Design Analysis Cover Sheet

Complete only applicable items.

①

WBS: 1.2.6

QA: QA

Page: 1 Of: 12

MOL.19951120.0134

2. DESIGN ANALYSIS TITLE

SANITARY SEWER CALCULATION

3. DOCUMENT IDENTIFIER

B00000000-01717-0200-00077 REV 01

4. REV. NO.

01

5. TOTAL PAGES

12

6. TOTAL ATTACHMENTS/NO. OF PAGES IN EACH

I-3 pages; II-2 pages; III-17pages

7. SYSTEM ELEMENT

ESF

	Print Name	Signature	Date
8. Originator	Roy D. Clark	<i>Roy D. Clark</i>	1/13/95 <i>RC 1/13/95</i>
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12. REMARKS

1.

[illegible]

1. PURPOSE

This analysis defines and evaluates the surface sanitary sewer system on the North Portal, and addresses the requirements for the collection of sanitary sewage from each of the proposed surface buildings. A sewage treatment system will be defined that meets the needs of the North Portal, conforms to the existing site conditions, and meets the needs of the state and local permitting agencies.

2. QUALITY ASSURANCE

This document is considered not to be quality affecting.

3. METHOD

The method used to analyze the system will be to evaluate the amount of sewage each building will produce and size the sewer system based on this volume.

4. CODES AND STANDARDS

- 4.1 U.S. Department of Energy (DOE); General Design Criteria, DOE Order 6430.1A, April 6, 1989
- 4.2 Manual of Septic-Tank Practice; U. S. Department of Health, Education, and Welfare; Public Health Service Publication No. 526; undated.
- 4.3 Nevada Administrative Code Chapter 444 (NAC444); Regulation Governing Individual Sewage Disposal Systems, July 20, 1982
- 4.4 Uniform Plumbing Code, 1991 Edition

5. DESIGN INPUTS

- 5.1 Sanitary sewer systems shall be designed in compliance with BFD Section 7.2.4.3, Sanitary System. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.3 IV A.4)
- 5.2 Roads, building sites, utility corridors, and storage areas for excavated rock shall be cleared, graded, and stabilized. Topsoil shall be stored in an environmentally acceptable manner. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.3 IV A.23)
- 5.3 Flow Quantities: The peak design flow shall be based on 400 people per day. The Exploratory Studies Facility (ESF) would best conform to item 7 of the Uniform Plumbing Code (UPC), Appendix I, Private Sewage Disposal System, Table I-3, factories with showers, which estimates the sewage flow rate to be 35 gallons per day per employee. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV.A.1)

- 5.4 Collection Pipe: Gravity sewers shall be designed for minimum velocity of two feet per second and a maximum velocity of ten feet per second. Each building or trailer shall have a branch collection line to collect all sanitary sewage. The point of interface with the building will be five feet from the exterior wall of the building. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.a)
- 5.5 Velocities in force mains shall be designed not to exceed ten feet per second and a minimum velocity of 3.5 feet per second. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.b)
- 5.6 The minimum pipe size for branch lines shall be six inches in diameter and main lines shall be eight inches in diameter. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.c)
- 5.7 Pipe joints shall be designed to have permanent water tight seal. Maximum infiltration-filtration allowances and infiltration-filtration test requirements shall be specified with the contract documents. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.d)
- 5.8 Collection Pipe Location: Sewers and force mains shall be designed to have a minimum depth cover of two feet. Additional cover shall be provided to prevent freezing in cold climates and at roadway crossings in high traffic areas. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.3.a)
- 5.9 Where feasible, sewers or force mains shall not be routed within ten feet of potable waterlines or firelines. Where potable waterlines must cross sewers or force mains, waterlines shall pass two feet above the sewer or force main. Where insufficient cover precludes such vertical separation, the sewer or force main shall be ductile iron pipe or shall be fully encased in concrete for a minimum distance of ten feet to each side of the waterline crossing. Where feasible, sewer or force main pipe joints shall not be located within three feet of such crossings, unless the joint is encased in concrete. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.3.b)
- 5.10 Pipe Material: The selection of sewer and force main pipe material shall be based on wastewater characteristics and soil conditions. Polyvinyl chloride (PVC) shall be considered where tree root and filtration is a problem. Ductile iron pipe shall also be used for inverted siphons and for sewers located in parking lots or other high traffic areas. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.4.a)
- 5.11 Pipe joints shall be designed to have a permanent watertight seal. Maximum infiltration-filtration allowances and infiltration-filtration test requirements shall be specified with the contract documents. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.4.b)
- 5.12 Manholes shall be installed at changes of direction and at intervals not more than 400 feet apart for access, testing and maintenance to provide a maintainable service life of a least 25 years. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.5.a)
- 5.13 Manholes shall be constructed of reinforced concrete, either cast-in-place or precast. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.5.b)

- 5.14 All technical requirements associated with obtaining state permits and licenses shall be considered in the design. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.6)
- 5.15 Provide a sanitary system for the surface collection and disposal of underground and subsurface sanitary sewage during ESF activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 FR1)
- 5.16 Sewage effluent discharge shall not adversely affect site characterization activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 PC1)
- 5.17 The sanitary waste disposal system shall accommodate the sewage for construction, operations, and testing personnel at the ESF. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 PC2)
- 5.18 Sanitary systems shall utilize an acceptable method of disposal, consistent with state or local codes, such as septic tanks or offsite disposal. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 C1)
- 5.19 Sanitary wastes shall be disposed of by means of collection piping from all buildings and trailers to a sanitary waste disposal system located beyond the perimeter of the potential repository subsurface facility. The sanitary system shall not interfere with the site characterization activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 C3)
- 5.20 Percolation test results and input to this design to determine the length of lead trench necessary to meet the existing soil conditions. (RSN-MTL-letter of 12/15/94; NTS: Q&I: MTL: 015-95, C. D. Harrington to David Kessel)

6. CRITERIA

- 6.1 Sanitary sewer systems shall be designed in compliance with BFD Section 7.2.4.3, Sanitary System. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.3 IV A.4)
- 6.2 Roads, building sites, utility corridors, and storage areas for excavated rock shall be cleared, graded, and stabilized. Topsoil shall be stored in an environmentally acceptable manner. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.3 IV A.23)
- 6.3 Flow Quantities: The peak design flow shall be based on 400 people per day. The Exploratory Studies Facility (ESF) would best conform to item 7 of the Uniform Plumbing Code (UPC), Appendix I, Private Sewage Disposal System, Table I-3, factories with showers, which estimates the sewage flow rate to be 35 gallons per day per employee. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV.A.1)

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- 6.5 Velocities in force mains shall be designed not to exceed ten feet per second and a minimum velocity of 3.5 feet per second. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.b)
- 6.6 The minimum pipe size for branch lines shall be six inches in diameter and main lines shall be eight inches in diameter. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.c)
- 6.7 Pipe joints shall be designed to have permanent water tight seal. Maximum infiltration-filtration allowances and infiltration-filtration test requirements shall be specified with the contract documents. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.2.d)
- 6.8 Collection Pipe Location: Sewers and force mains shall be designed to have a minimum depth cover of two feet. Additional cover shall be provided to prevent freezing in cold climates and at roadway crossings in high traffic areas. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.3.a)
- 6.9 Where feasible, sewers or force mains shall not be routed within ten feet of potable waterlines or firelines. Where potable waterlines must cross sewers or force mains, waterlines shall pass two feet above the sewer or force main. Where insufficient cover precludes such vertical separation, the sewer or force main shall be ductile iron pipe or shall be fully encased in concrete for a minimum distance of ten feet to each side of the waterline crossing. Where feasible, sewer or force main pipe joints shall not be located within three feet of such crossings, unless the joint is encased in concrete. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.3.b)
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- 6.11 Pipe joints shall be designed to have a permanent watertight seal. Maximum infiltration-filtration allowances and infiltration-filtration test requirements shall be specified with the contract documents. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.4.b)
- 6.12 Manholes shall be installed at changes of direction and at intervals not more than 400 feet apart for access, testing and maintenance to provide a maintainable service life of a least 25 years. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.5.a)
- 6.13 Manholes shall be constructed of reinforced concrete, either cast-in-place or precast. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.5.b)

