Y/TS-1374

MARTIN MARIETTA

ANALYSIS OF FECAL COLIFORM LEVELS AT SELECTED STORM WATER MONITORING POINTS AT THE OAK RIDGE Y-12 PLANT

B. E. Skaggs

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Health, Safety, Environment,
and Accountability Organization

July 1995

Prepared by the
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
operated by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
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DISCLAIMER

Introduction

The Environmental Protection Agency staff published the final storm water regulation on November 16, 1990. The storm water regulation is included in the National Pollutant Discharge Elimination System (NPDES) regulations. It specifies the permit application requirements for certain storm water discharges such as industrial activity or municipal separate storm sewers serving populations of 100,000 or greater. Storm water discharge associated with industrial activity is discharge from any conveyance used for collecting and conveying storm water that is directly related to manufacturing, processing, or raw material storage areas at an industrial plant. Quantitative testing data is required for these discharges.

An individual storm water permit application was completed and submitted to Tennessee Department of Environment and Conservation (TDEC) personnel in October 1992. After reviewing this data in the permit application, TDEC personnel expressed concern with the fecal coliform levels at many of the outfalls. The 1995 NPDES Permit (Part III-N, page 44) requires that an investigation be conducted to determine the validity of this data. If the fecal coliform data is valid, the permit requires that a report be submitted indicating possible causes and proposed corrective actions.

Data Analysis

Several sets of data were reviewed by Y-12 Plant personnel to identify elevated values for fecal coliform. For the purpose of this investigation, an "elevated value" was determined to be a value greater than the water quality standard for fecal coliform in each particular stream. The following data sets were reviewed: (1) analytical data supplied as part of the 1992 storm water permit application for the Oak Ridge Y-12 Plant, (2) data collected as a part of the Fecal Coliform Special Study conducted at the Y-12 Plant, (3) data collected as part of the Y-12 Plant Environmental Surveillance Project No. 1103, (4) data supplied as part of the NPDES permit application for the Oak Ridge National Laboratory, and (5) data for selected monitoring points at the K-25 Site.

Fecal Coliform Special Study

During May and June 1995, sampling for fecal coliform was performed at East Fork Poplar Creek (EFPC) in-stream locations. Three locations above Lake Reality (Outfall 200, Monitoring Station 8, and the inlet to Lake Reality) and one below Lake Reality (Monitoring Station 17) were selected for this study. Grab samples were taken daily at each location for a period of two weeks. The purpose of this study was to provide a comparison of the mean values for coliform to the General Water Quality Criteria for the recreational use classification. This data is provided in Appendix A. In general, the data demonstrates that the stream conforms to the recreational use criteria of 200 colonies per 100 mL except during wet conditions. This could be an indication of exfiltration in the lines or overflow at cross-connections of wastewater from the sanitary sewer collection system to the storm drain system.

Environmental Surveillance Project No. 1103

Since June 1993, 17 locations which reported elevated fecal values in the 1992 storm water permit application were resampled during wet and dry events. A project plan has been developed and implemented and is included as Appendix B. The data obtained from monitoring conducted under the plan is presented in Appendix C. In general, this data is lower than the data included in the permit application; however, the data indicates that values are elevated during wet weather conditions.

Locations with Elevated Values

Sampling at the following storm water outfalls which discharge to EFPC resulted in values greater than the recreational water quality standard for coliform in individual samples in EFPC: 002, 003, 006, 007, 011, 014, 017, 045, 046, 057, 062, 086, 110, and 200.

Sampling at the following outfalls and monitoring points on Bear Creek or Bear Creek tributaries resulted in values greater than the recreational water quality standard for coliform in individual samples in Bear Creek: S01, S02, S03, S04, S05, S06, S07, S08, S09, S10, S11, S12, S13, and S14.

Sampling at the following outfalls and monitoring points resulted in values greater than 1,000 colonies per 100 mL; these points are located along tributaries of the Clinch River: S15, S16, S17, S18, S20, and S21.

