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May 10, 1993 - June 1, 1994
Environmental Monitoring Report
Tennessee Department of Environment and Conservation
Department of Energy Oversight Division
761 Emory Valley Road
Oak Ridge, Tennessee

September 1, 1994

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ACRONYMS

AA -	Atomic Absorption Spectrophotometry
AAM -	Annual Arithmetic Mean
AEA -	Atomic Energy Act
AGM -	Annual Geometric Mean
ALARA -	As Low As Reasonably Achievable
APC -	Air Pollution Control
ARAP -	Aquatic Resource Alteration Permit
ASER -	Annual Site Environmental Report
ASTM -	American Society for Testing and Materials
BCBG -	Bear Creek Burial Grounds
BDAT -	Best Demonstrated Available Technology
BMAP -	Biological Monitoring and Abatement Plan
BMP -	Best Management Practice
BRW -	Bedrock Well
BTX -	Benzene, Toluene, and Xylene
CAA -	Clean Air Act
CEI -	Compliance Evaluation Inspection
CERCLA -	Comprehensive Environmental Response, Compensation and Liability Act
CFC -	Chlorofluorocarbon Compounds
CFR -	Code of Federal Regulations
CFU -	Colony Forming Unit (generally; # of bacteria)
CNF -	Central Neutralization Facility
CRM -	Clinch River Mile
CSI -	Compliance Sampling Inspection
CWA -	Clean Water Act
DCG -	Derived Concentration Guideline
DOE -	Department of Energy
DOE-O -	Department of Energy - Oversight
DMRs -	Discharge Monitoring Reports
DRH -	Department of Radiological Health
DQO -	Data Quality Objective
DWS -	Division of Water Supply
EA -	Environmental Assessment
EIS -	Environmental Impact Statement
EFPC -	East Fork Poplar Creek
EM/C -	Environmental Monitoring and Compliance
EMP -	Environmental Monitoring Plan
EPA -	Environmental Protection Agency
ERAMS -	Environmental Radiation Ambient Monitoring System
ER -	Environmental Restoration
ESD -	Environmental Sciences Division
ESH -	Environmental Safety and Health
ES -	Engineering Support
FC -	Fecal Coliform
FERC -	Federal Emergency Response Coordinator
FFA -	Federal Facilities Agreement
FFCA -	Federal Facilities Compliance Agreement
FS -	Fecal Strep
GW -	Groundwater Well

ACRONYMS cont.

GWQAR - Groundwater Quality Assessment Report
HAPs - Hazardous Air Pollutants
HSW - Hazardous and Solid Waste
HONs - Hazardous Organic NESHAPS
KFO - Knoxville Field Office
LREPP - Long Range Environmental Protection Plan
ICP - Inductively Coupled Plasma
IRC - Information Resource Center
IWMF - Interim Waste Management Facilities
MOR - Monthly Operating Report
NDA - No Detectable Activity
NEPA - National Environmental Policy Act
NESHAPS - National Emission Standards for Hazardous Air Pollution Sources
NOAA - National Oceanographic and Atmospheric Administration
NPDES - National Pollutant Discharge Elimination System
NPL - National Priority List
O&M - Operation and Maintenance
OREIS - Oak Ridge Environmental Information System
ORGDP - Oak Ridge Gaseous Diffusion Plant
ORNL - Oak Ridge National Laboratory
ORO - Oak Ridge Operations
ORR - Oak Ridge Reservation
ORTF - Oak Ridge Task Force
OSHA - Occupational Safety and Health Administration
OU - Operating Unit
PAI - Performance Audit Inspection
PCB - Polychlorinated Biphenyls
PCI - Pretreatment Compliance Inspection
PM₁₀ - Particulate Matter (10 micron)
ppm - parts per million
ppb - parts per billion
PWS - Public Water System
PWTF - Process Waste Treatment Facility
QA/QC - Quality Assurance/Quality Control
RaLa - Radioactive Lanthanum
RCRA - Resource Conservation and Recovery Act
RM/O - Radiological Monitoring and Oversight
RWA - Residential Well
SAFE - Site and Facility Evaluation
SAM - Soil and Air Monitoring
SCS - Soil Conservation Service
SDWA - Safe Drinking Water Act
SOP - Standard Operating Procedures
SPAD - Steam Plant Ash Disposal
STP - Sewer Treatment Plant
SWSA - Solid Waste Storage Area
TCR - Total Chlorine Residual
TDEC - Tennessee Department of Environment and Conservation

ACRONYMS cont.