- 6.14 All technical requirements associated with obtaining state permits and licenses shall be considered in the design. (BAB000000-01717-6300-00002 Rev. 03 Section 7.2.4.3, IV A.6)
- 6.15 Provide a sanitary system for the surface collection and disposal of underground and subsurface sanitary sewage during ESF activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 FR1)
- 6.16 Sewage effluent discharge shall not adversely affect site characterization activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 PC1)
- 6.17 The sanitary waste disposal system shall accommodate the sewage for construction, operations, and testing personnel at the ESF. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 PC2)
- 6.18 Sanitary systems shall utilize an acceptable method of disposal, consistent with state or local codes, such as septic tanks or offsite disposal. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 C1)
- 6.19 Sanitary wastes shall be disposed of by means of collection piping from all buildings and trailers to a sanitary waste disposal system located beyond the perimeter of the potential repository subsurface facility. The sanitary system shall not interfere with the site characterization activities. (RSN-BFD-001 Rev. 04 Section 1.2.6.2.3 C3)
- 6.20 Percolation test results and input to this criteria to determine the length of lead trench necessary to meet the existing soil conditions. (RSN-MTL-letter of 12/15/94; NTS: Q&I: MTL: 015-95, C. D. Harrington to David Kessel)

7. ASSUMPTIONS

- 7.1 It is assumed that a maximum of 400 people will use the North Portal daily. This is the same number of people used to size the domestic water supply system. No verification is necessary. This assumption is used throughout the calculation section of this study.
- 7.2 The ESF Title I North Portal plans will be assumed correct and current for the types and number of fixtures to be used to size the septic tank. This should be verified for accuracy when the remainder of the North Portal is constructed and connected into the septic system. This assumption is used throughout the calculation section of this study.
- 7.3 There is a possibility a General Support Facility (GSF) will be constructed on the south side of "H" Road at its intersection with the North Portal Access Road. This GSF may be built some time in the future and will require a sanitary sewage treatment facility. The facility that is being designed for the North Portal may be enlarged to accommodate the GSF. It is assumed that this facility will contribute no more than 6,000 gallons per day of sewage to the system. This value will be added to the design that is to be used for the North Portal ESF.

8. REFERENCE MATERIAL

- 8.1 Design and Construction of Sanitary and Storm Sewers; American Society of Civil Engineers (ASCE)-Manuals and Reports on Engineering Practice No. 37
- 8.2 Sanitary and Industrial Wastewater Collection-Gravity Sewers and Appurtenances; Army TM 5-814-1, Air Force AFM 88-11, Volume 1, March 1985
- 8.3 Civil Engineering Review Manual, Third Edition: Michael R. Lindeburg, P.E. Copyright 1981

9. COMPUTER PROGRAMS

Not used.

10. DESIGN ANALYSIS

10.1 GENERAL

The North Portal will be provided with potable water sufficient to meet the needs of the facility. When water is provided to a facility a system must be provided to treat the wastewater or sanitary sewage using an approved and legal method. There are two types of treatment methods available to treat sanitary sewage. One method is through a waste treatment plant and the other is through an individual sewage disposal system or a septic tank and leach field.

The collection system shall consist of a series of manholes and buried pipes used to collect the sewage from the various surface buildings and transport the raw sewage to a treatment facility.

10.2 COLLECTION SYSTEM

A main trunk line shall be installed during the first phase of construction to minimize site disturbance. Lateral wyes with plugs shall be installed in the main at the anticipated location, based on Title I plans, of the future buildings to ease in future development.

10.2.1 Manholes

Manholes shall be installed no more than 400 feet apart to ease access and maintenance. These shall be constructed of concrete, either cast-in-place or precast at the Constructor's discretion. The manhole covers shall be traffic-rated as there is a high probability of traffic loads. The connection between the manhole and pipe shall be a watertight seal to prevent leakage. The diameter of the manhole shall be 48 inches to facilitate maintenance of the line. The top of the manhole shall be flush with the surface. The invert shall be formed concrete to allow unobstructed flow through the junction.

10.2.2 Pipe

The sewer pipe shall be of the size and material that will allow the sewage to flow at a minimum velocity of two feet per second. This velocity is required by DOE 6430.1A to prevent solids from "falling out of suspension" while traveling through the pipe. Collection pipe used will be PVC laid at a minimum of 0.5% slope (see Attachment I for calculation).

The location of the pipe is a function of the DOE 6430.1A criteria. Sewer pipes shall not be located within 10 feet, horizontally, from any potable water lines or 50 feet from any well. If a sewer pipe must come within 10 feet of the water lines, the sewer pipe shall pass below the waterline with a minimum separation of 2 feet.

10.3 TREATMENT SYSTEM

A treatment system shall be provided to treat the sanitary sewer waste as it comes from the various buildings on the ESF pad. There are two types of treatment systems available to treat small quantities of raw sewage. One type of system is a "package waste treatment plant." This type of system would require a very time consuming permitting process as well as daily and/or weekly maintenance costs. Another type of system that could be used is a septic tank and leach field. There is minor cost involved for maintenance and the permit process requires less time than a package plant. The governing factor involved in the placement of a septic tank is the ability of the soil to percolate the tank effluent. This system consists of a septic tank, distribution box, and seepage bed.

10.3.1 Septic Tank

The location and size of the septic tank shall be according to the requirements of the UPC 1991 Edition. This project is located in Nye County, which does not have a building department that normally permits septic tanks and associated systems. The State of Nevada, Division of Environmental Protection will therefore govern the installation and permitting of this system, which will involve the use of NAC444 criteria.

The location of the septic tank is based upon UPC and BFD criteria. The BFD requires the system to be located away from the ESF area so as not to affect site characterization activities. Table I-1 (included in Attachment II) from the UPC, provides minimum horizontal distances from specific objects, e.g., buildings, property lines, wells, streams, that the septic tank, distribution box, and disposal field should be located. This will be used as a guide in locating the system.

The size of the septic tank is based on the size criteria established by the UPC, Appendix I. The "liquid capacity of all septic tanks shall conform to...Table I-3" (included in Attachment II) based on the "estimated waste/sewage design flow rate or the number of plumbing fixture units (F)," as determined from Table 4-1 (included in Attachment II), whichever is greater.

Table I-3 estimates the size of the tank based on institutional usage per person. The ESF would best conform to item 7, factories with showers, which estimates the sewage flow rate to be 35 gallons per day per employee.

400 people/day x 35 gallons/day/person = 14,000 gallon tank

"Recommended design criteria" allows for a reduction in size, based on sewage flow over 1,500 gallons per day

Flow (14,000) x 0.75 + 1125 = 11,625 gallon tank required<-----

Addition of 6,000 gallons from the GSF

Therefore, use an 18,000 gallon tank<-----

10.3.2 Distribution Box

A distribution box is required for all systems over 2,000 gallons. This box is required so that each distribution line is connected separately to the box and not to another line.

10.3.3 Seepage Bed

A seepage bed is required to distribute the liquid effluent from the septic tank into the ground. The size of this field is based on the rate at which the soil is able to percolate water into the ground. The NAC444 procedure used to calculate this rate is included as a reference in Attachment III.

NAC444 Section 444.816 relates the rate of sewage application to the field determined percolation rate by the following equation:

$Q = 5 \div \text{square root of } t$

Q = rate of sewage application in gallons/square foot/day

t = percolation rate in minutes per inch

The following portion of this analysis is on hold until various organizations can determine the exact location of the leach field. Once this location is determined, percolation tests will have to be done to size the field.

On December 13, 1994, six percolation tests were performed in the area shown on the attached site plan. The percolation test results are shown below:

Test 1	20.0 minutes/inch
Test 2	40.0 minutes/inch
Test 3	60.0 minutes/inch
Test 4	30.0 minutes/inch
Test 5	40.0 minutes/inch
Test 6*	6.7 minutes/inch

*Test 6 is very low compared to the rest of the tests. This number should be removed to calculate the average percolation rate.

Average percolation rate = 38.0 minutes/inch

$$Q = 5 \div 38.0^{1/2} = 0.8111 \text{ gallons/square foot/day}$$

Absorption field size is equal to the septic tank capacity divided by the application rate.

$$\begin{aligned} \text{field size} &= 18,000 \text{ gallons/day} \div 0.8111 \text{ gallons/square ft/day} \\ &= 22,192 \text{ square feet} \end{aligned}$$

Trench criteria:

length of each line = 100 feet maximum bottom width (2 feet) of each trench;
trench wall = 4 feet per wall (acceptable State criteria)

length of trench = $22,192 \text{ feet} \div (4 \text{ feet} \times 2) = 2,774 \text{ feet}$ or 28 lines 4 inches
Corrugated Polyethylene tubing will be used.

