioactive materials.

§ 174.715 **Cleanliness of cars after use.** (a) Each transport vehicle used for transporting radioactive materials as exclusive use as defined in § 173.389(e), must be surveyed with appropriate radiation detection instruments after each use. A vehicle may not be returned to service until the radiation dose rate at any accessible surface is 0.5 millirem per hour or less, and there is no significant removable radioactive surface contamination, as defined in paragraph (a) of this section.

(b) This section does not apply to any rail car used solely for transporting radioactive materials if a survey of the interior surface of the car shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. The car must be stenciled with the words "**FOR RADIOACTIVE MATERIALS USE ONLY**" in lettering at least 3 inches high in a conspicuous place on both sides of the exterior of the car and it must be kept closed at all times other than during loading and unloading.

§ 174.750 **Incidents involving leakage.** (a) In addition to the incident reporting requirements of §§ 171.15 and 171.16 of this subchapter, the carrier shall also notify the shipper at the earliest practicable amount following any incident in which there has been breakage, spillage, or suspected radioactive contamination involving radioactive materials shipments. Vehicles, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.397 of this subchapter).

(b) The package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the Energy Research and Development Administration (ERDA) should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions, from qualified persons. Information involving the handling of radioactive materials in the event of a wreck may be found in Bureau of Explosives Pamphlet No. 1 and No. 2.

supports having clamps or securing bands capable of holding the cylinders upright when they are subjected to an acceleration of at least 2 "g" in any horizontal direction

The combined total of the hydrogen venting rates as marked on the cylinders on one motor vehicle must not exceed 60 standard cubic feet per hour

- (ii) Motor vehicles loaded with cylinders containing liquefied hydrogen may not be driven through tunnels
- (iii) Highway transportation is limited to private and contract motor carriers only and to direct movement from point of origin to destination

(b) Portable tank containers containing compressed gases shall be loaded on motor vehicles only as follows

- (1) Onto a flat floor or platform of a motor vehicle
- (2) Onto a suitable frame of a motor vehicle

(3) In either such case, such containers shall be safely and securely blocked or held down to prevent movement relative to each other or to the supporting structure when in transit, particularly during sudden starts and stops and changes of direction of the vehicle

(4) Requirements of subparagraphs (1) and (2) of this paragraph shall not be construed as prohibiting stacking of containers provided the provisions of subparagraph (3) of this paragraph are fully complied with

(c) [Reserved]

(d) **Engine to be stopped in tank motor vehicles, except for transfer pump.** No flammable compressed gas shall be loaded into or on or unloaded from any tank motor vehicle with the engine running unless the engine is used for the operation of the transfer pump of the vehicle. Unless the delivery hose is equipped with a shut-off valve at its discharge end, the engine of the motor vehicle shall be stopped at the finish of such loading or unloading operation while the filling or discharge connections are disconnected

(e) Chlorine cargo tanks shall be shipped only when equipped (1) with a gas mask of a type approved by the U.S. Bureau of Mines for chlorine service, (2) with an emergency kit for controlling leaks in fittings on the dome cover plate

(f) No chlorine tank motor vehicle used for transportation of chlorine shall be moved coupled or uncoupled, when any loading or unloading connections are attached to the vehicle nor shall any semi-trailer or trailer be left without the power unit unless such semi-trailer or trailer be checked or equivalent means be provided to prevent motion

(g) Each liquid discharge valve on a cargo tank, other than an engine fuel line valve, must be closed during transportation except during loading and unloading

§ 177.841 Poisons. (See also § 177.834(a) to (k))

(a) **Arsenical compounds in bulk.** Care shall be exercised in the loading and unloading of "arsenical dust", "arsenic trioxide", and "sodium arsenate", allowable to be loaded into sift-proof, steel hopper-type or dump-type motor-vehicle bodies equipped with water-proof, dust-proof covers well secured in place on all openings, to accomplish such loading with the minimum spread of such compounds into the atmosphere by all means that are practicable, and no such loading or unloading shall be done near or adjacent to any place where there are or are likely to be, during the loading or unloading process assemblages of persons other than those engaged in the loading or unloading process, or upon any public highway or in any public place

(1) The motor vehicles must be marked in accordance with § 173.368(b) of this chapter

(2) Before any motor vehicle may be used for transporting any other articles, all detectable traces of arsenical materials must be removed therefrom by flushing with water, or by other appropriate method, and the marking removed

(b) No Class A or irritating materials in cargo tanks. No poison, Class A, or irritating material may be loaded into or transported in any cargo tank

(c) **Class A poisons or irritating materials.** The transportation of a Class A poison or an irritating material is not permitted if there is any interconnection between packagings

(d) **Poisons in cargo tanks.** A person shall not drive a tank motor vehicle and a motor carrier shall not require or permit a person to drive a tank motor vehicle containing poisons (regardless of quantity) unless—

(1) All manhole closures on the cargo tank are closed and secured,

(2) All valves and other closures in liquid discharge systems are closed and free of leaks

(e) A carrier may not transport a package bearing a poison label in the same transport vehicle with material that is marked as or known to be foodstuff feed or any other edible material intended for consumption by humans or animals

§ 177.842 **Radioactive material.** (a) The number of packages of radioactive materials in any motor vehicle, trailer, or storage location must be limited so that the total transport index number, as defined in § 173.389(i) of this subchapter and determined by adding together the transport index numbers on the labels of the individual packages, does not exceed 50. This provision does not apply to exclusive use shipments described in §§ 173.393(j), 173.396(f), or 173.392 of this subchapter

(b) Packages of radioactive material bearing "radioactive yellow" or "radioactive yellow-III" labels must not be placed in a motor vehicle or in any other place closer than the distances shown in the following table to any area which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than the distances shown in the table below to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) or packages in the vehicle or storeroom. Where more than one group of packages is present in any single storage location, a single group may not have a total transport index greater than 50. Each group of packages must be handled and stowed not closer than 6 meters (20 feet) (measured edge to edge) to any other group

(c) Shipments of low specific activity materials, as defined in § 173.391 of this subchapter, must be loaded so as to avoid spillage and scattering of loose materials. Loading restrictions are set forth in § 173.397 of this subchapter

(d) Packages must be so blocked and braced that they cannot change position during conditions normally incident to transportation

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartments
	Up to 2 hours	2-4 hours	4-8 hours	8-12 hours	Over 12 hours	
None	0	0	0	0	0	0
0.1 to 1.0	1	2	3	4	5	1
1.1 to 5.0	3	4	6	8	11	2
5.1 to 10.0	4	6	9	11	15	3
10.1 to 20.0	5	8	12	16	22	4
20.1 to 30.0	7	10	15	20	29	5
30.1 to 40.0	8	11	17	22	33	6
40.1 to 50.0	9	12	19	24	36	7

Note 1. The distance in the table must be measured from the nearest point on the packages of radioactive materials

(e) Persons should not remain unnecessarily in a vehicle containing radioactive materials

(f) Each fissile class III radioactive material shipment (as defined in § 173.389(a)(3) of this subchapter) must be transported in accordance with one of the methods prescribed in § 173.396(g) of this subchapter. The transport controls must be adequate to assure that no fissile class III shipment is transported in the same transport vehicle with any other fissile radioactive material shipment. In loading and storage areas each fissile class III shipment must be segregated by a distance of at least 20 feet from other packages required to bear one of the "Radioactive" labels described in § 173.416 of this subchapter

§ 177.843 **Contamination of vehicles.** (a) Each motor vehicle used for transporting low specific activity radioactive materials in truckload lots under the provisions of § 173.392(d) of this subchapter must be surveyed with appropriate radiation detection instruments after each use. Carriers must not return such vehicles to service until the radiation dose rate at any accessible surface is not more than 0.5 millirem per hour, and there is no significant removable radioactive surface contamination (see § 173.399 of this subchapter)