TEMA - Tennessee Emergency Management Agency
TOA - Tennessee Oversight Agreement
TPH - Total Petroleum Hydrocarbons
TRM - Tennessee River Mile
TRV - Thermal Release Valve
TSCA - Toxic Substances Control Act
TSP - Total Suspended Particulates
TVA - Tennessee Valley Authority
TWRA - Tennessee Wildlife Resources Agency
UTK - University of Tennessee, Knoxville
UEFPC - Upper East Fork Poplar Creek
UNW - Unconsolidated Well
USFWS - United States Fish and Wildlife Service
UST - Underground Storage Tank
VEE - Visible Emission Evaluation
VOA - Volatile Organic Analyte
VOCs - Volatile Organic Compounds
WETF - West End Treatment Facility
WM - Waste Management
WOC - White Oak Creek
WPC - Water Pollution Control
WWTF - Waste Water Treatment Facility

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May 10, 1993 - June 1, 1994
Environmental Monitoring Report
Tennessee Department of Environment and Conservation
Department of Energy Oversight Division

Executive Summary

Introduction

The Tennessee Department of Environment and Conservation, DOE Oversight Division (TDEC/DOE-O) under the terms of the Tennessee Oversight Agreement (TOA) are providing annual reports: reporting of State's monitoring and analysis, and findings of DOE's quality and effectiveness of DOE's monitoring and surveillance. This report blends some of both of the required annual reports as described in the TOA section A.7.2.2. The Federal Facilities Agreement (FFA) integrates the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for the Oak Ridge Reservation.

Air Quality Monitoring

Air quality monitoring is performed primarily by three separate program areas within TDEC/DOE-O: Waste Management, Radiological Monitoring, and Environmental Monitoring and Compliance. The efforts within the Division have been integrated to verify and enhance the monitoring of the air quality on the Oak Ridge Reservation (ORR) as well as the surrounding areas which may be impacted from DOE/MMES activities. The sources permitted by TDEC/APC (Air Pollution Control) are audited by the Waste Management Section. The ambient air monitoring systems, which are run by MMES, and the resulting data are reviewed by both the Radiological Monitoring section and the Environmental Monitoring and Compliance section. The Radiological Monitoring Section plans on continuing the review of the radiological ambient air systems and also plans on co-locating samplers at some of the monitoring locations. The Environmental Monitoring and Compliance section has plans to review the non-radiological ambient air monitoring performed on the reservation along with the data produced by this monitoring. The Environmental Monitoring and Compliance section also plans to review the source emissions inventory in the upcoming year. TDEC/DOE-O works with TDEC/APC in training and consulting when problems arise on the ORR concerning ambient air quality. EPA is also consulted on matters in which TDEC/APC does not have jurisdiction, such as radiological NESHAPs. EPA sponsors the Air Pollution Training Institute which provides classes, telecourses, and self instructional courses that TDEC/DOE-O uses for training its air quality control staff.

Biological Fish and Wildlife

The Biological Fish and Wildlife Program often works in conjunction with several other state and federal agencies. The program works with the Tennessee Wildlife Resources Agency (TWRA), the Tennessee Valley Authority (TVA), and with regional Tennessee Department of Environment and Conservation offices. The program aided in surveys at Clear Creek and collected mussels, assisted with water samples, and sediment samples from the Clinch River. Biologists from the State of Tennessee; Knoxville, Nashville, and Chattanooga field offices have been involved in various surveys, inspections, meetings, and training exercises. The program has most recently worked with the Tennessee Valley Authority (TVA) conducting stream surveys on the Emory and French Broad Rivers. These cooperative efforts among the different agencies throughout the state provide continuity to the way data is collected in the field and analyzed in this office.

Environmental Restoration (ER)

The Environmental Restoration (ER) Program within the TDEC/DOE-O Division works with issues that fall primarily under the Federal Facilities Agreement (FFA), but also involves the Tennessee Oversight Agreement (TOA). Personnel in ER work closely with personnel from other programs and divisions within the Tennessee Department of Environment and Conservation. ER monitoring activities include the review, analysis, and oversight of data and documents associated with the CERCLA/RCRA process and environmental restoration activities on the Oak Ridge Reservation (ORR). Staff from ER programs conduct field trips to insure that DOE ER programs are progressing as scheduled and are being conducted in accordance with approved agreements.