The remaining design criteria are based on UPC and NAC444 rules and regulations concerning emplacement of the septic tank and leach field.

10.4 Dosing Tank

NAC444 Section 444.814 requires that a dosing tank be provided where there is over 500 linear feet of distribution line in an absorption system. These tanks shall have sufficient capacity to distribute sewage equally to all parts of the absorption field at 3 to 4 hour intervals. The capacity should be equal to 60 to 75 percent of the interior volume of the "tile" system. The siphons must be automatic and alternating when the length of the distribution lines are over 1,000 feet. Alternating siphons shall be used as there will have to be two separate disposal areas.

Volume of "tile" system = 2800 feet of 4 inch diameter pipe = 244 cubic feet
60 percent of the "tile" volume = 147 cubic feet

Fluid Dynamic Siphon, Inc. of Steamboat Springs, Colorado, a manufacturer of these siphons, constructs a model that has a difference in high and low water elevation of 23 inches. This will require a plan area of not less than 76 square feet, which is approximately 8.5 foot by 9 foot.

11. CONCLUSION

Based on the design analysis of Section 10, the sewer collection system and waste treatment system shall consist of pipes and manholes leading to a septic tank and leach field. This is only the first part of installing a septic tank and leach field. Permits shall have to be obtained from the Division of Environmental Protection in Carson City, Nevada. The system will have to be permitted by the State and the installation will have to be inspected and approved by the State. This will be a hold point in the construction of the system.

12. ATTACHMENTS**ATTACHMENT****TITLE**

I	Calculations
II	Uniform Plumbing Code Excerpts
III	Percolation Test Results

CALCULATIONS .

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
Civilian Radioactive Waste Management System
Management & Operating Contractor

CONTRACT NO. DE-AC01-91RW00134

SUBJECT: MINIMUM SLOPE FOR SANITARY SEWER

PAGE NO. I-2 OF I-3

ATTACHMENT I

WBS NO: 1.2.6.

DATE: 01-09-95 REV NO: 01

CALC NO: 80000000-01717-0200-00077

ORIGINATOR: R.D. CLARK RC

CHECKED BY: H.A. ASGARIAN HAA

CHECKED DATE: 01-09-95

MIN Slope for 8' PVC 1/3 Full

SLOPE BASED ON MANNING'S EQUATION

$$V = 1.486 R^{2/3} S^{1/2}$$

$n = 0.013$ for PVC Pipe (Roughness Coef)

$V = 20$ FPS min Velocity

$R = \text{Hydraulic Radius} = \text{AREA} / \text{WETTED PERIMETER}$

THERE ARE CHARTS AVAILABLE THAT RELATE DEPTH OF FLOW TO DIAMETER, AREA, WETTED PERIMETER etc (ATTACHED)

$$\frac{d}{D} = 0.33 \quad \frac{\text{Area}}{D^2} = .2260 \quad \frac{\text{WETTED PERIMETER}}{D} = 1.2239$$

$$\text{hydraulic RADIUS} = 0.1848 \quad D = 8' = 67"$$

$$\text{Hyd. RAD} = \frac{0.1848}{.67} \rightarrow = .1232 = R$$

$$S = \left(\frac{nV}{1.486 R^{2/3}} \right)^2$$

$$= \left(\frac{.013(20)}{1.486 (.1232)^{2/3}} \right)^2 = 0.005 \text{ ft/ft}$$

$$= 0.5\% \text{ min.}$$

THIS PAGE WAS REVISED TO CORRECT SPELLING & GRAMMAR ERRORS
AS WELL AS SAP 3-9 REV.

DI/ CALC No. 80000000 01717-0200-
00017

Table 3.9

Area, Wetted Perimeter and Hydraulic Radius of
Partially Filled Circular Pipes

ATTACHMENT I

PAGE 13 JF3

$\frac{d}{D}$	area	wet. per.	hyd. rad.	$\frac{d}{D}$	area	wet. per.	hyd. rad.
$\frac{D}{D}$	$\frac{D^2}{D^2}$	$\frac{D}{D}$	$\frac{D}{D}$	$\frac{D}{D}$	$\frac{D^2}{D^2}$	$\frac{D}{D}$	$\frac{D}{D}$
0.01	0.0013	0.2003	0.0066	0.51	0.4027	1.5908	0.2531
0.02	0.0037	0.2838	0.0132	0.52	0.4127	1.6108	0.2561
0.03	0.0069	0.3482	0.0197	0.53	0.4227	1.6308	0.2591
0.04	0.0105	0.4027	0.0262	0.54	0.4327	1.6509	0.2620
0.05	0.0147	0.4510	0.0326	0.55	0.4426	1.6710	0.2649
0.06	0.0192	0.4949	0.0389	0.56	0.4526	1.6911	0.2676
0.07	0.0242	0.5355	0.0451	0.57	0.4625	1.7113	0.2703
0.08	0.0294	0.5735	0.0513	0.58	0.4723	1.7315	0.2728
0.09	0.0350	0.6094	0.0574	0.59	0.4822	1.7518	0.2753
0.10	0.0409	0.6435	0.0635	0.60	0.4920	1.7722	0.2776
0.11	0.0470	0.6761	0.0695	0.61	0.5018	1.7926	0.2797
0.12	0.0534	0.7075	0.0754	0.62	0.5115	1.8132	0.2818
0.13	0.0600	0.7377	0.0813	0.63	0.5212	1.8338	0.2839
0.14	0.0668	0.7670	0.0871	0.64	0.5308	1.8546	0.2860
0.15	0.0739	0.7954	0.0929	0.65	0.5404	1.8755	0.2881
0.16	0.0811	0.8230	0.0986	0.66	0.5499	1.8965	0.2899
0.17	0.0885	0.8500	0.1042	0.67	0.5594	1.9177	0.2917
0.18	0.0961	0.8763	0.1097	0.68	0.5687	1.9391	0.2935
0.19	0.1039	0.9020	0.1152	0.69	0.5780	1.9606	0.2950
0.20	0.1118	0.9273	0.1206	0.70	0.5872	1.9823	0.2962
0.21	0.1199	0.9521	0.1259	0.71	0.5964	2.0042	0.2973
0.22	0.1281	0.9764	0.1312	0.72	0.6054	2.0264	0.2984
0.23	0.1365	1.0003	0.1364	0.73	0.6143	2.0488	0.2995
0.24	0.1449	1.0239	0.1416	0.74	0.6231	2.0714	0.3006
0.25	0.1535	1.0472	0.1466	0.75	0.6318	2.0944	0.3017
0.26	0.1623	1.0701	0.1516	0.76	0.6404	2.1176	0.3025
0.27	0.1711	1.0928	0.1566	0.77	0.6489	2.1412	0.3032
0.28	0.1800	1.1152	0.1614	0.78	0.6573	2.1652	0.3037
0.29	0.1890	1.1373	0.1662	0.79	0.6655	2.1895	0.3040
0.30	0.1982	1.1593	0.1709	0.80	0.6736	2.2143	0.3042
0.31	0.2074	1.1810	0.1755	0.81	0.6815	2.2395	0.3044
0.32	0.2167	1.2025	0.1801	0.82	0.6893	2.2653	0.3043
0.33	0.2260	1.2239	0.1848	0.83	0.6969	2.2916	0.3041
0.34	0.2355	1.2451	0.1891	0.84	0.7043	2.3186	0.3038
0.35	0.2450	1.2661	0.1935	0.85	0.7115	2.3462	0.3033
0.36	0.2546	1.2870	0.1978	0.86	0.7186	2.3746	0.3026
0.37	0.2642	1.3078	0.2020	0.87	0.7254	2.4038	0.3017
0.38	0.2739	1.3284	0.2061	0.88	0.7320	2.4341	0.3008
0.39	0.2836	1.3490	0.2102	0.89	0.7384	2.4655	0.2996
0.40	0.2934	1.3694	0.2142	0.90	0.7445	2.4981	0.2980
0.41	0.3032	1.3898	0.2181	0.91	0.7504	2.5322	0.2963
0.42	0.3130	1.4101	0.2220	0.92	0.7560	2.5681	0.2944
0.43	0.3229	1.4303	0.2257	0.93	0.7612	2.6061	0.2922
0.44	0.3328	1.4505	0.2294	0.94	0.7662	2.6467	0.2896
0.45	0.3428	1.4706	0.2331	0.95	0.7707	2.6906	0.2864
0.46	0.3527	1.4907	0.2366	0.96	0.7749	2.7389	0.2830
0.47	0.3627	1.5108	0.2400	0.97	0.7785	2.7934	0.2787
0.48	0.3727	1.5308	0.2434	0.98	0.7816	2.8578	0.2735
0.49	0.3827	1.5508	0.2467	0.99	0.7841	2.9412	0.2665
0.50	0.3927	1.5708	0.2500	1.00	0.7854	3.1416	0.2500