(b) This section does not apply to any vehicle used solely for transporting radioactive material if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These vehicles must be stenciled with the words "For Radioactive Materials Use Only" in lettering at least 3 inches high in a conspicuous place, on both sides of the exterior of the vehicle. These vehicles must be kept closed at all times other than loading and unloading

(c) In case of fire, accident, breakage, or unusual delay involving shipments of radioactive material, see § 177.861

§ 177.844 **Other regulated materials.** Asbestos must be handled, and unloaded, and any asbestos contamination of transport vehicles removed in a manner that will minimize occupational exposure to airborne asbestos particles released incident to transportation (See § 173.1090 of this subchapter)

APPENDIX C
CONRAIL TARIFF CR4426-B

The provisions published herein will, if effective, not result in an effect on the quality of the human environment.
No change in Rates, except as indicated by Reference Mark "•".
Subject (except as otherwise provided) to ICC TEA 9000 and ICC TEA RCCR X082, supplements thereto or successive issues thereof

CTPUC CR 4426-B
ILL CC 97
INRC CR 4426-B
MDPSC CR 4426-B
MDPU CR 4426-B

MDOT CR 4426-B
NJDOT CR 4426-B
NYDOT CR 4426-B
OHPUC CR 4426-B

ICC CR 4426-B
PAPUC CR 4426-B
RIPUC CR 4426-B
VCC CR 4426-B
PSC-WVA CR 4426-B

(see Page 2 for Cancellations)

Consolidated Rail Corporation

FREIGHT TARIFF CR 4426-B

(See Page 2 for Cancellation)

LOCAL AND PROPORTIONAL FREIGHT TARIFF
ON
RADIOACTIVE MATERIALS
AND
RADIOACTIVE MATERIAL SHIPPING CASKS OR CONTAINERS
AS DESCRIBED HEREIN
CARLOADS

FROM STATIONS ON

TO STATIONS ON

CONSOLIDATED RAIL CORPORATION

CONSOLIDATED RAIL CORPORATION

IN THE STATES OF:

CONNECTICUT
DELAWARE
DISTRICT OF
COLUMBIA
ILLINOIS

INDIANA
KENTUCKY
MARYLAND
MASSACHUSETTS
MICHIGAN

MISSOURI
NEW JERSEY
NEW YORK
OHIO

PENNSYLVANIA
RHODE ISLAND
VIRGINIA
WEST VIRGINIA

— VIA —

CONSOLIDATED RAIL CORPORATION DIRECT

INTRASTATE APPLICATION OF TARIFF

This Tariff also applies on Intrastate Traffic in the States of:

CONNECTICUT
DELAWARE
DISTRICT OF
COLUMBIA

ILLINOIS
INDIANA
MARYLAND
MASSACHUSETTS

MICHIGAN
NEW JERSEY
NEW YORK
OHIO

PENNSYLVANIA
RHODE ISLAND
VIRGINIA
WEST VIRGINIA

RADIOACTIVE MATERIALS TARIFF

Governed, except as otherwise provided herein, by Uniform Classification, and by Exceptions to said Classification. (See Item 5).

ISSUED: FEBRUARY 2, 1982

EFFECTIVE: FEBRUARY 25, 1982

This publication filed on less than 20 days' notice under authority of Section 10762 of the Interstate Commerce Act.

Issued by:
H.A. TRAUTMANN, Jr.
Manager - Tariff Publications
30th Street Station Building
Philadelphia, Pa. 19104

Reduction

FREIGHT TARIFF CR 4426-B

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CANCELLATION NOTICE

This Tariff cancels the following Consolidated Rail Corporation Tariff in full:

ICC AND TARIFF	CTPUC	ILL CC	INRC	MDPSC	MDPU	MDOT	NJDOT	NYDOT	OHPUC	PAPUC	RIPUC	VCC	PSC- WVA
CR	CR		CR	CR	CR	CR	CR	CR	CR	CR	CR	CR	CR
4426-A	4426-A	88	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A	4426-A

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RULES AND OTHER GOVERNING PROVISIONS

GENERAL RULES AND REGULATIONS

ITEM	SUBJECT	APPLICATION
5	DESCRIPTION OF GOVERNING CLASSIFICATION AND EXCEPTIONS.	<p>The terms "Uniform Classification" and "Exceptions to Uniform Classification" when used herein, mean respectively</p> <p>ICC UFC 6000 SERIES.</p> <p>Exceptions to Uniform Classification, ICC TEA 2009-Series.</p>
10	STATION LIST AND CONDITIONS . . .	<p>This tariff is governed by ICC OPSL 6000 Series, to the extent shown below</p> <p>PREPAY REQUIREMENTS AND STATION CONDITIONS</p> <p>(a) For additions and abandonments of stations and except as otherwise shown herein, for prepay requirements, changes in names of stations, restrictions as to acceptance or delivery of freight, and changes in station facilities</p> <p>When a station is abandoned as of a date specified in the above named tariff, the rates from and to such station as published in this tariff are unapplicable on and after that date.</p> <p>GEOGRAPHICAL LIST OF STATIONS</p> <p>(b) For geographical locations of stations referred to in this tariff by station numbers.</p> <p>STATION NUMBERS</p> <p>(c) For the identification of stations when stations are shown or referred to by numbers in this tariff.</p>
20	REFERENCE TO TARIFFS, ITEMS, NOTES, RULES, ETC	<p>(a) Where reference is made in this tariff to tariffs, items, notes, rules, etc., such references are continuous and include supplements to and successive issues of such tariffs and reissues of such items, notes, rules, etc.</p> <p>(b) Where reference is made in this tariff to another tariff by ICC number, such reference applies also to such tariff to the extent it may be applicable on intrastate traffic</p>
25	TERMINAL OR TRANSIT PRIVILEGES OR SERVICES. . . .	<p>Shipments made under the rates contained in this tariff are not entitled to terminal and transit services and privileges.</p>
40	CONSECUTIVE NUMBERS	<p>Where consecutive numbers are represented in this tariff by the first and last numbers connected by the word "to" or a hyphen, they will be understood to include both of the number shown.</p> <p>If the first number only bears a reference mark, such reference mark also applies to the last number shown and to all numbers between the first and last number.</p>
45	CAPACITIES AND DIMENSIONS OF CARS.	<p>For marked capacities, lengths, dimensions and cubical capacities of cars, see ICC RER 6410 Series</p> <p>Cars may not be loaded in excess of the load limit.</p>
60	NATIONAL SERVICE ORDER TARIFF. . . .	<p>This tariff is subject to provisions of various Interstate Commerce Commission Service Orders and General Permits as shown in ICC NSO 6100 Series</p>
75	METHOD OF CANCELLING ITEMS	<p>As this tariff is supplemented, numbered items with letter suffixes cancel correspondingly numbered items in the original tariff or in a prior supplement. Letter suffixes will be used in alphabetical sequence starting with A.</p> <p>EXAMPLE;--Item 445-A cancels Item 445, and Item 365-B cancels Item 365-A in a prior supplement, which, in turn, cancelled Item 365.</p>
100	METHOD OF DENOTING REISSUED MATTER IN SUPPLEMENTS.	<p>Matter brought forward without change from one supplement to another, will be designated as "Reissued" by a reference mark in the form of a square enclosing a number, the number being that of the supplement in which the reissued matter first appeared in its currently effective form. To determine its original effective date, consult the supplement in which the reissued matter first became effective.</p>