Quality Assurance/Quality Control

Samples were taken at random points along the Y-12 Plant sanitary sewer collection system to determine typical values of fecal coliform in raw sewage. This data was compared to values of fecal coliform found in the storm water permit application. Fecal coliform values for raw sewage ranged from 125,000 to 547,000 colonies per 100 mL. The values listed in the storm water permit application ranged from <1 to 200,000 colonies per 100 mL. These values can be found in Appendix D. In most instances, the storm water samples did not exhibit elevated values for fecal coliform as compared to typical values for raw sewage.

In order to evaluate the analytical techniques used in the laboratory, samples were split and taken to two different laboratories; and a comparison of the resulting data was made. The two laboratories provided consistent results. Field blanks taken during this sampling event revealed that proper sampling techniques were successful in preventing contamination of samples. Therefore, it is believed that sampling techniques and analysis are providing reliable results. Tabular data from this analysis is presented in Appendix E.

Possible Causes

As indicated in the Permit Rationale Section of the NPDES Permit, some storm water outfalls are located near to, or cross, sanitary sewer lines. Elevated levels at these outfalls could indicate a local break in the sanitary sewer system. However, of the outfalls with elevated values, only five are in close proximity to sanitary sewer lines: 007, 014, 045, 110, and 200.

The Y-12 Plant is underlaid with an old and extensive system of storm drains and sanitary sewer collection lines. Breaks and blockages have occurred over recent years and have been quickly repaired; however, the incidents serve as an indication of the condition of the existing systems. The August 1993 report, "Y-12 Plant Sanitary Sewer Collection System Flow Study," provides information on the deficiencies of the sanitary collection system and addresses the increase in flow during major rain events. This increased flow is attributed to inflow and infiltration. Additionally, it is known that cross-connections exist between storm and sanitary sewers. Data collected during wet and dry weather conditions is presented in Appendices A and C. The data shows an increase in concentrations of fecal coliform during wet weather conditions, even in storm drains at locations not immediately adjacent to sanitary sewers. Exfiltration from sewer lines has possibly migrated to enter at joints in the storm drains, and is probably the primary contributor to storm drains not immediately adjacent to sanitary sewers.

Because some of the storm water monitoring points are located in nonindustrialized areas, it is believed that some of the elevated values for fecal coliform are primarily due to the wildlife present in the area. Fecal coliform data from similar locations at the Oak Ridge National Laboratory range from 24 to >6,000 colonies per 100 mL, while data from similar locations at the K-25 Site range from 1 to 11,000 colonies per 100 mL. Therefore, it is possible that wildlife is contributing to the fecal coliform values in nonindustrialized areas of the Y-12 Plant site. This would also be true for storm water outfalls along the south bank of EFPC which would be impacted by runoff from Chestnut Ridge.

Proposed Actions

The Y-12 Plant Sanitary Sewer Upgrade (SSU) line item project is an integral part of the effort to reduce fecal coliform levels in EFPC. The SSU project is intended to reduce the potential for blockages and back-ups of wastewater in the sanitary sewer system which could result in overflows of sewerage to EFPC. More than 250 manhole deficiencies and 11,900 feet of sewer line are scheduled to be repaired or replaced. Currently the Y-12 Plant sewer system flow increases in excess of 100 percent during rainfall events as a result of inflow and infiltration. The same sewer line deficiencies which could allow inflow and infiltration may also be conducive to exfiltration of sewerage into the surrounding soil, groundwater, and EFPC drainage area.

Sources of infiltration and/or exfiltration include deteriorated lines, joint separations, and manhole deficiencies. Selected lines and manholes will be rehabilitated through replacement and slip-lining. Sources of inflow, including cross-connections, roof drains, and deficient manhole covers, will

also be addressed under this project. Some roof drains have already been rerouted to the storm sewer, and activities have been initiated to identify and reroute any remaining roof drains through normal maintenance activities. Another component of the SSU project is to replace the force main serving the west end of the Y-12 Plant. The force main has had recent failures that could have contributed to the fecal coliform levels in EFPC.