Groundwater Monitoring

Groundwater addressed under both acts integrated in the FFA include investigation, remediation and monitoring for groundwater. The investigation and remediation under the FFA is beyond the scope of this monitoring report. The Underground Storage Tank Act covers investigation, remediation and monitoring for Underground Storage Tanks (UST). The petroleum UST's are addressed in this report. The Safe Drinking Water Act is to protect underground water sources from contamination and set federal drinking water quality standards. This is addressed in the Surface Water and Safe Drinking Water sections of this report. Sampling of groundwater by this office has been limited to 3 springs, 2 residential wells, 4 exit pathway wells, and 1 petroleum UST for the May 10, 1993 to June 1, 1994, time frame. This information has been gathered to help make decisions for designing a possible groundwater monitoring network. Additionally one of the exit pathway wells sampled verified the offsite

contamination of carbon-tetrachloride in Union Valley. The complex hydrogeology for the Oak Ridge area requires much work to be successful at monitoring. We feel the groundwater activities by this office have influenced DOE to improve their monitoring efforts by placing additional emphasis on the Karst Aquifer or Knox Aquifer groundwater flow. Efforts put into the modeling of the groundwater in karst systems appears to be premature for the level of background work in karst investigations. There are many uncertainties that may jeopardize the validity of numerical modeling and vast amounts of data collected on groundwater is of limited use. The problems exist in the origin of data, validity of data, and consolidation into a common format.

Radiological Monitoring

Radiological Monitoring has been directed toward the development of a comprehensive radiological monitoring system utilizing the contribution of all TDEC/DOE-O Programs, the Division of Radiological Health, the Tennessee Wildlife Resources Agency, and the Tennessee Emergency Management Agency in addressing the responsibility prescribed by the TOA (A.6 and C.3). Current activities include: the review and evaluation of DOE-OR radiological monitoring programs; participation with DOE in the monitoring of pathway indicators (e.g., milk and wildlife); sampling and analysis of water, sediment, and aquatic biota; assessment of hazards associated with DOE operations (past and present); and the development of programs to warn of and respond to emergency conditions.

Safe Drinking Water/Safe Dams

There are fourteen public water systems (PWS) which have the potential to be adversely impacted by DOE activities on the Oak Ridge Reservation. TDEC/DOE-O will work closely with TDEC/DWS in performing sanitary surveys, investigating possible cross-connections, and reviewing engineering plans for system changes on the public water systems located on the Oak Ridge Reservation. TDEC/DOE-O plans on collecting samples in order to supplement the required sampling performed by the PWS owners. TDEC/DOE-O plans to work with TDEC/DWS in reviewing sampling analysis data from all fourteen PWS. TDEC/DOE-O also reviews audits performed on dams and impoundments, and emergency drills performed for White Oak and Radder Dams.

Surface Water Monitoring

Surface water programs are established and executed by different sections within the division that work closely together to integrate a complete, projected picture of the health and integrity of surface waters on or around the reservation. The WM/WPC sections' major emphases are the National Pollutant Discharge Elimination System (NPDES) permits. This includes

review of the monthly Discharge Monitoring Reports, conduct NPDES compliance inspections and review Monthly Operating Reports and Stormwater Pollution Prevention Plans. Other activities that WM/WPC leads are fish kill and spill response, wetland identifications, aquatic resource alteration issues, stormwater evaluations, as well as project assistance to other programs within the surface water program. The Surface Water section of EM/C has the responsibility for the Ambient Surface Water Program and related projects in environmental monitoring, working with a number of other programs within and beyond the division. Within the ambient water quality program, EM/C draws assistance from RM/O in screening samples for radioactivity. EM/C also works with WM/WPC in spot sampling, special projects, and reviewing BMAP reports. Additionally, training and assistance is utilized from sister agencies (TDEC/WPC in Knoxville and Nashville), MMES, TWRA, and TVA. This past year EM/C established a full year's ambient water sampling data base and is working toward creating statistical and analytical programs to analyze data. The Surface Water section is in the process of integrating sediment sampling with the ambient water sampling stations. It is intended to be reflective of the amount and type of contaminants that accumulate in sediment that might not be detected at the surface in water samples. RM/O's Water Section (RM/O-W) has been tasked with the radiological support of the surface and groundwater monitoring components of the Division and the implementation of the radiological water monitoring requirements of the TOA. TDEC/DOE-O Programs and the Division of Radiological Health have cooperated in addressing the specific radiological water monitoring responsibilities of that document.