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS - UNLIMITED

ITEM	SUBJECT	APPLICATION
200	APPLICATION OF SURCHARGES. . .	<p>The rates and charges named in this tariff, as amended, are to be increased for the account of any individual carrier to the extent provided in any applicable surcharge tariff issued by such individual carrier and lawfully on file with the Interstate Commerce Commission.</p> <p>To determine the surcharge to be assessed, consult the applicable surcharge tariff separately published by such individual carrier.</p> <p>Rule 1300.4 (i) of 49 CFR 1300.0 waived; ICC Special Tariff Authority No. 81-4908 of June 16, 1981.</p>
205	RULE 24 EXCEPTIONS, WAIVER OF TARIFF PUBLISHING RULES .	Where items or other provisions in this tariff now provide that rates are not subject to the provisions of Rule 24 of the Uniform Freight Classification, as described in Item 5, such rates will not be subject to "Exceptions to Rule 24" of Uniform Freight Classification, as described in Item 5.
210	RULES, REGULATIONS AND PACKING REQUIREMENTS. . .	The commodities for which carload rates are provided for in this tariff, will be subject to all rules, regulations and packing requirements of the Governing Classification and Exceptions thereto, as named in Item 5, unless otherwise specifically provided herein.
215	PACKAGING, LABELING, AND PLACARDING OF SHIPMENTS . . .	<p>Shipments must be packaged, labelled, and placarded in accordance with Title 49, Code of Federal Regulations, Parts 171-179 inclusive, of Bureau of Explosives Tariff No. ICC BOE-6000 Series, supplements thereto or successive issues thereof.</p> <p>This item supersedes any packing requirements of Item 210 of this Tariff.</p>
220	SHIPPING PAPERS.	Shipments must be described in accordance with regulations contained in Title 49, Code of Federal Regulations, Part 172. Commodity shall also be described as listed in Items 270-305 of this tariff for proper application of freight rates.
225	49 SERIES STANDARD TRANSPORTATION COMMODITY CODE (STCC) . .	The appropriate 49-series Standard Transportation Commodity Code from Section 3 of Standard Transportation Commodity Code Tariff ICC STCC 6001-Series, supplements thereto, or successive issues thereof, must be shown on the bill of lading.
230	LIABILITY.	<p>Shipments to which this tariff applies will not be received for transportation unless the shipper executes an agreement, endorsed upon or attached to the bill of lading in the following form: "In partial consideration for carrier's acceptance of this shipment for transportation, shipper agrees that the declared value of the property does not exceed 40 cents per pound and that carrier shall not be liable for loss of or damage to the property in excess of said amount" . .</p> <p>Shipments of irradiated fuel elements and radioactive waste material will not be received for transportation unless the shipper executes a certificate, endorsed upon or attached to the bill of lading, reading as follows: "This is to certify that the articles named within or in the attached bill of lading are properly described, and are packed, marked and in proper condition for transportation according to the regulations prescribed by the U.S. Department of Transportation.</p> <p>The shipper is making the shipment described in such bill of lading (1) as contractor or licensee of the Nuclear Regulatory Commission under the provisions of the Atomic Energy Act of 1954, as amended by the "Price-Anderson Act", Public Law 85-256, as amended or (2) to such contractor or licensee;</p> <p>that there is now in full force and effect a contract between such contractor or licensee and such Commission under such Act, indemnifying such contractor or licensee and the carrier or carriers handling this shipment against public liability as defined in such Act, and (1) that there are no monetary, exclusions or limitations in such contract of indemnity, except as stated in such Act, or (2) that there is in full force and effect a policy or policies of insurance issued by an insurance company or companies licensed to do business in the State of New York or other adequate financial protection as provided by regulations of such Commission in an amount equal to that provided under such Act and regulations thereunder holding the carrier or carriers handling such shipment free and harmless of and from all public liability".</p> <p>If shipper fails or is unable to execute and furnish the above certificate the Consolidated Rail Corporation does not hold itself out as a common carrier to transport shipments of irradiated fuel elements and radioactive waste material.</p>

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS

UNLIMITED

ITEM	SUBJECT	APPLICATION
240	EQUIPMENT SUPPLY.	Furnishing of Nuclear Regulatory Commission licensed casks, or cask cars, or tank cars shall be the responsibility of the shipper. Originating carrier shall be responsible for furnishing box cars or gondolas.
245	MILEAGE ALLOWANCES	Applicable mileage allowances under Tariff ICC PHJ 6007 Series will be paid.
250	MOVEMENT OF SHIPMENTS IN SPECIAL TRAIN SERVICE	If shipper requests movement of commodities in special train service, special train charges published in CR Tariff ICC CR 9500 Series, supplements thereto, or successive issues thereof, will be assessed. These special train charges will be in addition to rates published in this tariff.
255	PHYSICAL SECURITY.	Any physical security provided, either in compliance with NPC or DOT regulations, or at the request of the shipper, shall be at the expense of the shipper. It is not included in the rates.
260	ATTENDANTS	Any attendants accompanying the shipment; either as physical security or technical personnel, will be transported in accordance with charges published in Tariff ICC WTL 9001-Series, supplements thereto, or successive issues thereof.
265	ROUTING OF SHIPMENTS	Routing between Consolidated Rail Corporation stations or interchanges, shall be determined by Consolidated Rail Corporation. Any specific Consolidated Rail Corporation internal routing requested by shipper, either voluntarily or to comply with regulations of a local, county, state or federal government agency will cause the shipment to be billed at rates for the actual operating miles between intermediate stations for the routes utilized. These mileages are published in Conrail Tariff ICC CR 9516-Series.

SPECIAL RULES AND REGULATIONS

APPLICATION OF RATES

ITEM	COMMODITY	APPLICATION
270	Fuel elements, nuclear reactor, irradiated and requiring protective shielding, or irradiated parts or constituents - shipped in General Electric cask car (STCC 28 197 10)	Apply Table "A"
275	- shipped in NLI cask car (STCC 28 197 10)	Apply Table "B"

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS

APPLICATION OF RATES

ITEM	COMMODITY	APPLICATION
280	Casks, radioactive material, shipping, steel and lead or steel and uranium metal combined, empty General Electric IF 300 Cask, empty (STCC 34 919 40)	Apply Table "A"
285	NLI 10/24 Cask, empty (STCC 34 919 40)	Apply Table "B"
290	Containers, radioactive material, shipping, steel and lead or steel and uranium metal combined, empty - shipped in gondola cars (STCC 34 919 40)	Apply Table "D"
295	Radioactive material or radioactive waste, low specific activity, having no reclamation value, in drums or packages - shipped in box cars (STCC 40 251 33)	Apply Table "C"
* 300	Radioactive waste, low specific activity, having no reclamation value - shipped in gondola cars - shipped in flat cars (STCC 40 251 33)	Apply Table "D"
305	Radioactive waste, low specific activity, liquid, having no reclamation value - shipped in bulk, in tank cars (STCC 40 251 33)	Apply Table "E"
310	Fuel elements, nuclear reactor, irradiated and requiring protective shielding, or irradiated parts or constituents, in containers, shipped on a Government-owned DODX depressed center flat car. (STCC 28 197 10)	Apply Table "F"
315	Casks or containers, radioactive material shipping, empty, permanently mounted or shipped on a Government-owned DODX depressed center flat car. (STCC 34 919 40)	Apply Table "G"
320	Irradiated components, shipped on Government-owned DODX flat cars. (STCC 28 197 10)	Apply Table "H"
325	<p>(Applicable only when specific reference is made to this item)</p> <p>Rates will only apply on shipments moving between stations served by Consolidated Rail Corporation.</p> <p>To determine a rate from a given origin to a given destination, find the Rate Basis Number applicable from point of origin to point of destination in ICC TEA 1009 Series or ICC WTL 1002 Series, disregarding the letter suffix, if any, and then apply the rate provided for that Rate Basis Number in Tables "A", "B", "C", "D", "E", "F", "G", or "H", of this tariff.</p> <p>The rates published herein, from or to points for which Rate Basis Numbers are provided in tariffs, shown above, will also apply from or to points taking same rates as shown in ICC NRB 6000 Series.</p>	

* - Reduction.