The SSU project is currently scheduled to begin video surveying of the entire collection system in August 1995. Upon completion of the video work, tentatively scheduled for fall 1995, detail design work of the line repair/replacement will be initiated. Actual construction of line rehabilitation work is presently scheduled to begin in August 1996 and be completed in August 1997. Work under this proposed schedule is contingent on availability of funds.

Actions will be taken to eliminate the sanitary sewer line at the East Pistol Range near Outfall 7. Because values for fecal coliform have been elevated at Outfall 7, the sanitary sewer line will be closed or eliminated to remove a potential source of contamination. It is believed that this sanitary sewer line is cross-connected or leaking.

Fecal coliform monitoring will continue to evaluate possible sources and will be conducted as detailed in the Storm Water Pollution Prevention Plan. The NPDES Permit requires a minimum of 25 storm water characterizations each year. Sampling may be expanded, if necessary, as sources of fecal coliform in storm water continue to be investigated.

APPENDIX A

Data
Fecal Coliform Special Study

Date	Weather	Monitoring Point	Fecal Coliform, co./100 mL
5/22/95	Dry	Station 17	270
5/22/95	Dry	Lake Reality Inlet	77
5/22/95	Dry	Station 8	24
5/22/95	Dry	Outfall 200	2
5/23/95	Dry	Station 17	280
5/23/95	Dry	Lake Reality Inlet	42
5/23/95	Dry	Station 8	23
5/23/95	Dry	Outfall 200	1
5/24/95	Dry	Station 17	88
5/24/95	Dry	Lake Reality Inlet	62
5/24/95	Dry	Station 8	38
5/24/95	Dry	Outfall 200	1
5/25/95	Dry	Station 17	92
5/25/95	Dry	Lake Reality Inlet	39
5/25/95	Dry	Station 8	22
5/25/95	Dry	Outfall 200	1
5/26/95	Dry	Station 17	50
5/26/95	Dry	Lake Reality Inlet	20
5/26/95	Dry	Station 8	48
5/26/95	Dry	Outfall 200	1
5/30/95	Dry	Station 17	78
5/30/95	Dry	Lake Reality Inlet	77
5/30/95	Dry	Station 8	120
5/30/95	Dry	Outfall 200	150
5/31/95	Dry	Station 17	80
5/31/95	Dry	Lake Reality Inlet	87
5/31/95	Dry	Station 8	240
5/31/95	Dry	Outfall 200	52
6/1/95	Dry	Station 17	60
6/1/95	Dry	Lake Reality Inlet	150
6/1/95	Dry	Station 8	250
6/1/95	Dry	Outfall 200	94
6/2/95	Wet	Station 17	4,400
6/2/95	Wet	Lake Reality Inlet	16,000
6/2/95	Wet	Station 8	9,200
6/2/95	Wet	Outfall 200	7,700
6/5/95	Dry	Station 17	1,000
6/5/95	Dry	Lake Reality Inlet	80
6/5/95	Dry	Station 8	150
6/5/95	Dry	Outfall 200	19

APPENDIX B

Y-12 PLANT ENVIRONMENTAL SURVEILLANCE PROJECT ACTION PLAN

PROJECT NO. 1103

Project History

The Environmental Protection Agency (EPA) staff published the final storm water regulation on November 16, 1990. The storm water regulation is included in the National Pollutant Discharge Elimination System (NPDES) regulations. It deals with permit application requirements for certain storm water discharges such as industrial activity or municipal separate storm water sewers serving populations of 100,000 or greater. Storm water discharge associated with industrial activity is discharge from any conveyance used for collecting and conveying storm water that is directly related to manufacturing, processing, or raw material storage areas at an industrial plant. Quantitative testing data is required for these discharges. It is to be reported on EPA Form 2F.