Waste Management (WM)

The Waste Management Program includes regulatory and oversight responsibility in the areas of water pollution control, air pollution control, and solid waste which includes solid, hazardous, mixed, and radioactive waste. In essence, each of these program elements involve coordination with each of the Division's other programs. Particularly close coordination is required to successfully integrate RCRA corrective actions with CERCLA remedial activities.

During the year major accomplishments include completion of water and air pollution annual compliance inspections conducted as a result of memorandums of understanding with sister regulatory divisions. As a consequence of lengthy discussions initiated by our Division, with DOE and its contractors, the underground disposal of radioactive waste has been terminated and a radioactive seep through a holding pond dike has been reduced by approximately 95 per cent. Current waste management practices on the Oak Ridge Reservation are generally good, while the most significant waste management problems are related to historical or legacy waste.

2. SURFACE WATER MONITORING

Environmental Monitoring and Compliance (EM/C)

Ambient Surface Water Monitoring

Surface water is an important pathway by which contaminants enter the ecosystem and create ecological and human health risks. Sources of contaminants that impact water bodies are often the result of industrial, agricultural, or mining processes, and those activities related to DOE sites. It is anticipated that surface water sampling will be developed through, and be an indicator of: solid waste, stormwater, or groundwater related contaminated sites. Most streams on the Oak Ridge Reservation are classified as supporting wildlife, fish and aquatic life, livestock watering, recreation, and irrigation. Since the Clinch River is the major surface water body that receives discharges from the Oak Ridge plants, it is necessary to collect samples of surface water to obtain data that reflects the quality of health and the environment. Surface water sampling will often be representative of any impacts from solid waste or groundwater contaminated sites. Additionally, this data is intended to fill in any data gaps and support sampling efforts within other programs, such as the Environmental Restoration/Clinch River study.

During the 1993-1994 fiscal year two sampling sites were added to the ambient surface water monitoring program reflected in the 1993 Environmental Monitoring Plan due to an indication of heavy metals appearing between Station #2, the Anderson County Water Treatment Plant, and Station #3, Melton Hill Lake (see Table 2.1). Station #6 is located at Clinch River Mile 48.7, downstream of the marina and upstream of Bull Run Steam Plant. Station #7 is located at Clinch River Mile 41.2 adjacent to Guinn Road Park and just downstream of the Y-12 pumping station.

To date there have been no statistically significant results from the ambient data that would cause concern or present a hazard to human health and the environment. At present no values except fecal coliform results, sampled in 1/26/94 at station 5, with a count of 1120 cfu/100mL, exceeded EPA DCG's or water quality criteria. See Tables 2.2-2.6 for ambient data results for the 1993-1994 sampling events and Table 2.7 for a list of EPA's primary and secondary drinking water regulations. Note that stations 6 and 7 are located in the tables spatially and not numerically. The Clinch River, being large and subject to dilution, is not expected to have concentrations of pollutants, from surface water grab samples, in substantial amounts to cause alarm. It does however, set up a baseline for comparison to previous sampling events, and in the case of an unplanned release or an accident, will reflect the amount and extent of pollution.

Table 2.1

Ambient Surface Water Sampling Sites

- Station #1 - Clinch River Mile 78.7, Downstream of Norris Dam
- Station #2 - Anderson County Water Treatment intake line
- Station #3 - Clinch River Mile 35.5, on Melton Hill Lake
- Station #4 - Clinch River Mile 17.9, near Grubbs Island
- Station #5 - Clinch River Mile 10.1, near Brashears Island
- Station #6 - Clinch River Mile 48.7, just above the Bull Run Steam Plant
- Station #7 - Clinch River Mile 41.2, located downstream of the Johnson Controls water intake