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RATE TABLE "A"

COMMODITIES AS DESCRIBED IN ITEMS 270 AND 280

(1) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS					RATE BASIS				
CARLOAD MINIMUM WEIGHT					CARLOAD MINIMUM WEIGHT				
NOT OVER	144,000 Pounds	160,000 Pounds	170,000 Pounds	180,000 Pounds	NOT OVER	144,000 Pounds	160,000 Pounds	170,000 Pounds	180,000 Pounds
20	31	28	27	26	1020	241	229	224	217
40	35	32	31	30	1040	245	233	227	222
60	39	36	35	33	1060	249	237	231	226
80	44	40	38	37	1080	253	242	235	229
100	48	45	43	40	1100	258	246	239	233
120	52	48	47	46	1120	262	249	243	236
140	56	52	50	49	1140	266	253	247	241
160	61	56	54	52	1160	271	258	250	245
180	65	61	59	56	1180	275	262	255	248
200	69	64	62	60	1200	279	265	259	252
220	72	68	66	64	1220	283	269	262	256
240	77	72	70	68	1240	288	274	266	260
260	81	77	73	71	1260	292	278	271	264
280	85	81	78	76	1280	296	282	275	267
300	89	84	82	79	1300	300	285	278	272
320	94	88	85	83	1320	305	290	282	275
340	98	93	89	87	1340	309	294	286	279
360	102	97	94	91	1360	313	298	290	283
380	107	101	98	95	1380	317	301	294	286
400	111	104	101	99	1400	322	306	298	291
420	115	109	105	102	1420	325	310	301	295
440	119	113	110	107	1440	329	314	306	298
460	124	117	113	110	1460	333	318	310	302
480	128	120	117	114	1480	338	322	313	306
500	132	125	121	118	1500	342	326	317	310
520	136	129	125	121	1520	346	330	322	314
540	141	133	129	126	1540	350	334	325	317
560	145	137	133	129	1560	355	338	329	322
580	149	141	136	133	1580	359	342	333	325
600	153	145	141	137	1600	363	346	338	329
620	157	149	145	141	1620	367	350	341	333
640	161	153	148	145	1640	372	355	345	337
660	165	157	152	148	1660	376	358	349	341
680	169	161	157	152	1680	380	362	353	349
700	174	165	161	157	1700	384	366	357	348
720	178	169	164	160	1720	389	371	361	353
740	182	174	168	164	1740	393	374	364	356
760	186	177	173	167	1760	397	378	368	360
780	191	181	176	171	1780	402	382	373	363
800	195	185	180	176	1800	406	387	376	367
820	199	190	184	179	1820	409	391	380	372
840	203	193	187	183	1840	413	394	384	375
860	208	197	192	186	1860	417	398	388	379
880	212	201	196	191	1880	422	403	392	382
900	216	206	199	195	1900	426	407	396	387
920	220	210	203	198	1920	430	410	400	391
940	225	213	208	202	1940	435	414	404	394
960	229	217	211	207	1960	439	419	408	398
980	233	222	215	210	1980	443	423	412	403
1000	237	226	219	214	2000	447	427	415	406

(1) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RATE TABLE "B"

COMMODITIES AS DESCRIBED IN ITEMS 275 AND 285

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS				CARLOAD MINIMUM WEIGHT				RATE BASIS				CARLOAD MINIMUM WEIGHT			
NOT OVER				200,000 Pounds	210,000 Pounds	220,000 Pounds		NOT OVER				200,000 Pounds	210,000 Pounds	220,000 Pounds	
20	20	20	19					1020	208	202	198				
40	24	23	22					1040	211	206	201				
60	28	27	27					1060	215	210	204				
80	32	31	30					1080	218	213	209				
100	35	34	33					1100	223	217	212				
120	39	38	37					1120	226	220	215				
140	43	42	40					1140	230	224	219				
160	47	46	44					1160	233	228	223				
180	50	49	48					1180	237	231	226				
200	54	52	51					1200	241	235	230				
220	58	56	54					1220	245	239	233				
240	62	60	59					1240	248	243	237				
260	65	64	62					1260	252	246	241				
280	69	67	65					1280	256	249	244				
300	72	71	69					1300	260	253	248				
320	77	75	72					1320	263	257	251				
340	80	78	77					1340	267	261	255				
360	84	82	80					1360	271	264	259				
380	87	85	83					1380	275	268	262				
400	92	89	87					1400	278	272	265				
420	95	93	91					1420	282	275	269				
440	99	97	94					1440	285	279	273				
460	102	100	98					1460	290	282	276				
480	107	103	101					1480	293	286	280				
500	110	108	104					1500	297	290	283				
520	114	111	109					1520	300	294	288				
540	117	115	112					1540	305	297	291				
560	121	118	115					1560	308	300	294				
580	125	122	119					1580	312	305	298				
600	129	126	122					1600	315	308	301				
620	132	129	127					1620	320	312	305				
640	136	133	130					1640	323	315	309				
660	140	136	133					1660	327	320	312				
680	144	141	137					1680	330	323	315				
700	147	144	141					1700	334	326	320				
720	151	147	144					1720	338	330	323				
740	154	151	148					1740	342	333	326				
760	159	154	151					1760	345	338	330				
780	162	159	154					1780	349	341	333				
800	166	162	159					1800	353	344	338				
820	169	166	162					1820	357	348	341				
840	174	169	165					1840	360	351	344				
860	177	173	169					1860	364	356	348				
880	181	177	173					1880	367	359	351				
900	185	180	177					1900	372	363	355				
920	189	184	180					1920	375	366	359				
940	193	187	183					1940	379	370	362				
960	196	192	187					1960	382	374	365				
980	200	195	191					1980	387	377	370				
1000	203	198	194					2000	390	381	373				

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For Explanation of Abbreviations, see concluding page of this Tariff.

FREIGHT TARIFF CR 4426-B

RATE TABLE "C"

COMMODITIES AS DESCRIBED IN ITEM 295

(I) RATES IN CENTS PER 100 POUNDS (SEE Item 325)