UNIFORM PLUMBING CODE EXCERPTS

UNIFORM PLUMBING CODE

completely dimensioned, showing of surface, location of all present or channels, water supply lines or wells, lot, number of bedrooms or plumbing fixtures of the private sewage disposal structures.

necessary to assure compliance with the other with a full description of the city, kind and grade of all materials, ship, and methods of assembly and

ground water level as determined by any proposed seepage pit or disposal after absorption characteristics of the y approved percolation tests.

ATTACHMENT II

DI: 800000000-01717-0200-00017

REV 01

PAGE II-2

TABLE I-1

LOCATION OF SEWAGE DISPOSAL SYSTEM

Minimum Horizontal Distance In Clear Required From:	Building Sewer		Septic Tank		Disposal Field		Seepage Pit or Cesspool	
Buildings or structures ¹	2 feet	(.6 m)	5 feet	(1.5 m)	8 feet	(2.4 m)	8 feet	(2.4 m)
Property line adjoining private property	Clear ²		5 feet	(1.5 m)	5 feet	(1.5 m)	8 feet	(2.4 m)
Water supply wells	50 feet ³	(15.2 m)	50 feet	(15.2 m)	100 feet	(30.5 m)	150 feet	(45.7 m)
Streams	50 feet	(15.2 m)	50 feet	(15.2 m)	50 feet ⁷	(15.2 m) ⁷	100 feet ⁷	(30.5 m) ⁷
Trees	—		10 feet	(3 m)	—		10 feet	(3 m)
Seepage pits or cesspools	—		5 feet	(1.5 m)	5 feet	(1.5 m)	12 feet	(3.7 m)
Disposal field	—		5 feet	(1.5 m)	4 feet ⁴	(1.2 m)	5 feet	(1.5 m)
On site domestic water service line	1 foot ⁵	(.3 m)	5 feet	(1.5 m)	5 feet	(1.5 m)	5 feet	(1.5 m)
Distribution box	—		—		5 feet	(1.5 m)	5 feet	(1.5 m)
Pressure public water main	10 feet ⁶	(3 m)	10 feet	(3 m)	10 feet	(3 m)	10 feet	(3 m)

NOTE:

When disposal fields and/or seepage pits are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be fifteen (15) feet (4.6 m).

1. Including porches and steps, whether covered or uncovered, breezeways, roofed porte-cocheres, roofed patios, carports, covered walks, covered driveways and similar structures or appurtenances.

2. See also Section 315(c) of the Uniform Plumbing Code.

3. All drainage piping shall clear domestic water supply wells by at least fifty (50) feet (15.2 m). This distance may be reduced to not less than twenty-five (25) feet (7.6 m) when the drainage piping is constructed of materials approved for use within a building.

4. Plus two (2) feet (.6 m) for each additional foot (.3 m) of depth in excess of one (1) foot (.3 m) below the bottom of the drain line. (See also Section 16.)

5. See Section 1108 of the Uniform Plumbing Code.

6. For parallel construction - For crossings, approval by the Health Department shall be required.

7. These minimum clear horizontal distances shall also apply between disposal field, seepage pits, and the ocean mean higher high tide line.

PRIVATE SEWAGE DISPOSAL SYSTEMS

TABLE I-1

PERCOLATION TEST RESULTS

Page III - 2

Sandia National Laboratories

PO Box 5800
Albuquerque, New Mexico 87185-1399

Managed by Martin Marietta Corporation
for the US Department of Energy

Michael Riggins, Ph.D., P.E.
YMP Las Vegas Operations Department 6314

December 16, 1994
W.B.S. 1.2.3.2.6.2.3
QA: L

Mr. Hector Montalvo
Management and Operations Group
Fluor Daniel, Inc.
101 Convention Center Drive, Suite 524
Las Vegas, NV 89109

Subject: Percolation Tests for the Proposed Leach Field Site at the ESF Muck Storage Area

Dear Mr. Montalvo:

At your request we were on site to monitor the percolation tests for the proposed leach field site at the ESF Muck Storage Area. RSN/REECo conducted the tests and the test results are attached. The tests were monitored by Mr. Roy Johnston of SNL and his field notes are also attached. The tests were conducted in general accordance with the Nevada Administrative Code 444.796 titled "Percolation test procedures: Test data". The tests were conducted under Job Package 95-3 titled "Yucca Mountain Site Characterization ESF Leach Field Percolation Testing", SSCP 8.3.1.14.2.2.

If you have any questions, please contact us.

Respectfully submitted,

Michael Riggins, Ph.D., P.E.
Principal Investigator
YMP-Las Vegas Operations Dept. 6314

MR:6314:mr

Enclosures: Percolation Test Results in a Letter from Dale Herrington dated Dec. 15, 1994
Field Notes from Roy Johnston dated Dec. 12 & 13, 1994

cc: Tim Sullivan	YMSCO/DOE	David Kessel	SNL/6314
Jim Salchak	M&O/Fluor-Daniel		90/1.2.3.2.6.2.3/MGA/1.2/L
Matt Gomez	M&O/Fluor-Daniel		YMP CRF
Ron Smith	M&O/WCFS		6314 Day File
Mikaeey Brady	SNL/6314		

WBS # 1.2.3.5.2.2

QA: QA

**Raytheon Services Nevada
Materials Testing Laboratory
Nevada Test Site**

December 15, 1994

NTS:Q&I:MTL:015-95

David Kessel
Sandia National Laboratories
101 Convention Center Drive, Suite 860, M/S 509
Las Vegas, NV 89109

PERCOLATION TEST RESULTS: YMP ESF MUCK STORAGE AREA

As requested, the Materials Testing Laboratory performed six percolation tests at a depth of four feet and drilled one hole to a depth of six feet beyond the depth of the soil percolation test holes.

Percolation Test #1 yielded a rate of 20.0 minutes per inch.
Percolation Test #2 yielded a rate of 40.0 minutes per inch.
Percolation Test #3 yielded a rate of 60.0 minutes per inch.
Percolation Test #4 yielded a rate of 30.0 minutes per inch.
Percolation Test #5 yielded a rate of 40.0 minutes per inch.
Percolation Test #6 yielded a rate of 6.7 minutes per inch.

The seven test locations which were located and staked by the Raytheon Survey Department, the percolation test results and the drilling logs are attached.

If you have any further questions concerning this matter or need additional tests, please contact Mr. Dale Herrington at 295-6813.