An initial storm water permit application was completed and submitted to Tennessee Department of Environment and Conservation (TDEC) personnel in October 1992. After reviewing this data, TDEC personnel expressed concern with the fecal coliform levels at many of the outfalls. The 1995 NPDES Permit (Part III-N, page 44) requires that an investigation be conducted to determine the validity of this data. If the fecal coliform data is valid, the permit requires that a report be submitted indicating possible causes and proposed corrective actions.

Project Objective

The objective of the project is to determine the validity of the fecal coliform data obtained during the initial storm water characterization.

Project Description

Sampling will be done by obtaining a grab sample at each of these outfalls during one dry weather event and sometime during one storm event. Storm event sampling will be performed if the storm event occurs after 72 hours of less than 0.1 inches of precipitation. The storm event must be at least 0.1 inches. Where feasible, the variance in the duration of the event and the total rainfall of the event should not exceed 50 percent from the average or median rainfall event in this area. According to Scientific Application International Corporation (SAIC), for the Central United States Rain Zone (which contains East Tennessee) an average rainfall event has a duration of 9.2 hours and a magnitude of 0.62 inches. This translates to a rainfall that has a magnitude between 0.31 and 0.93 inches with a duration between 4.6 and 13.8 hours. Dry weather sampling should also take place only after 72 hours of less than 0.1 inches of precipitation.

Grab samples should include the fecal coliform analysis obtained by requesting FCOLI and using one, sterile 200-mL plastic container for collection. Samples should be taken in duplicate in sets of five. One bottle of each sample is to be delivered to the Y-12 Plant Environmental Laboratory at Building 9769. The second bottle is to be delivered to the K-25 Site Analytical Laboratory. Due to the very short holding time associated with this analysis (6 hours), laboratory personnel should be contacted to verify laboratory capacity status before sampling occurs. The outfalls and monitoring points presented in Table 1 are to be sampled.

Table 1. Storm Water Outfalls and Monitoring Points to be Sampled Under the Environmental Surveillance Project No. 1103

Outfall/Monitoring Point	Description
002	48-inch reinforced concrete pipe outfall to EFPC
004	54-inch corrugated metal pipe outfall to EFPC
006	42-inch corrugated metal pipe outfall to EFPC
007	24-inch reinforced concrete pipe outfall to EFPC
014	36-inch reinforced concrete pipe outfall to EFPC
046	6-inch terra-cotta tile outfall to EFPC
058	36-inch terra-cotta tile outfall to EFPC
S01	36-inch reinforced concrete pipe outfall to BC
S02	48-inch corrugated metal pipe outfall to BC
S03	18-inch reinforced concrete pipe outfall to BC
S04	18-inch reinforced concrete pipe outfall to BC
S09	In-stream monitoring point in Tributary 4
S10	In-stream monitoring point in Tributary 5
S11	In-stream monitoring point in Tributary 6
S16	East Borrow Area Sedimentation Basin Discharge
S20	48-inch corrugated metal pipe outfall

BC = Bear Creek
EFPC = East Fork Poplar Creek

Quality Control

Laboratory water should be taken to the field and poured into sampling containers as a field blank with every sampling event. All samples will be kept under chain of custody at all times according to Procedure ESP-500. All equipment will be decontaminated between samples according to ESP-900. All grab samples will be taken according to ESP-301-1. Sterile techniques should be strictly adhered to during sampling. Samples should be collected directly into the container and not transferred from another container.

Safety Concerns

The sampling technicians will wear safety glasses, gloves, and company clothing as the minimum personal protective equipment. Due to inclement weather conditions, sampling personnel should work in teams of at least two persons at all times.

Data Management

Data will be reviewed by Water Compliance Section personnel. The prescribed outfalls detailed by this plan were selected because at least one of the samples obtained during the original storm water sampling effort had a fecal coliform result of more than 10,000 colonies per 100 mL. If no conclusions can be drawn from this new data, the sampling effort may be expanded.