RATE BASIS						RATE BASIS					
CARLOAD MINIMUM WEIGHT						CARLOAD MINIMUM WEIGHT					
NOT OVER	60,000 Pounds	80,000 Pounds	100,000 Pounds	120,000 Pounds	140,000 Pounds	NOT OVER	60,000 Pounds	80,000 Pounds	100,000 Pounds	120,000 Pounds	140,000 Pounds
20	209	158	128	108	93	1020	1105	878	741	650	585
40	226	173	140	118	103	1040	1124	892	753	660	594
60	244	186	152	129	113	1060	1142	906	766	672	605
80	262	201	164	140	122	1080	1159	921	777	683	615
100	280	215	177	151	132	1100	1177	935	790	693	624
120	298	230	189	162	143	1120	1195	950	802	704	634
140	316	244	201	173	152	1140	1213	964	815	715	644
160	334	259	213	183	162	1160	1231	979	826	726	654
180	351	273	226	194	171	1180	1249	993	839	737	663
200	370	288	237	206	181	1200	1266	1007	851	748	673
220	388	301	250	216	192	1220	1284	1021	864	758	684
240	406	316	263	227	201	1240	1302	1036	875	769	693
260	424	330	275	237	211	1260	1321	1050	888	781	703
280	442	345	288	248	230	1280	1339	1065	901	791	712
300	459	359	299	260	231	1300	1357	1079	913	802	722
320	477	374	312	271	241	1320	1375	1094	925	813	733
340	495	388	324	281	250	1340	1391	1108	937	823	742
360	513	403	337	292	260	1360	1410	1123	950	834	752
380	531	417	348	302	271	1380	1428	1136	962	846	761
400	550	431	361	313	280	1400	1446	1151	974	856	772
420	567	446	373	325	290	1420	1464	1165	986	867	782
440	585	460	386	335	299	1440	1482	1180	999	878	791
460	603	475	397	346	310	1460	1500	1194	1011	888	801
480	621	489	410	357	320	1480	1518	1209	1023	900	812
500	639	504	422	367	329	1500	1536	1223	1035	911	821
520	657	518	435	379	339	1520	1554	1238	995	921	831
540	675	533	446	390	348	1540	1572	1251	1060	932	840
560	692	546	459	400	359	1560	1590	1266	1072	943	851
580	710	561	471	411	368	1580	1607	1280	1084	954	861
600	728	575	484	422	378	1600	1625	1295	1097	965	870
620	747	590	495	433	388	1620	1643	1310	1109	976	880
640	765	604	508	444	398	1640	1661	1324	1121	986	890
660	783	619	520	455	408	1660	1680	1339	1133	997	900
680	800	633	533	465	417	1680	1698	1353	1146	1007	910
700	818	648	544	476	427	1700	1716	1367	1158	1019	919
720	836	661	557	487	438	1720	1733	1381	1170	1030	929
740	854	676	570	498	447	1740	1751	1396	1182	1041	939
760	872	690	581	509	457	1760	1769	1410	1195	1051	949
780	890	705	594	520	466	1780	1787	1425	1207	1062	959
800	908	719	606	530	477	1800	1805	1439	1219	1074	968
820	925	734	619	541	487	1820	1823	1454	1232	1084	979
840	944	748	630	553	496	1840	1840	1468	1244	1095	988
860	962	763	643	563	506	1860	1858	1482	1257	1105	998
880	980	776	655	574	517	1880	1877	1496	1268	1116	1007
900	998	791	668	585	526	1900	1895	1511	1281	1128	1018
920	1016	805	679	595	536	1920	1913	1525	1293	1138	1028
940	1033	820	692	607	545	1940	1931	1540	1306	1149	1037
960	1051	834	704	618	555	1960	1949	1554	1317	1160	1047
980	1069	849	717	628	566	1980	1966	1569	1330	1170	1058
1000	1087	864	728	639	575	2000	1984	1583	1342	1181	1067

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For Explanation of Abbreviations, see concluding page of this Tariff.

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RATE TABLE "D" *

COMMODITIES AS DESCRIBED IN ITEMS 290 AND 300

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS		CARLOAD MINIMUM WEIGHT					RATE BASIS		CARLOAD MINIMUM WEIGHT				
(NOT OVER MILES)	100,000 Pounds	120,000 Pounds	140,000 Pounds	160,000 Pounds	180,000 Pounds		NOT OVER		100,000 Pounds	120,000 Pounds	140,000 Pounds	160,000 Pounds	180,000 Pounds
20	126	105	92	81	72		1020		803	702	629	575	534
40	138	117	102	91	82		1040		817	714	640	586	542
→ 60	152	129	113	100	91		1060		830	725	651	595	552
80	166	142	124	111	100		1080		843	738	661	605	561
100	179	153	134	120	110		1100		857	750	673	615	570
120	193	165	145	130	118		1120		871	761	684	625	579
140	207	177	155	141	128		1140		873	773	694	635	589
160	220	189	167	150	137		1160		898	785	705	644	597
180	233	201	178	160	146		1180		912	798	716	655	607
200	247	213	189	169	155		1200		919	809	726	665	617
220	261	225	199	180	165		1220		938	821	737	674	625
240	275	236	210	190	174		1240		952	833	748	684	635
260	288	248	220	199	183		1260		966	845	758	694	644
280	301	261	231	210	193		1280		979	857	770	704	653
300	315	273	242	219	201		1300		993	869	781	714	662
320	328	284	252	229	211		1320		1006	881	791	724	672
340	342	296	264	240	220		1340		1019	892	802	734	681
360	356	308	275	249	229		1360		1033	904	813	743	690
380	370	321	285	260	239		1380		1047	917	823	754	700
400	382	332	296	268	248		1400		1061	929	834	764	708
420	396	344	307	279	257		1420		1074	940	845	773	718
440	410	356	317	289	268		1440		1087	952	855	783	726
460	424	367	328	298	276		1460		1101	964	867	793	736
480	437	380	339	309	284		1480		1115	977	878	803	746
500	450	392	349	318	294		1500		1128	988	888	813	754
520	464	404	360	328	302		1520		1142	1000	899	823	764
540	477	415	372	338	312		1540		1156	1012	910	833	773
560	491	427	382	348	322		1560		1168	1023	920	842	782
580	505	440	393	358	330		1580		1182	1036	931	852	791
600	519	452	404	367	340		1600		1196	1048	941	863	801
620	531	463	414	378	349		1620		1240	1060	952	872	809
640	545	475	425	388	358		1640		1233	1071	963	882	819
660	559	487	436	397	367		1660		1236	1083	974	892	829
680	573	499	446	407	377		1680		1250	1096	985	902	837
700	586	511	457	417	386		1700		1264	1108	996	912	847
720	600	523	469	427	395		1720		1277	1119	1006	921	856
740	613	535	479	437	405		1740		1291	1131	1017	932	865
760	626	546	490	447	413		1760		1205	1143	1006	941	885
780	640	559	501	457	423		1780		1317	1102	1038	951	884
800	654	571	511	466	432		1800		1331	1167	996	962	892
820	668	583	522	476	441		1820		1345	1179	1060	971	902
840	681	594	533	487	450		1840		1359	1191	1071	981	912
860	694	606	543	496	460		1860		1372	1202	1082	990	920
880	708	619	554	506	469		1880		1386	1214	1093	1001	930
900	722	630	566	517	478		1900		1398	1227	1103	1011	949
920	735	642	576	526	488		1920		1413	1239	1114	1020	948
940	749	654	587	536	496		1940		1426	1250	1125	1031	957
960	763	666	597	545	506		1960		1440	1262	1135	1041	966
980	775	678	608	556	514		1980		1454	1274	1146	1050	976
1000	789	690	619	566	524		2000		1467	1287	1157	1060	985

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* + 4.7% INCR EFF 1/1/82 THRU 1/1/83

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RATE TABLE "E"

COMMODITIES AS DESCRIBED IN ITEM 305

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS		CARLOAD MINIMUM WEIGHT		RATE BASIS		CARLOAD MINIMUM WEIGHT	
NOT OVER	160,000 Pounds	180,000 Pounds	NOT OVER	160,000 Pounds	180,000 Pounds		
20	59	52	1020	730	671		
40	71	65	1040	743	684		
60	85	78	1060	756	695		
80	99	89	1080	770	708		
100	112	102	1100	784	720		
120	126	115	1120	797	733		
140	138	127	1140	810	746		
160	152	140	1160	823	757		
180	166	151	1180	837	770		
200	179	164	1200	851	782		
220	193	177	1220	864	794		
240	207	186	1240	878	807		
260	219	201	1260	891	819		
280	233	213	1280	904	832		
300	246	226	1300	918	843		
320	260	239	1320	931	856		
340	274	250	1340	945	869		
360	286	263	1360	959	881		
380	300	275	1380	971	894		
400	313	288	1400	985	906		
420	327	300	1420	998	918		
440	341	312	1440	1012	931		
460	354	325	1460	1026	943		
480	367	337	1480	1038	955		
500	380	349	1500	1052	968		
520	394	362	1520	1065	980		
540	408	374	1540	1079	993		
560	421	387	1560	1093	1004		
580	435	399	1580	1105	1017		
600	447	411	1600	1119	1030		
620	461	424	1620	1132	1042		
640	475	436	1640	1146	1054		
660	488	448	1660	1160	1066		
680	502	461	1680	1173	1079		
700	515	473	1700	1186	1092		
720	518	486	1720	1200	1103		
740	542	497	1740	1213	1116		
760	555	510	1760	1227	1128		
780	569	523	1780	1240	1141		
800	583	535	1800	1254	1153		
820	595	547	1820	1267	1165		
840	609	559	1840	1280	1178		
860	622	572	1860	1294	1198		
880	636	585	1880	1307	1202		
900	650	596	1900	1321	1215		
920	662	609	1920	1334	1227		
940	676	621	1940	1347	1240		
960	689	634	1960	1361	1252		
980	703	646	1980	1374	1264		
1000	717	658	2000	1388	1277		