TABLE 2.2

AMBIENT WATER QUALITY DATA

4/27/93

	<u>units</u>	<u>Station 1</u>	<u>Station 2</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Conductivity	umho	264	270	127	271	258	252	252
Dissolved Oxygen	mg/L	11.3	11.1	*	9.6	10.6	10.5	10.9
pH	Units	7.82	8.1	7.64	7.91	7.79	8.05	8.11
Temperature	C	8.1	14.2	13.3	16.3	16	17.2	18.4
Coliform - fecal	cfu/100mL	6	54	24	12	8	6	18
Streptococci - fecal	cfu/100 mL	4	38	4	24	2	4	4
Residue - dissolved	mg/L	139	135	140	141	135	133	130
Residue - suspended	mg/L	<1	7	2	3	4	4	2
BOD, 5-day, 20 C	mg/L	<5	<5	<5	<5	<5	<5	<5
COD (low)	mg/L	<5	<5	<5	<5	<5	<5	<5
Hardness, total, as CaCO ₃	mg/L	128	129	129	130	136	136	130
Nitrogen, total kjeldahl	mg/L	0.13	<0.1	0.17	0.25	0.17	0.17	<0.1
Nitrogen, ammonia	mg/L	<0.02	<0.02	0.03	<0.02	0.02	<0.02	<0.02
Nitrogen, NO ₃ & NO ₂	mg/L	0.6	0.45	0.59	0.53	0.66	0.53	0.49
Phosphate, total	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum, Al	ug/L	102	404	409	378	315	155	277
Arsenic, As	ug/L	<2	<2	<2	<2	<2	<2	<2
Cadmium, Cd	ug/L	<1	<1	<1	<1	<1	<1	<1
Chromium, Cr	ug/L	<1	<1	<1	<1	<1	<1	<1
Copper, Cu	ug/L	10	26	7	22	18	6	<5
Iron, Fe	ug/L	47	307	310	276	212	122	187
Lead, Pb	ug/L	<4	<4	<4	<4	<4	<4	<4
Manganese, Mn	ug/L	<10	75	85	49	54	24	26
Mercury, Hg	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Ni	ug/L	<3	<3	<3	<3	<3	<3	<3
Zinc, Zn	ug/L	4	9	12	8	10	8	14

* Equipment malfunction

TABLE 2.3

AMBIENT WATER QUALITY DATA

7/14/93

	<u>units</u>	<u>Station 1</u>	<u>Station 2</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Conductivity	umho	263	253	269	249	218	242	253
Dissolved Oxygen	mg/L	6.6	8.6	9.3	*	10.9	9.1	10.6
pH	Units	6.2	6.54	6.9	8.6	8.91	8.09	8.13
Temperature	C	11.4	14.2	23.1	29.4	29.1	26.1	26.2
Coliform - fecal	cfu/100mL	220	104	18	2	<2	<2	4
Streptococci - fecal	cfu/100 mL	12	110	<2	2	<2	6	<2
Residue - dissolved	mg/L	132	130	135	128	121	138	134
Residue - suspended	mg/L	<1	<1	<1	<1	<1	<1	<1
BOD, 5-day, 20 C	mg/L	<5	<5	<5	<5	<5	<5	<5
COD (low)	mg/L	7.95	6.57	<5	5.64	<5	5.18	<5
Hardness, total, as CaCO ₃	mg/L	135	126	128	119	121	125	127
Nitrogen, total kjeldahl	mg/L	0.15	0.19	0.2	0.2	0.38	0.31	0.43
Nitrogen, ammonia	mg/L	<0.02	<0.02	0.04	<0.02	0.03	<0.02	<0.02
Nitrogen, NO ₃ & NO ₂	mg/L	0.6	0.68	0.59	0.18	0.08	0.44	0.37
Phosphate, total	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum, Al	ug/L	155	164	169	138	85	61	191
Arsenic, As	ug/L	<2	<2	<2	<2	<2	<2	<2
Cadmium, Cd	ug/L	<1	<1	<1	<1	<1	<1	<1
Chromium, Cr	ug/L	<1	<1	<1	<1	<1	<1	<1
Copper, Cu	ug/L	6	14	3	<1	10	10	4
Iron, Fe	ug/L	112	154	233	134	45	51	194
Lead, Pb	ug/L	<4	<4	<4	<4	<4	<4	<4
Manganese, Mn	ug/L	42	55	59	18	11	40	21
Mercury, Hg	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Ni	ug/L	<3	<3	<3	<3	<3	<3	<3
Zinc, Zn	ug/L	15	11	12	13	19	15	13