C. Dal Herrington

C. D. Herrington
Senior Specialist

Enclosures
As Stated

#7 Soil Strat. Hole

N 763182.11

E 573266.12

Percol Hole #4

N 763237.0

E 573226.0

Percol Hole #3

N 763237.0

E 573306.0

Percol Hole #2

N 763182.13

E 573306.12

LEACHFIELD

Percol Hole #1

N 763127.0

E 573306.0

Percol Hole #5

N 763182.0

E 573226.0

Percol Hole #6

N 763127.0

E 573226.0

N

H ROAD

FROM: MTL MERCURY

TO: USGS YMP NUOPS

DEC 16, 1994 7:56AM #767 P.04

WBS # 1.2.3.5.2.22

QA: QA

Raytheon Services Nevada

MATERIALS TESTING LABORATORY

P. O. BOX 3228

MERCURY NV 89023

PERCOLATION TESTS RESULTS

NAC 444.706.1 & 2

REQUESTED BY	M. RIGGINS	USER/AGENCY	SANDIA
PROJECT NAME	YMP ESF MUCK STORAGE AREA	REQUEST DATE	12/12/94
ID #	61500 - 3018	LAB #	1569
TESTED BY	D. ANDERSON	DATE TESTED	12/13/94

1 TEST DATA

HOLE DIAMETER (INCHES)	6"	TEST DEPTH (FT)	4 FEET
TIME OF PRESOAKING (HRS)	4 HOURS	WATER IN HOLE	12 INCHES
HOLE #	# 1	AFTER SOAKING	NONE

TIME READING	TIME DIFFERENCE (MINUTES) (1)	DEPTH TO WATER (INCHES)	DEPTH DIFFERENCE (INCHES) (2)	PERCOLATION RATE (MINUTES/INCH) (1)/(2)	COMMENTS
10:00 AM	0	40.00	---	---	
10:30 AM	30	42.50	2.50	12.0	
11:00 AM	30	44.50	2.00	15.0	
11:30 AM	30	45.75	1.25	24.0	
11:30 AM	0	40.00	---	---	
12:00 PM	30	41.00	1.00	30.0	
12:30 PM	30	43.00	2.00	15.0	
01:00 PM	30	40.00	1.50	20.0	
01:30 PM	30	41.25	1.25	24.0	
01:30 PM	0	40.00	---	---	
02:00 PM	30	41.50	1.50	20.0	PERCOLATION RATE

CHECKED BY: D. HERRINGTON

Dab H.

DATE: 12-15-94

FOR INFORMATION ONLY NO SPECIFICATION GIVEN
 THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
 SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
 SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION

WBS # 1.2.3.5.2.2

QA: QA

Raytheon Services Nevada
MATERIALS TESTING LABORATORY
P. O. BOX 328
MERCURY NV 89023

PERCOLATION TESTS RESULTS

NAC 444.796.1 & 2

REQUESTED BY	M. RIGGINS	USER/AGENCY	SANDIA
PROJECT NAME	YMP ESF MUCK STORAGE AREA	REQUEST DATE	12/12/94
ID #	61500 - 3016	LAB #	1570
TESTED BY	D. ANDERSON	DATE TESTED	12/13/94

2 TEST DATA

HOLE DIAMETER (INCHES)	6"	TEST DEPTH (FT)	4 FEET
TIME OF PRESOAKING (HRS)	4 HOURS	WATER IN HOLE	12 INCHES
HOLE #	# 2	AFTER SOAKING	NONE

TIME READING	TIME DIFFERENCE (MINUTES) (1)	DEPTH TO WATER (INCHES)	DEPTH DIFFERENCE (INCHES) (2)	PERCOLATION RATE (MINUTES/INCH) (1)/(2)	COMMENTS
10:05 AM	0	40.00	---	---	
10:35 AM	30	42.00	2.00	15.0	
11:05 AM	30	43.00	1.00	30.0	
11:35 AM	30	43.75	0.75	40.0	
12:05 PM	30	44.75	1.00	30.0	
12:35 PM	30	45.75	1.00	30.0	
12:35 PM	0	40.00	---	---	
01:05 PM	30	40.00	1.00	30.0	
01:35 PM	30	41.00	1.00	30.0	
02:05 PM	30	41.75	0.75	40.0	PERCOLATION RATE

CHECKED BY: D. HERRINGTON *Dale H*

DATE: 12-15-94

FOR INFORMATION ONLY NO SPECIFICATION GIVEN
 THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
 SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
 SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION

WBS # 1.2.3.5.2.2

QA: QA

Raytheon Services Nevada
MATERIALS TESTING LABORATORY
P.O. BOX 328
MERCURY NV 89023

PERCOLATION TESTS RESULTS

NAC 444.796.1 & 2

REQUESTED BY	M. RIGGINS	USER/AGENCY	SANDIA
PROJECT NAME	YMP ESF MUCK STORAGE AREA	REQUEST DATE	12/12/94
ID #	61500 - 3016	LAB #	1671
TESTED BY	D. ANDERSON	DATE TESTED	12/13/94

3 TEST DATA

HOLE DIAMETER (INCHES)	6"	TEST DEPTH (FT)	4 FEET
TIME OF PRESOAKING (HRS)	4 HOURS	WATER IN HOLE	12 INCHES
HOLE #	# 3	AFTER SOAKING	NONE

TIME READING	TIME DIFFERENCE (MINUTES) (1)	DEPTH TO WATER (INCHES)	DEPTH DIFFERENCE (INCHES) (2)	PERCOLATION RATE (MINUTES/INCH) (1)/(2)	COMMENTS
10:10 AM	0	40.00	---	---	
10:40 AM	30	41.50	1.50	20.0	
11:10 AM	30	42.50	1.00	30.0	
11:40 AM	30	43.25	0.75	40.0	
12:10 PM	30	44.00	0.75	40.0	
12:40 PM	30	44.75	0.75	40.0	
01:10 PM	30	45.50	0.75	40.0	
01:10 PM	0	40.00	---	---	
01:40 PM	30	40.75	0.75	40.0	
02:10 PM	30	41.25	0.50	60.0	PERCOLATION RATE

CHECKED BY: D. HERRINGTON *Del H*

DATE: 12-15-94

FOR INFORMATION ONLY NO SPECIFICATION GIVEN
 THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
 SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
 SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION

WBS # 1.2.3.5.2.2

QA: QA

Raytheon Services Nevada
MATERIALS TESTING LABORATORY
P. O. BOX 328
MERCURY NV 89023

PERCOLATION TESTS RESULTS
NAC 444.796.1 & 2

REQUESTED BY	<u>M. RIGGINS</u>	USER/AGENCY	<u>SANDIA</u>
PROJECT NAME	<u>YMP ESEF MUCK STORAGE AREA</u>	REQUEST DATE	<u>12/12/94</u>
ID #	<u>61500 - 3016</u>	LAB #	<u>1572</u>
TESTED BY	<u>D. ANDERSON</u>	DATE TESTED	<u>12/13/94</u>

4 TEST DATA

HOLE DIAMETER (INCHES)	<u>6"</u>	TEST DEPTH (FT)	<u>4 FEET</u>
TIME OF PRESOAKING (HRS)	<u>4 HOURS</u>	WATER IN HOLE	<u>12 INCHES</u>
HOLE #	<u># 4</u>	AFTER SOAKING	<u>NONE</u>

TIME READING	TIME DIFFERENCE (MINUTES) (1)	DEPTH TO WATER (INCHES)	DEPTH DIFFERENCE (INCHES) (2)	PERCOLATION RATE (MINUTES/INCH) (1)/(2)	COMMENTS
10:15 AM	0	40.00	---	---	
10:45 AM	30	42.50	2.50	12.0	
11:15 AM	30	44.00	1.50	20.0	
11:45 AM	30	45.75	1.75	17.1	
11:45 AM	0	40.00	---	---	
12:15 PM	30	41.75	1.75	17.1	
12:45 PM	30	43.25	1.50	20.0	
01:15 PM	30	44.50	1.25	24.0	
01:45 PM	30	45.75	1.25	24.0	
01:45 PM	0	40.00	---	---	
02:15 PM	30	41.00	1.00	30.0	PERCOLATION RATE

CHECKED BY: D. HERRINGTON *D.H.*

DATE: 12-15-94

FOR INFORMATION ONLY NO SPECIFICATION GIVEN
 THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
 SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
 SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION

WBS # 1.2.3.5.2.2

QA: QA

Raytheon Services Nevada
MATERIALS TESTING LABORATORY
 P. O. BOX 328
 MERCURY NV 89023

PERCOLATION TESTS RESULTS

NAC 444.796.1 & 2

REQUESTED BY	M. RIGGINS	USER/AGENCY	SANDIA
PROJECT NAME	YMP ESF MUCK STORAGE AREA	REQUEST DATE	12/12/94
ID #	61500 - 3016	LAB #	1573
TESTED BY	D. ANDERSON	DATE TESTED	12/13/94

5 TEST DATA

HOLE DIAMETER (INCHES)	6"	TEST DEPTH (FT)	4 FEET
TIME OF PRESOAKING (HRS)	4 HOURS	WATER IN HOLE	12 INCHES
HOLE #	# 5	AFTER SOAKING	NONE