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RATE TABLE "F"

COMMODITIES AS DESCRIBED IN ITEM 310

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS		CARLOAD MINIMUM WEIGHT		RATE BASIS		CARLOAD MINIMUM WEIGHT	
NOT OVER		231,000 Pounds	300,000 Pounds	NOT OVER		231,000 Pounds	300,000 Pounds
20		13	11	1020		107	104
40		15	13	1040		109	107
60		17	15	1060		110	108
80		18	16	1080		112	110
100		20	18	1100		114	112
120		22	20	1120		116	114
140		24	22	1140		118	115
160		27	23	1160		119	117
180		28	26	1180		121	119
200		30	28	1200		124	121
220		32	30	1220		126	122
240		34	31	1240		127	125
260		35	33	1260		129	127
280		37	35	1280		131	129
300		39	37	1300		133	130
320		42	38	1320		134	132
340		43	40	1340		136	134
360		45	43	1360		138	136
380		47	45	1380		141	137
400		49	46	1400		142	140
420		50	48	1420		144	142
440		52	50	1440		146	144
460		54	52	1460		148	146
480		56	53	1480		149	147
500		58	55	1500		151	149
520		60	58	1520		153	151
540		62	60	1540		155	153
560		64	62	1560		157	154
580		65	63	1580		159	157
600		67	65	1600		161	159
620		69	67	1620		163	161
640		71	69	1640		164	162
660		72	70	1660		166	164
680		75	72	1680		168	166
700		77	75	1700		170	168
720		79	77	1720		171	169
740		80	78	1740		174	171
760		82	80	1760		176	174
780		84	82	1780		178	176
800		86	84	1800		179	177
820		87	85	1820		181	179
840		89	87	1840		183	181
860		92	89	1860		185	183
880		94	92	1880		186	184
900		95	93	1900		189	186
920		97	95	1920		191	189
940		99	97	1940		193	191
960		101	99	1960		194	192
980		102	100	1980		196	194
1000		104	102	2000		198	196

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RATE TABLE "G"

COMMODITIES AS DESCRIBED IN ITEM 315

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS				CARLOAD MINIMUM WEIGHT				RATE BASIS				CARLOAD MINIMUM WEIGHT			
NOT OVER				142,000 Pounds	218,000 Pounds	245,000 Pounds		NOT OVER				142,000 Pounds	218,000 Pounds	245,000 Pounds	
20	25	14	13					1020	144	108	105				
40	27	16	14					1040	146	109	108				
60	29	17	16					1060	148	111	110				
80	32	19	18					1080	150	113	112				
100	34	21	20					1100	153	115	113				
120	36	23	21					1120	155	116	115				
140	38	24	23					1140	158	118	117				
160	40	27	26					1160	160	120	119				
180	44	29	28					1180	163	122	121				
200	46	31	29					1200	165	124	122				
220	48	32	31					1220	167	126	125				
240	50	34	33					1240	169	128	127				
260	53	36	35					1260	173	130	129				
280	55	38	37					1280	175	131	130				
300	58	39	38					1300	177	133	132				
320	60	42	40					1320	179	135	134				
340	63	44	43					1340	182	137	136				
360	65	46	45					1360	184	138	137				
380	67	47	46					1380	186	141	140				
400	69	49	48					1400	189	143	142				
420	72	51	50					1420	191	145	144				
440	75	53	52					1440	194	146	145				
460	77	54	53					1460	196	148	147				
480	79	56	55					1480	198	150	149				
500	82	59	58					1500	200	152	151				
520	84	61	60					1520	203	153	152				
540	86	62	61					1540	206	155	154				
560	88	64	63					1560	208	158	157				
580	91	66	65					1580	210	160	159				
600	94	68	67					1600	213	161	160				
620	96	69	68					1620	215	163	162				
640	98	71	70					1640	217	165	164				
660	100	73	72					1660	219	167	166				
680	103	76	75					1680	223	168	167				
700	105	77	76					1700	225	170	169				
720	108	79	78					1720	227	173	171				
740	110	81	80					1740	229	175	174				
760	113	83	82					1760	231	176	175				
780	115	84	83					1780	234	178	177				
800	117	86	85					1800	236	180	179				
820	119	88	87					1820	239	182	181				
840	122	91	89					1840	241	183	182				
860	125	92	91					1860	244	185	184				
880	127	94	93					1880	246	187	186				
900	129	96	95					1900	248	190	189				
920	132	98	97					1920	250	192	190				
940	134	100	98					1940	253	193	192				
960	136	101	100					1960	256	195	194				
980	138	103	102					1980	258	197	196				
1000	141	105	104					2000	260	199	197				

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RATE TABLE "H"

COMMODITIES AS DESCRIBED IN ITEM 320

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS				CARLOAD MINIMUM WEIGHT				RATE BASIS				CARLOAD MINIMUM WEIGHT			
NOT OVER				96,000 Pounds	135,000 Pounds	180,000 Pounds		NOT OVER				96,000 Pounds	135,000 Pounds	180,000 Pounds	
20	46	33	24					1020	460	323	246				
40	54	38	29					1040	469	328	250				
60	63	45	34					1060	427	334	255				
80	71	50	38					1080	486	340	259				
100	80	56	43					1100	494	346	263				
120	87	62	47					1120	502	351	267				
140	96	67	51					1140	510	357	273				
160	104	73	55					1160	519	363	277				
180	113	79	60					1180	527	368	281				
200	120	85	65					1200	535	375	285				
220	129	91	69					1220	543	380	290				
240	137	97	73					1240	552	387	294				
260	146	102	78					1260	560	392	298				
280	154	109	82					1280	569	398	304				
300	162	114	86					1300	576	404	308				
320	170	119	91					1320	585	409	312				
340	179	126	96					1340	593	415	316				
360	187	131	100					1360	602	421	321				
380	196	137	104					1380	609	427	325				
400	203	143	109					1400	618	432	329				
420	212	149	113					1420	626	439	334				
440	220	154	117					1440	635	444	339				
460	229	161	121					1460	643	450	343				
480	236	166	127					1480	651	456	347				
500	245	171	131					1500	659	461	351				
520	253	178	135					1520	668	468	356				
540	262	183	140					1540	676	473	361				
560	271	190	144					1560	684	479	365				
580	278	195	148					1580	692	485	370				
600	286	201	153					1600	701	491	374				
620	295	207	158					1620	709	496	378				
640	301	212	162					1640	718	502	382				
660	311	218	166					1660	725	508	387				
680	320	224	170					1680	734	513	392				
700	328	230	175					1700	742	520	396				
720	337	235	179					1720	751	525	400				
740	345	242	184					1740	758	531	405				
760	353	247	189					1760	767	537	409				
780	361	253	193					1780	775	543	413				
800	370	259	197					1800	784	548	417				
820	378	264	201					1820	792	554	423				
840	386	271	206					1840	800	560	427				
860	394	276	210					1860	808	566	431				
880	403	282	215					1880	817	572	436				
900	411	288	219					1900	825	577	440				
920	420	294	224					1920	833	584	444				
940	427	299	228					1940	841	589	448				
960	436	306	232					1960	850	595	454				
980	444	311	236					1980	858	601	458				
1000	453	316	241					2000	867	606	462				