* Equipment malfunction

TABLE 2.4

AMBIENT WATER QUALITY DATA

10/6/93

	<u>units</u>	<u>Station 1</u>	<u>Station 2</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Conductivity	umho	268	273	256	275	292	279	258
Dissolved Oxygen	mg/L	•	•	•	•	•	•	•
pH	Units	7.55	7.87	7.59	7.69	7.78	7.59	7.55
Temperature	C	15.4	16.4	22.9	20.95	19.65	19.35	21.15
Coliform - fecal	cfu/100mL	16	200	26	<2	<2	<2	<2
Streptococci - fecal	cfu/100 mL	10	28	4	<2	<2	<2	<2
Residue - dissolved	mg/L	174	162	163	264	163	16	154
Residue - suspended	mg/L	8	3	8	7	5	4	4
BOD, 5-day, 20 C	mg/L	<5	<5	<5	<5	<5	<5	<5
COD (low)	mg/L	<5	<5	<5	<5	<5	<5	<5
Hardness, total, as CaCO ₃	mg/L	157	150	146	141	147	139	147
Nitrogen, total kjeldahl	mg/L	0.32	<0.1	0.11	0.14	<0.1	0.17	0.11
Nitrogen, ammonia	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrogen, NO ₃ & NO ₂	mg/L	0.38	0.45	0.46	0.44	0.45	0.78	0.15
Phosphate, total	mg/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum, Al	ug/L	177	101	91	186	104	221	74
Arsenic, As	ug/L	<2	<2	<2	<2	<2	<2	<2
Cadmium, Cd	ug/L	<1	<1	<1	<1	<1	<1	<1
Chromium, Cr	ug/L	<1	<1	<1	<1	<1	<1	<1
Copper, Cu	ug/L	<1	16	10	5	2	1	1
Iron, Fe	ug/L	269	138	122	199	118	127	99
Lead, Pb	ug/L	5	<4	<4	<4	<4	<4	<4
Manganese, Mn	ug/L	448	163	83	100	35	42	27
Mercury, Hg	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Ni	ug/L	<3	4	<3	<3	<3	3	<3
Zinc, Zn	ug/L	6	10	10	3	12	8	9

* Equipment malfunction

TABLE 2.5

AMBIENT WATER QUALITY DATA

1/26/94

	<u>units</u>	<u>Station 1</u>	<u>Station 2</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Conductivity	umho	264	281	268	265	266	262	260
Dissolved Oxygen	mg/L	10.64	11.42	11.41	11.04	10.74	11.48	11.25
pH	Units	8.13	7.91	8.16	8.17	8.23	8.8	7.96
Temperature	C	6.1	9.13	6.3	6.3	7.5	6.1	5.9
Coliform - fecal	cfu/100mL	<2	<2	58	4	10	14	1120
Streptococci - fecal	cfu/100 mL	<2	<2	230	32	6	30	560
Residue - dissolved	mg/L	127	127	135	135	132	123	131
Residue - suspended	mg/L	<1	1	<1	<1	1	<1	5
BOD, 5-day, 20 C	mg/L	<5	<5	<5	<5	<5	<5	<5
COD (low)	mg/L	6.76	<5	8.34	6.76	11.1	9.92	9.53
Hardness, total, as CaCO ₃	mg/L	128	129	138	132	128	133	134
Nitrogen, total kjeldahl	mg/L	0.17	<0.1	0.18	0.15	0.16	0.13	0.25
Nitrogen, ammonia	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrogen, NO ₃ & NO ₂	mg/L	0.44	0.43	0.42	0.38	0.41	0.38	0.43
Phosphate, total	mg/L	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum, Al	ug/L	102	90	168	230	182	208	532
Arsenic, As	ug/L	<2	<2	<2	<2	<2	<2	<2
Cadmium, Cd	ug/L	<1	<1	<1	2	<1	<1	<1
Chromium, Cr	ug/L	<1	<1	<1	<1	<1	<1	<1
Copper, Cu	ug/L	23	28	5	43	40	5	19
Iron, Fe	ug/L	99	62	150	1160	196	1180	359
Lead, Pb	ug/L	<4	<4	<4	19	<4	<4	<4
Manganese, Mn	ug/L	15	14	29	43	43	33	42
Mercury, Hg	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Ni	ug/L	<3	<3	<3	<3	<3	<3	<3
Zinc, Zn	ug/L	3	42	<1	1	3	2	2