TIME READING	TIME DIFFERENCE (MINUTES) (1)	DEPTH TO WATER (INCHES)	DEPTH DIFFERENCE (INCHES) (2)	PERCOLATION RATE (MINUTES/INCH) (1)/(2)	COMMENTS
10:20 AM	0	40.00	---	---	
10:50 AM	30	41.00	1.00	30.0	
11:20 AM	30	42.00	1.00	30.0	
11:50 AM	30	42.75	0.75	40.0	
12:20 PM	30	43.00	0.25	120.0	
12:50 PM	30	43.75	0.75	40.0	
01:20 PM	30	44.25	0.50	60.0	
01:50 PM	30	44.50	0.25	120.0	
02:20 PM	30	45.25	0.75	40.0	PERCOLATION RATE

CHECKED BY: D. HERRINGTON *Dale H*

DATE: 12-15-94

FOR INFORMATION ONLY NO SPECIFICATION GIVEN
 THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
 SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
 SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION

WBS # 1.2.3.5.2.2

QA: QA

Raytheon Services Nevada
MATERIALS TESTING LABORATORY

P.O. BOX 328

MER C U R Y N V. 89023

PERCOLATION TESTS RESULTS

NAC 444.796.1 &.2

REQUESTED BY	M. RIGGINS	USER/AGENCY	SANDIA
PROJECT NAME	YMP ESF MUCK STORAGE AREA	REQUEST DATE	12/12/94
ID #	61500 -- 3016	LAB #	1574
TESTED BY	D. ANDERSON	DATE TESTED	12/13/94

6 TEST DATA

HOLE DIAMETER (INCHES)	6"	TEST DEPTH (FT)	4 FEET
TIME OF PRESOAKING (HRS)	4 HOURS	WATER IN HOLE	12 INCHES
HOLE #	# 6	AFTER SOAKING	NONE

[illegible]

CHECKED BY: D. HERRINGTON *Deb H.*

DATE: 12-15-94

**FOR INFORMATION ONLY NO SPECIFICATION GIVEN
THIS TEST REQUIRES NO CALIBRATED EQUIPMENT.
SEE ATTACHED PLOT PLAN FOR TEST HOLE LOCATIONS
SEE ATTACHED DRILLING LOGS FOR SOIL DESCRIPTION**

[illegible]

NO CALIBRATED EQUIPMENT USED

[illegible]

NO CALIBRATED EQUIPMENT USED

ASTM 2488	MURKIN	Area: 25	Lab #: 1574
Project: YMP EST MUCK STORAGE AREA	Drilled by: D. ANDERSON	Date: 12/2/94	
Boring No.: #6	Checked by: D. HERRINGTON	Date: 12-15-94	
Hole Diameter: 6"			

[illegible]

NO CALIBRATED EQUIPMENT USED

LOG OF BORING	Raytheon Services Nevada	JOB NO. 51500
ASTM 1452	MATERIALS TESTING LABORATORY	SUB JOB NO. 3016
ASTM 1586	P.O. BOX 328	DATE TYPED 12/15/94
ASTM 2488	MERCURY, NV 89029	PAGE 7 OF 9

Project: YMP ESF MUCK STORAGE AREA Area: 25 Lab #: 1575
 Boring No.: #7 Drilled by: D. ANDERSON Date: 12/12/94
 Hole Diameter: 6" Checked by: D. HERRINGTON *Del. H.* Date:

Depth in Feet	Blow Counts	No of Samples	Depth Sampled	Texture	Color Moisture Compaction	Estimated Grading			Remarks
						Maximum Size	Retained % on # 4	Passing % # 200	
0				Gravelly	Light Brown				
TO				Fine sandy	Dry				
3' 8"	N/A	1	3' 8"	Silt	Loose	2"	15	15	Easy to drill
3' 8"				Gravelly	Light Brown				
TO				Fine sandy	Dry				
5' 5"	N/A	1	5' 5"	Silt	Stiff	1"	20	15	Medium difficulty to drill
5' 5"				Gravelly	Light Brown				
TO				Fine sandy	Dry				
10'	N/A	1	10'	Silt	Stiff	1"	15	15	Medium difficulty to drill
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NO CALIBRATED EQUIPMENT USED

RAYTHEON SERVICES NEVADA

SECTION 02740

SANITARY SEWAGE TREATMENT SYSTEM

SECTION COVER SHEET

0	10/19/92	Issued for Construction	HC 10.19.92	BTH 10/19/92	GRM 10/19/92	BTS 10/19/92
REV	DATE	REVISION DESCRIPTION	DE	SE	LDE	SCDM

REMARKS

SECTION 02740

SANITARY SEWAGE TREATMENT SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

Work covered in this section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Sanitary Sewage Treatment System as specified herein and as indicated on the Drawings.

1.02 RELATED WORK

Section 02730 - Sanitary Sewer Collection System

Section 02220 - Trenching, Excavation, and Backfill

SECTION 03300 - CAST-IN-PLACE CONCRETE

1.03 REFERENCES

A. American Society For Testing and Materials (ASTM)

1. ASTM A 615-90 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
2. ASTM C 33-90 Standard Specification for Concrete Aggregates.
3. ASTM C 150-92 Standard Specification for Portland Cement
4. ASTM C 330-89 Standard Specification for Lightweight Aggregates for Structural Concrete
5. ASTM F 405-89 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings
6. ASTM F 481-87 Standard Recommended Practice for Installation of Thermoplastic Pipe and Corrugated Tubing in Septic Tank Leach Fields
7. ASTM C-858-83 STANDARD SPECIFICATION FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE (REAPPROVED 1990)

1.04 FUNCTIONAL REQUIREMENTS

The system consists of a septic tank used to treat the sanitary sewage coming from the surface based Exploratory Studies Facility (ESF). The liquids will overflow from the tank and be distributed through a dosing tank and distribution box to the leach field. The leach field will pipe the liquids over a bed of pervious drain medium. The liquid will then percolate into the prepared drain bed and on into the ground.

1.05 QUALITY ASSURANCE

- A. Quality Assurance will be conducted in accordance with Section 01400.
- B. Products covered by this Section shall be considered not important to waste isolation or radiological safety.

ATTACHMENT 1 page 1 of 5

FLR# _____

02740 - 2

C. Acceptance of Product:

1. Receipt Verification: Dimensional/visual inspection of the septic tank and leach field components (HOLD point).
2. Field Verification: Dimensional/visual inspection of the installed Sewage Treatment System components (HOLD point).

PART 2 PRODUCTS

2.01 SEPTIC TANK

- A. Septic tanks shall be precast concrete, watertight below the cover exclusive of the inlet and outlet, ~~and shall be built so as to constitute a separate structure.~~
- B. Septic tanks shall have a minimum of two compartments. The inlet compartment side of the tank shall not be less than two-thirds of the total capacity of the tank.
- C. The capacity of the tank shall be as indicated on the Drawings. The minimum liquid capacity of the tank shall be measured from below the outlet. The liquid depth shall not be less than 30 inches or more than 5 feet. The freeboard shall be at least 9 inches or 20% of the liquid depth, whichever is greater.
- D. The inlet invert must enter the septic tank at least 3 inches above the liquid level. A vented inlet tee or baffle must penetrate at least 6 inches below the liquid level, but not greater than that allowed for the outlet device. The vented outlet tee or baffle must extend a distance below the liquid level equal to 40 percent of the liquid depth. The vented inlet and outlet device must extend above the liquid line to approximately 2 inches from the top of the septic tank, or provide a vent openings of 12 square inches. The inlet and outlet pipes where they pass through the septic tank walls must be sealed.
- E. The inlet and outlet pipe between the tank and firm ground beyond the excavation made to install the tank shall be cast iron pipe. The joint between the tank and the pipe shall be made watertight.
- F. ^{A MINIMUM OF 2 SHALL} ~~*Two manholes will~~ be provided to each septic tank with a minimum dimension of 20 inches square or 24 inch diameter on the top. Manholes shall extend to ~~within at least twelve inches of the ground surface and be provided with substantial~~ ^{TRAFFIC RATED (45-20)} concrete, steel, or cast iron cover.
- G. Plans for all septic tanks must be submitted ~~to the state for approval.~~ The plans must show all dimensions, reinforcing, structural calculations and other pertinent data, ~~as may be required.~~ Independent laboratory tests and calibrations may be required on prefabricated septic tanks. ~~Septic tanks must be constructed of sound durable materials, not subject to excessive corrosion or decay and be watertight. Each tank must be structurally designed to withstand all anticipated earth or other loads and be installed level and on a solid bed. Watertight materials must be used. The tank shall be precast concrete specifically for septic tank use, and All septic tanks must conform to the design on the drawings, and all buildings must be done under strict controlled supervision by the manufacturer. Any changes in design must be submitted to the state for approval. Any septic tank manufactured anywhere but in its permanent location, must be permanently and legibly marked as to manufacturer, total tank capacity, liquid capacity and general location of~~