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

EXPLANATION OF ABBREVIATIONS

BOE - - - Bureau of Explosives, Thomas A. Phemister, Agent.
 CONRAIL - - Consolidated Rail Corporation.
 CR- - - - Consolidated Rail Corporation.
 CT PUC- - - Connecticut Public Utilities Commission.
 DOT - - - Department of Transportation.
 ICC - - - Interstate Commerce Commission.
 ILLCC - - - Illinois Commerce Commission.
 INRC - - - Public Service Commission of Indiana.
 MDOT- - - Michigan Department of Transportation.
 MD PSC- - - Public Service Commission of Maryland.
 NJ DOT- - - New Jersey - Department of Transportation.
 NRB - - - National Rate Basis (Western Trunk Line Committee, Agent).
 NRC - - - Nuclear Regulatory Commission.
 NSO - - - National Service Order.
 NY DOT- - - New York - Department of Transportation.
 OH PUC- - - Public Utilities Commission of Ohio.
 OPSL- - - Official List of Open and Prepay Stations (Station List Publishing Company, Agent).
 PAPUC - - - Pennsylvania Public Utility Commission.
 PHJ - - - H. J. Positano, Agent.
 RCCR- - - Rail Cost Recovery Tariff (Traffic Executive Association-Eastern Railroads, Agent).
 RIPUC - - - Rhode Island Division of Public Utilities and Carriers.
 STCC- - - Standard Transportation Commodity Code (Traffic Executive Association-Eastern Railroads, Agent).
 TEA - - - Traffic Executive Association - Eastern Railroads, Agent.
 UFC - - - Uniform Freight Classification (Uniform Classification Committee, Agent).
 VCC - - - Commonwealth of Virginia State Corporation Commission.
 PSCWVA- - - West Virginia Public Service Commission.
 WTL - - - Western Trunk Lines (Western Trunk Line Committee, Agent).

Appendix J
FLOOD-PLAIN ASSESSMENT

Appendix J

FLOOD-PLAIN ASSESSMENT

J.1 EXPANDED CANONSBURG SITE

J.1.1 Project description

At the present time, residual radioactive materials and associated radioactively contaminated materials from the prior operations of the Vitro Rare Metals Plant exist in the 100- and 500-year flood plains of Chartiers Creek, as shown on Figures A.1-1 and D.1-1, and as described in Sections 2.1 and subsections 4.2.1 and 4.3.3.

The principal feature of the proposed remedial action would be the consolidation of the more radioactively contaminated materials (Figure A.1-1) into a lined encapsulation cell (Figures A.1-2 through A.1-4) located in Areas A and B of the Canonsburg site above the 100-year flood level (Section 3.1, Appendix A.1). The location of the encapsulation cell, as shown on Figure A.1-2, was chosen for the following reasons. First, it is preferable to locate the encapsulation cell on the Canonsburg site to prevent the spread of radioactively contaminated materials (via construction activity) to nonradioactively contaminated areas of the expanded Canonsburg site. This restriction limits the encapsulation cell location to a more centralized area to allow for ease of construction and material movement on a small site (the Canonsburg site encompasses about 18 acres) in a residential district. It is also preferable to design the encapsulation cell so that it blends with the surrounding topography. Therefore, to encapsulate the estimated 85,000 cubic yards of radioactively contaminated materials, limit cell height, and allow for expeditious construction sequencing, the only practicable location for the encapsulation cell would be in Areas A and B of the Canonsburg site. This location would require fill in a low-lying area along Ward Avenue.

In addition to encapsulation, the radioactively contaminated materials remaining on the Canonsburg site would be stabilized in place using a thick, compacted cover. Some of these radioactively contaminated materials in Areas B and C would remain within the 100-year flood plain.

This proposed action would require the following major construction activities, which to a great extent, would occur within the 100-year flood plain.

1. Preparation of the expanded Canonsburg site, including construction of a flood-control berm and construction of a waste-water sedimentation basin to prevent the release of contaminants from the expanded Canonsburg site during construction.
2. Construction of drainage-control measures to direct all generated waste and storm-water runoff to the sedimentation basin during construction activities.

3. Removal and relocation of onsite surface and subsurface utilities to prevent the need for human intrusion.
4. Excavation and handling of radioactively contaminated materials during their relocation and encapsulation.
5. Dewatering of soils within Area C to facilitate excavation of the radioactively contaminated materials from this area.
6. Installation and operation of a waste-water treatment facility to prevent contamination of surface waters during construction.
7. Removal of Chartiers Creek bank materials above the ordinary high water mark at the northeast corner of Area B (i.e., the Canonsburg Street railway terminus).
8. Placement of fill in low-lying areas (within the 100-year flood plain) for construction of the encapsulation cell liner above the 100-year flood level.
9. Emplacement of radioactively contaminated materials in the encapsulation cell to control radon exhalation and protect ground water (not in the 100-year flood plain).
10. Decontamination (if necessary), demolition, and disposal of all buildings and railroad spur lines on the expanded Canonsburg site.
11. Construction of the final cover system over the encapsulation cell to exhibit water infiltration and radon exhalation (not in the 100-year flood plain).
12. Emplacement of a soil cover over the remainder of the Canonsburg site with final grading to provide suitable drainage control.
13. Emplacement of topsoil and erosion protection on the encapsulation cell and the remainder of the Canonsburg site.
14. Revegetation of all disturbed areas to mitigate erosion.
15. Installation of temporary and permanent fencing to discourage human intrusion.
16. Reconstruction of Strabane Avenue.

Additional details can be found in Section 3.1 and Appendix A.1 of this Canonsburg FEIS.

J.1.2 Flood-plain effects

Alteration of the flood plain during and after the remedial action is a prime concern because of the potential for changes in creek elevations during flood events and resulting flood impacts on nearby properties and structures. Other impacts, such as increased erosion and sedimentation, loss or alteration of riparian and aquatic habitat, and changes in water quality, are major concerns during the remedial action. These latter temporary impacts, which are discussed in subsections 5.2.1 and 5.6.1 and Section 5.7 of this Canonsburg FEIS, are of lesser significance. After remedial action, long-term impacts on ground-water quality and flow, and ultimately, surface-water quality and use, would result from the disposal of the radioactively contaminated materials on the Canonsburg site. These long-term impacts are discussed in subsections 5.6.1 and 5.6.2 of the Canonsburg FEIS. Mitigation measures to address short- and long-term impacts are contained in the proposed remedial-action description (Appendix A.1 and Section 5.21) in the Canonsburg FEIS. This assessment primarily addresses the potential for flooding of the final expanded Canonsburg site and nearby property.

The Federal Emergency Management Agency (FEMA) flood insurance study HEC-2 model (FEMA, 1979) was used to predict the changes in the flood elevations and resulting velocities that could occur during construction and after completion of the remedial action. This model was modified to reflect the physical topography of the expanded Canonsburg site for three phases: existing conditions, construction, and post-remedial-action. For each phase the HEC-2 model was used to predict the resulting 100-year flood-plain water-surface elevations. For the post-remedial action phase, flood elevations and velocities during the 1000-year and probable maximum flood (PMF) were also predicted. (A PMF is a flood in Chartiers Creek adjacent to the expanded Canonsburg site that could result from probable maximum precipitation on the drainage basin upstream from the expanded Canonsburg site.) The following paragraphs contain brief descriptions of each model run:

1. Existing flood plain -- The HEC-2 model was modified to be more site specific by adding six cross-sections in the vicinity of the expanded Canonsburg site (Figure J-1). The resulting flood elevations are slightly different from the elevations predicted in the flood insurance study, but are more accurate due to the increased definition of the topography. This represents the baseline flood-plain conditions.
2. Construction flood plain -- The cross-sections in the vicinity of the flood berm were modified to reflect the change in topography due to the berm. The model was executed to predict the impact of the berm on the 100-year flood-plain elevations.
3. Post-remedial-action flood plain -- The cross-sections in the vicinity of the expanded Canonsburg site were modified to reflect the proposed topography changes. The model was executed to predict the impact the topography changes would have on the 100-year, 1000-year, and PMF flood-plain elevations and creek velocities.