APPENDIX C

Fecal Coliform Data
Environmental Surveillance Project No. 1103

Date	Weather	Outfall or Monitoring Point	Fecal Coliform, co./100 mL	Notes
6/25/93	Dry	002	520	
6/25/93	Dry	004	130	
6/25/93	Dry	014	1	
9/15/93	Wet	002	20,000	
9/15/93	Wet	007	120,000	Deer Near-by
9/15/93	Wet	014	8,300	
9/15/93	Wet	046	3,500	
12/2/93	Dry	S02	22	
12/2/93	Dry	S09	96	
2/16/94	Dry	S03	1	
2/16/94	Dry	S04	1	
4/21/94	Dry	046	1	
4/21/94	Dry	058	26	
4/21/94	Dry	S11	14	
7/27/94	Wet	S02	1,200	
7/27/94	Wet	S09	720	
7/27/94	Wet	S09	720	
7/27/94	Wet	S11	410	
2/16/95	Dry	S04	1	
6/7/95	Wet	014	9,500	
6/7/95	Wet	046	1	
6/7/95	Wet	S01	5,100	
6/7/95	Wet	S02	1,200	
6/7/95	Wet	S03	7,100	
6/7/95	Wet	S04	8,100	
6/7/95	Wet	S11	1,400	
6/15/95	Dry	002	110	
6/15/95	Dry	004	130	
6/15/95	Dry	014	1	
6/26/95	Dry	002	82	
6/26/95	Dry	004	80	
6/26/95	Dry	014	1	
6/26/95	Dry	S02	470	
6/26/95	Dry	S09	190	

APPENDIX D

Fecal Coliform Data
Sanitary Sewer System Monitoring

Date	Location	Fecal Coliform, co./100 mL
5/17/95	East End Sanitary Sewer Monitoring Station	125,000
5/18/95	East End Sanitary Sewer Monitoring Station	407,000
5/18/95	Lift Station southeast of Building 9204-3	547,000

APPENDIX E

Fecal Coliform Data
Laboratory Comparison Study

Outfall	Date	Weather	Y-12 Lab	K-25 Lab
002	6/25/93	Sunny	520	367
004	6/25/93	Sunny	130	240
014	6/25/93	Sunny	<1	<1
002	9/15/93	Rain	20,000	TNTC
007	9/15/93	Rain	120,000	TNTC
014	9/15/93	Rain	8,300	TNTC
046	9/15/93	Rain	>3,500	TNTC
S03	2/16/94	Sunny	<1	20
S04	2/16/94	Sunny	<1	26
S20	2/16/94	Sunny	18	14
046	4/21/94	Sunny	<1	1,137
058	4/21/94	Sunny	26	18
S11	4/21/94	Sunny	14	31

APPENDIX F

Fecal Coliform Data
1992 National Pollutant Discharge Elimination System Storm Water Permit Application

	Fecal Coliform (co./100 mL)	
Outfall No.	Max. Daily	Long-Term Average
002	130	<83.67
003	7,840	7,840
006	TNTC	>4000
007	165,000	165,000
011	1,500	1,100
014	160	79
015	36	36
017	2,020	81
018	57	<1
021	42	<21.5
032	8,000	8,000
033	20	20
041	250	40
044	100	100
045	34,000	34,000
057	640	300
062	630	630
064	217	162
086	960	960
088	320	<107
098	446	87
110	3,800	3,800
111	1,158	1,158
114	300	<107
S01	40,000	18,000
S02	9,000	9,000
S03	27,000	<1
S04	30,000	30,000
S05	6,700	6,700
S06	1,800	1,400
S07	1,000	1,000
S08	1,300	30
S09	33,000	30,000
S10	10,000	2,000
S11	35,000	35,000
S12	950	950
S13	1,000	1,000
S14	9,000	9,000
S15	1,200	1,200
S16	200,000	200,000
S17	234	234

APPENDIX F

Fecal Coliform Data
1992 National Pollutant Discharge Elimination System Storm Water Permit Application

	Fecal Coliform (co./100 mL)	
Outfall No.	Max. Daily	Long-Term Average
S18	1,226	1,226
S19	20	20
S20	68,000	68,000
S21	260	260
S22	57	57
TNTC = Too Numerous To Count		