CONSTRUCTED OF

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manufacturing firm. Tanks must be so designed as to support an earth load of not less than 300 pounds per square foot or 4 feet of earth cover plus 200 pounds per square foot surcharge plus any other anticipated loads. All concrete septic tanks must be protected from corrosion by coating the inside with an approved bituminous coating ~~or by other acceptable means. The coating must extend to at least 4 inches below the water line and cover all of the internal area above that point.~~ All aggregates fine and coarse, ~~other than lightweight aggregate, must conform to specifications outlined by ASTM C-33. Lightweight aggregates, fine and coarse, must conform to the specifications outlined by ASTM C-330.~~ Aggregates must be free of deleterious substances causing reactivity with oxidized hydrogen sulfide. Both types of aggregate must be graded in a manner to produce a homogeneous concrete mix. All materials are to be accurately weighed at a central batching facility for mixing. All cement must be Portland cement conforming to ASTM C-150 Type V. Cement content must be sufficient to produce a minimum strength of 3,000 PSI, ~~or other design strengths required.~~ All concrete must be handled from the ~~mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until the approved unit operation is completed. Each pour must be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle must be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.~~ All reinforcing steel, including welded wire mesh, must be of the size and in the location as shown on the plans. All reinforcing must be sufficiently tied to withstand any displacement during the pouring operation. All bars must be intermediate or hard graded billet steel conforming to ASTM A 615, grade 40. Bars must be deformed in accordance with ASTM A 615. ~~Inspection by the state may be required of the tank reinforcing steel before any concrete is poured. Back-filling must be carefully done to prevent damage to the tank. Before back-filling, each septic tank must be adequately supported and may be required at the discretion of the state inspectors, to be filled with water to determine that it is watertight. The tank must be level after setting.~~

2.02 DISTRIBUTION BOX

— BY the Engineer or Designer

- A The distribution box shall be the size indicated on the Drawings. The box shall be of watertight construction. ~~A masonry baffle at least six inches high and twelve inches long shall be placed transversely to the distribution box inlet and 6 inches in front of it. The box shall be provided with a masonry or steel removable cover.~~ AND

- B. CONSTRUCTION AND MATERIAL SHALL conform to the same Requirements as the
2.03 DISTRIBUTION PIPE ~~SEPTIC TANK AS Identified in 2.01 or shall be precast~~
~~conforming to the Requirements of ASTM C 854.~~

Distribution pipe shall be the size and length indicated on the Drawings. The pipe shall conform to the requirements of ASTM F 405.

2.04 DRAIN MEDIUM

Drain medium around the leach lines shall be crushed stone or crushed gravel meeting the requirements of ASTM C 33, grading 4.

2.05 BACKFILL MATERIAL

Backfill shall conform to the requirements for Pipe Bedding Material specified in Section 02220.

2.06 DOSING TANK

- A. Construction and materials shall conform to the same requirement of septic tank construction as identified in Section 2.01 above *or shall be precast conforming to the requirements of ASTM C 858.*
- B. The tank shall be constructed in a manner that will permit venting the absorption system.
- C. The syphon shall be constructed of chemical resistant materials which are unaffected by the fluids found in domestic sewage. All bolts and hardware shall be stainless steel.
- D. There shall be no moving parts nor shall the syphon require any electrical power to operate.
- E. The syphons shall be installed at a different elevation within the tank. This difference shall only be 1 to 2 inches.
- F. The syphons shall conform to the requirements as set forth by Fluid Dynamic Siphons, Inc., of Steamboat Springs, Colorado or approved equal.

PART 3 EXECUTION

3.01 TRENCHING, EXCAVATION, AND BACKFILL

Trenching, Excavation, and Backfill shall be performed in accordance with Section 02220.

3.02 SEPTIC TANK INSTALLATION

The tank excavation shall extend a minimum of 2 feet beyond the outer limits of the tank. The bottom may be over excavated and the tank placed on bedding material to facilitate leveling. The tank shall be installed level ~~to within 1% of level for every 15 feet of horizontal dimension. In no way shall the contractor use this tolerance to place the tank in a manner that will, in the opinion of the state or A/E inspectors, create low spots in the tank that would prevent the septic tank from operating as it should.~~ The installed tank shall be watertight. The Contractor shall submit a leak test procedure to the A/E for approval.

3.03 DISTRIBUTION BOX INSTALLATION

The box excavation shall extend a minimum of 2 feet beyond the outer limits of the box. The bottom may be over excavated and the tank placed on bedding material to facilitate leveling. The box shall be installed level ~~to within 1% in the horizontal direction.~~

3.04 DISTRIBUTION PIPE

The pipe shall be installed according to the details shown on the Drawings, according to the lines and grades indicated, and according to ASTM F 481. The excavation for the pipe shall extend a minimum of 2 feet beyond the pipe.

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page 4 of 5
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3.05 DOSING TANK INSTALLATION

The box excavation shall extend a minimum of 2 feet beyond the outer limits of the box. The bottom may be over excavated and the tank placed on bedding material to facilitate leveling. The box shall be installed level, ~~to within 1% in the~~
~~horizontal direction.~~

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3.06 FIELD QUALITY CONTROL

At the completion of the septic system installation, a registered professional engineer, registered to practice as a Professional Civil Engineer (PE) in Nevada, shall review the installation. This PE shall submit a report to the State of Nevada Division of Environmental Protection that this system has been installed in accordance with the state approved and permitted, plans and specifications. This report shall bear the seal, signature and date of the PE. Copies of these reports shall also be sent to the Project Office Project and Operations Control Division.

PART 4 SUBMITTALS AND NOTIFICATIONS

4.01 SUBMITTALS

- A. Submittals shall be in accordance with Form LV-370.
- B. Submit manufacturer's and/or shop drawings for septic tank, dosing tank distribution box construction drawings showing reinforcement and construction procedures.
- C. Submit manufacturer's data for distribution pipe.
- D. Submit gradation sample of material to be used for absorption trench.
- E. Submit leak test report.

4.02 NOTIFICATION

- A. Notify the A/E and state prior to the backfill of any portion of the system described herein, so the constructed product may be inspected.
- B. Should any change in the Specification Package be required to comply with these requirements, notify the A/E in writing for review and approval.

SHEET OF

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED[illegible]

COMMENTS:

*** END OF SECTION ***

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

WBS: 1.2.6
QA QA

By _____ Date 1/5/94

Civilian Radioactive Waste Management System
Management and Operating Contractor

RECEIVED

JAN 07 1994

Specification Section 02730

DOCUMENT AND RECORDS CENTER

SANITARY SEWER SYSTEM COLLECTION SYSTEM
CI.16.2000

Document Identifier: BAB000000-01717-6300-02730 REV. 01
QA Classification: ~~MC~~ ~~SV~~ ~~SS~~ ~~TH~~ ~~NO~~ Q 12/29/93

This Specification includes QA Controls ☒ Yes ☐ No including permanent items classified as QA-1, 2, 3... etc.

Revision No.	Date
00	11/03/93
	10/01/93 <u>MC</u> <u>12/2/93</u>
01	12/10/93 <u>MC</u> <u>12/21/93</u>
	<u>12/21/93</u>

ATTACHMENT A
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**NOTICE OF OPEN CHANGE
DOCUMENTS**

**THIS DOCUMENT IS IMPACTED BY THE
LISTED CHANGE DOCUMENT AND CANNOT
BE USED WITHOUT THEM**

CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR 94/150	AL	3/22/94	OPEN
FCR 94/204	TK	5/16/94	OPEN

**NOTICE OF OPEN CHANGE
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BE USED WITHOUT THEM**

CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS

BAB000000-01717-6300-02730

Certification of Design
Specification

Complete only applicable items.