FIGURE J-1
LOCATIONS OF CREEK CROSS-SECTIONS USED
IN 'HEC-2' FLOOD PLAIN MODELING ANALYSIS
EXPANDED CANONSBURG SITE

J.1.2.1 During remedial action

The principal short-term effect on water levels would result from the construction of the flood-control berm and associated construction activities (see Appendix A.1). The results of the HEC-2 analysis indicate that the berm would cause a slight increase in the water-surface elevation in the vicinity of and upstream of the expanded Canonsburg site (Table J-1). The greatest increase (3.2 inches) would occur at the terminus of the abandoned railway berm (cross-section 104). Downstream of this area, elevations would be expected to remain unchanged or slightly reduced (a function of increased velocity). Given the predicted change in creek elevations ($\pm$ 3-4 inches), no impacts on offsite properties or structures would occur during a 100-year storm event.

Table J-1. Flood-plain elevations

Cross-section	100-year flood-plain elevations ^a	
	Baseline	During remedial action
101	943.07	943.07
4.3	949.08	949.08
4.41	949.36	949.35
102 ^b	949.31	949.00
103	949.97	949.85
104	949.62	949.89
105	951.02	951.22
5 (N)	951.74	951.91
106	951.22	951.39

^aBased on the use of the FEMA HEC-2 model (FEMA, 1979).

^bCell is located between cross-sections 102 and 103.

J.1.2.2 After remedial action

The primary long-term effect on creek elevations and velocities would be a function of the final expanded Canonsburg site conditions. As described in Appendix A.1 and in Section J.1, the main final expanded Canonsburg site conditions impacting the 100-year flood plain (Figure D.1-1) include the following:

1. Location of fill in the 100-year flood plain along Ward Street to support the encapsulation cell (Figure A.1-2).

2. Removal of Chartiers Creek bank materials (cross-section 104, Figure J-1).

The HEC-2 analysis indicates that a maximum increase in creek elevation of about 10 inches would occur at cross-section 104 after remedial action (Table J-2). The HEC-2 analysis indicates only slight increases in creek elevations would occur along the remainder of the expanded Canonsburg site. Therefore, incremental offsite impacts to property and structures during a 100-year storm event are expected to be minimal.

Table J-2. Post-remedial action flood-plain elevations

Cross-section	Baseline	100 year	1000 year	PMF
101	943.07	943.04	949.79	970.88
4.3	949.08	949.12	---	---
4.41	939.36	949.39	954.63	973.23
102 ^a	949.31	949.30	954.29	971.23
103	949.97	950.00	955.12	973.17
104	949.62	950.47	955.54	974.73
105	951.02	950.38	955.42	975.54
5 (N)	951.74	951.28	956.56	976.72
106	951.22	950.77	955.21	977.25

^aCell is located between cross-sections 102 and 103.

Given the long-term hazards of the radioactively contaminated materials and the EPA longevity standard (40 CFR 192) for safe disposal (200 to 1000 years), it is important to assess the impacts on the expanded Canonsburg site from extreme storm events and from possible creek intrusion. Therefore, post-remedial action flow velocities and flood levels have been calculated for three flood events: a 100-year flood, a 1000-year flood, and a probable maximum flood (PMF) (Tables J-2 and J-3), and the potential for creek intrusion has been evaluated.

As indicated on Figure A.1-3 and in Table J-2, the bottom of the encapsulation cell would be placed above the 100-year flood plain (approximate elevation would be 950 feet); encapsulated radioactively contaminated materials would be above the 500-year flood-plain elevation (approximate elevation would be 952 feet). The location of the encapsulation cell would be such that even during a 1000-year flood (approximate elevation would be 954.5 feet), the encapsulation cell would not be subjected to erosive water velocities (about 1.0 foot per second) (Table J-3). Regardless, the encapsulation cell would have additional rock protection to above the 1000-year flood level. The analyses also indicate that most of the encapsulation cell would be inundated during the PMF; however, the velocities along the toe of the encapsulation cell would be too low to affect cell integrity.

In addition, the expanded Canonsburg site is located on alluvial fill along Chartiers Creek and therefore has a slight possibility of being subject to creek meander. Based on drill logs and visual inspection, the creek bank adjacent to the western, northwestern, and northern boundaries of the expanded Canonsburg site consists of bedrock and is not likely to erode and allow the creek to encroach on the expanded Canonsburg site in the foreseeable future. Along the northeastern and eastern sides of the expanded Canonsburg site, the creek bank consists of alluvial fill and is subject to a slight potential encroachment into the expanded Canonsburg site.

To further protect the expanded Canonsburg site, those areas of the expanded Canonsburg site potentially subject to creek encroachment would be protected with a buried rock structure (Figure A.1-3). This rock structure is designed to preclude lateral creek migration and to withstand creek flows that could encroach toward the radioactively contaminated materials.

Table J-3. Post-remedial action flood velocities (feet/second)

Location	Cross-section	100 year	1000 year	PMF
Toe of cell	102 ^a	---	1.6	4.0
	103	---	0.6	3.1
Flood plain adjacent to cell	102	1.6	2.7	6.8
	103	1.6	2.1	6.2
Center of creek	102	9.5	11.1	24.4
	103	7.3	8.3	18.8
Riprap wall ^b	---	8.2	9.4	21.0

^aCell is located between cross-sections 102 and 103.

^bVelocities based on weighted average between the cross-sectional areas of 102 and 103.

J.1.3 Alternatives

The alternatives to the proposed remedial action are described in Section 3.1. The impacts of these alternatives are presented in subsections 5.2.1 and 5.6.1 and Section 5.7, and are summarized in Table 1-3. Mitigation measures that are likely to be employed are described in subsection 5.2.1.

Alternative 1, no action, entails leaving the Canonsburg site in its present condition. As such, no impacts other than those at present would occur. The UMTRCA, however, requires the cleanup of the Canonsburg site.

For the other alternatives (Alternatives 2, 4, and 5) the construction activities, and hence, the short-term impacts as discussed in subsection J.1.2, would still occur. The mitigation measures described for the proposed remedial action would also apply for Alternatives 2, 4, and 5.

The long-term impacts identified for the proposed remedial action would not occur after completion of the remedial action for Alternatives 4 and 5. The topography of the Canonsburg site (i.e., flood plain) would be restored to its preconstruction configuration and all radioactively contaminated materials would be disposed of at the Hanover site.

J.2 BURRELL SITE

The part of the Burrell site that would require remedial action lies within the U.S. Army Corps of Engineers flood easement area for the Conemaugh Dam. The actions proposed at this location are either to stabilize the existing radioactively contaminated materials in place with a minimum of disturbance and to place additional cover on the radioactively contaminated area (Alternatives 3 and 5), or to excavate up to 80,000 cubic yards of radioactively contaminated materials from the landfill and consolidate it with the major body of the radioactively contaminated materials at either the Canonsburg or Hanover site (Alternatives 2 and 4). The concept of the proposed remedial action (Alternative 3) is given in Appendix A.2. All remedial-action alternatives (Alternatives 2 through 5) would be conducted in areas that are outside the estimated 1000-year flood plain. A 1000-year flood is believed to have occurred at the Burrell site during Hurricane Agnes in 1972. The only action at the Burrell site anticipated within the flood plain would be the removal of the very low dam that forms the onsite ponds at the western end of the Burrell site. These actions would be reviewed by the U.S. Army Corps of Engineers personnel before enactment.

REFERENCES FOR APPENDIX J

FEMA (Federal Emergency Management Agency), Federal Insurance Administration,
1979. Flood Insurance Study, Borough of Canonsburg, Pennsylvania,
Washington County, Community No. 420849, Washington, DC.