Title of Design Specification SANITARY SEWER SYSTEM COLLECTION SYSTEMDocument Identifier: BAB000000-01717-6300-02730Revision Number 01

This specification covers QA Classification TCV 155 ^{1/14/93} ~~ME~~ items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐No ☒If Yes, identify attachment(s):

_____Prepared by [Signature] Date 12/17/93Reviewed by Ray D. Clark Date 12/11/93Reviewed by [Signature] Date 12-17-93Reviewed by N/A Date _____Reviewed by [Signature] Date _____Verified by [Signature] Date 1-4-94Approved by [Signature] Date 12/21/93QA Approval Fred Att Date 1-5-94

Civilian Radioactive Waste
Management System

Revision Description

WBS: 1.2.6
QA Class: QA
Page: 3 of: 7

Management & Operating
Contractor

Complete only applicable items.

<i>Revision No.</i>	<i>Pages Revised and Description</i>
01	Issued for Construction

SECTION 02730

SANITARY SEWER COLLECTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor to construct a Sanitary Sewer Collection System, complete, as indicated on the Drawings.

1.02 RELATED SECTIONS

(NOT USED)

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C144E1-91	Standard Specification for Aggregate for Masonry Mortar
2. ASTM C150-92	Standard Specification for Portland Cement
3. ASTM C478BE1-90	Standard Specification for Precast Reinforced Concrete Manhole Sections
4. ASTM D2321-89	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
5. ASTM D3034-89	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
6. ASTM D3212-92	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

1.04 QUALITY ASSURANCE

- A. Quality Assurance shall be conducted in accordance with Specification Section 01400.
- B. Products covered by this Specification Section shall be considered not important to waste isolation or radiological safety. *(TBV-155) JTW 12/29/93*
- C. Acceptance of Product
1. Receipt Verification: Dimensional/visual inspection of the Sanitary Sewer Collection System components. (WITNESS POINT)

2. Field Verification: Dimensional/visual inspection of the installed Sanitary Sewer Collection System components. (WITNESS POINT)

D. SEE ATTACHMENT B PAGE 121 for PARAGRAPH.

PART 2 PRODUCTS

2.01 SEWER PIPE

- A. Sewer Pipe shall be Polyvinyl Chloride (PVC) conforming to the requirements of ASTM D3035 side/diameter ratio (SDR) 35.
- B. Pipe joints shall conform to ASTM D3212.

2.02 MANHOLES

- A. Manholes shall conform to the requirements of ASTM C478.
- B. Manhole lid and frame shall be solid cast iron. frame minimum 4-inches high with minimum 21-inch clear opening and with traffic rating indicated on the Drawings. The lid shall be unwe. Frame shall be furnished with six 3/4-inch bolt holes.
- C. Joint sealant between manhole sections and between the base and the first section shall be a premolded bitumastic material expressly manufactured for that purpose.
- D. Grout for jointing the sections shall be composed of Portland Cement conforming to ASTM C and sand meeting the requirements of ASTM C144.
- E. Manhole bases may be either cast-in-place or precast. If cast-in-place, the concrete shall conform to Specification Section 03300.

2.03 PIPE BEDDING MATERIAL

Pipe Bedding Material shall conform to the requirements of Specification Section 02220.

PART 3 EXECUTION

3.01 TRENCHING, EXCAVATION, AND BACKFILL

- A. Trenching, Excavation, and Backfill shall be performed in accordance with Specification Section 02220.

- B. Sewer pipe shall be ^{installed} bedded in Pipe Bedding Material, in accordance with ASTM D2321 and indicated on the Drawings, and shall be bedded in Pipe Bedding Material in accordance with Specification Section 02220.

3.02 MANHOLE BASES

Inverts shall be hand formed to provide smooth flow of the sewage through the manhole, whether the base is precast or cast-in-place.

3.03 TESTING

- A. Backfill shall be tested as specified in Specification Section 02220.
- B. Lamp Testing: Each new sewer line shall be lamped between manholes to determine proper grade and alignment and to ascertain that it is free of obstructions. Ninety percent of full circle shall be considered acceptable.
- C. ~~Leak Testing: Air Testing: The minimum time interval allowable for a pressure drop from 3.5 psi to 3.0 psi for air exfiltration tests performed between two consecutive manholes shall be 4 minutes for 6 inch pipe and 5 minutes for 8 inch pipe. See Pages 2 of 3 and 3 of 3 of Attachment B for details.~~
- D. Mandrel Testing: Not less than 30 days after installation and backfill of PVC sewer lines, the pipe shall be tested for deflection with a mandrel (Go/NoGo device). The minimum radius of each mandrel shall be 94 percent of the nominal inside radius of the line being tested and shall have a length not less than the pipe diameter. The mandrel shall pass freely through the pipe when pulled by hand.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

- A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.
- B. Submit manufacturer's design data for manhole sections, including reinforcing.
- C. Submit manufacturer's data for manhole lid and frame.
- D. Submit manufacturer's data for bitumastic joint sealant with manufacturer's certification that use in sanitary sewer manholes is a proper use of the material.

4.02 NOTIFICATION

- A. Notify the Architect/Engineer (A/E) two working days prior to any leak tests or mandrel tests so they can be observed by the A/E QC Inspector. (WITNESS POINT)
- B. Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

C. TEST FOR LEAKAGE

Each section of sewer between two successive manholes shall be tested for leakage. If the leakage rate as shown by the tests specified herein is greater than the amount specified, the pipe joints shall be repaired or, if necessary, the pipe shall be removed and relaid. The sewer will not be considered acceptable until the leakage rate, as determined by test, is less than the allowable.

The Contractor shall water test for leakage all sections of pipe between structures. Where the difference in elevation between the invert of the upper structure and the invert of the lower structure is more than 10 feet, then the air test shall be made.

(1) Water Test

Each section of sanitary sewer, between two successive structures, shall be tested by closing the lower ends of the sewer to be tested and the inlet sewer of the upper structure with plugs or stoppers and filling the pipe and structure with water to a point 4 feet above the invert of the open sewer in the upper structure.

The total leakage shall be the decrease in volume of water in the upper structure. the leakage shall not exceed 4 gallons per 24 hours per inch of nominal diameter of pipe per 100 feet of sewer pipe being tested. The test shall last a minimum of 24 hours.

If leakage, as shown by the test, is greater than allowed, the pipe shall be overhauled and, if necessary, replaced and relaid until the joints and pipe shall hold satisfactorily under this test.

(2) Air Test Procedure

Each section of sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs. air shall be slowly added until the internal pressure is raised to 4.0 psig. The compressor used to add air to the pipe shall have a blow-off valve set at 5 psig to assure that at no time the internal pressure in the pipe exceeds 5 psig. The internal pressure of 4 psig shall be maintained for at least two minutes to allow temperature to stabilize after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psig. The time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig shall be measured and the results compared with the values as tabulated.

Pipe Diameter Inches	Test Time in Seconds	Minimum Distance Between Manholes Feet
4	115	650
6	170	450
8	227	350

The above tabulated values shall be used for the respective diameter pipes except where the distance between successive manholes is less than the above tabulated values, in which case the following formula will be used to determine the test time:

$$T = 0.00183 d^2 L$$

T = Test Time in Seconds

d = Inside Diameter of Pipe in Inches

L = Distance Between Successive Manholes in Feet

If the pressure drop from 3.5 psig to 2.5 psig occurs in less time than the above tabulated or calculated values, the pipe shall be overhauled and, if necessary, replaced and relaid until the joints and pipe shall hold satisfactorily under test.

At the end of air testing, all manholes shall be water tested to insure they are water tight per the above described water test.

1.04 D. 0 Control shall apply: Final completion of this product shall be based on the Contractors submittal of a procedure to the Architect/Engineer (A/E) for approval that addresses repeating, on an annual bases, either the air or water test of the sanitary sewer system as required under this specification. The purpose of this annual test is to assure the client that the systems has not developed any leaks. This inspection procedure shall address inspection of the system every month once the system is put into use. If leaks are detected during this inspection, the potable water system shall be turned off and leak found and repaired prior to the potable system being turned back on. Should this procedure require revision, the A/E shall review and accept the change.

ATTACHMENT B
PAGE 1 OF 1

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SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

[illegible]

END OF SPECIFICATION SECTION