TABLE 2.6

AMBIENT WATER QUALITY DATA

4/19 - 20/94

	<u>units</u>	<u>Station 1</u>	<u>Station 2</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Conductivity	umho	214	205	199	210	211	208	199
Dissolved Oxygen	mg/L	10.5	10.96	11.62	11.52	11.1	11.5	10.49
pH	Units	8.08	8.25	8.7	8.11	7.99	8.04	8.03
Temperature	C	11.2	12.5	10.2	11.7	12.1	12.7	13.1
Coliform - fecal	cfu/100mL	<2	70	26	98	60	152	200
Streptococci - fecal	cfu/100 mL	2	10	<2	20	10	20	12
Residue - dissolved	mg/L	125	124	125	132	130	121	124
Residue - suspended	mg/L	8	14	16	21	13	18	20
BOD, 5-day, 20 C	mg/L	<5	<5	<5	<5	<5	<5	<5
COD (low)	mg/L	<5	16.2	15.3	13	<5	<5	<5
Hardness, total, as CaCO ₃	mg/L	120	125	*	*	*	*	*
Nitrogen, total kjeldahl	mg/L	0.18	0.11	0.13	0.2	0.15	0.11	0.14
Nitrogen, ammonia	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrogen, NO ₃ & NO ₂	mg/L	0.69	0.67	0.67	0.66	0.67	0.66	0.64
Phosphate, total	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum, Al	ug/L	59	255	210	328	328	340	485
Arsenic, As	ug/L	<2	<2	<2	<2	<2	3	<2
Cadmium, Cd	ug/L	<1	<1	<1	<1	<1	<1	<1
Chromium, Cr	ug/L	<1	<1	1	<1	<1	2	1
Copper, Cu	ug/L	4	15	2	<1	3	6	4
Iron, Fe	ug/L	82	249	247	381	365	471	563
Lead, Pb	ug/L	5	9	8	<4	10	19	8
Manganese, Mn	ug/L	<10	36	35	56	51	49	55
Mercury, Hg	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Ni	ug/L	<3	<3	3	4	<3	4	5
Zinc, Zn	ug/L	4	12	3	2	11	24	18

* lab accident

TABLE 2.7

EPA PRIMARY AND SECONDARY DRINKING WATER REGULATIONS

Primary Drinking Water Regulations

<u>Contaminant</u>	<u>MCL, mg/L</u>	<u>Sources</u>
Fecal Coliform	1/100 mL	Human and animal fecal matter
Fecal Streptococci	1/100 mL	Human and animal fecal matter
Nitrate, as NO ₃ & NO ₂	10	
Arsenic	0.05	Geological, pesticide residues, industrial waste and smelting operation
Cadmium	0.01	Geological, mining, and smelting
Chromium	0.05	Industrial
Lead	0.05	Leaches from lead pipe and lead based solder pipe joints
Mercury	0.002	Manufacturing, fungicides, geological
Nickel	0.1	
Gross Alpha activity	15 pCi/L	Radioactive waste, uranium deposits
Gross Beta activity	50 pCi/L	Radioactive waste, uranium deposits
Strontium 90	8 pCi/L	Radioactive waste, uranium deposits

Secondary Drinking Water Regulations

<u>Contaminant</u>	<u>MCL, mg/L</u>
pH	6.5 - 8.5
Aluminum	0.05 - 0.2
Copper	1
Iron	0.3
Manganese	0.05
Zinc	5

Ambient surface water sampling follows protocols outlined in the Ambient Water Standard Operating Procedures. These protocols follow EPA guidelines and include site selection criteria, sampling procedures, sample handling, recordkeeping, and chain-of-custody procedures to ensure adequate QA/QC. The EM/C program has the lead for the ambient surface water sampling, and draws assistance from the Radiation Monitoring and Oversight (RM/O) program. A representative from RM/O program screens each sample for radiological activity before delivery to the lab for analysis.

Additional Activities

Some sampling efforts have been addressed on a case-by-case basis. An effort to focus on the influx of metals, indicated in the ambient water sampling data, was initiated by sampling below the Rogers Group quarry and mining area. A sample was taken at the end of Union Valley Road on 10/12/93 where the quarry effluent enters the Clinch at approximately Clinch River Mile 49.4. Data levels remained constant with previous samples taken on the ambient sampling runs. Metals which were present above detection limits in previous Clinch River water samples were analyzed. The results are given below in Table 2.8

Table 2.8

<u>Metal</u>	<u>Value ug/L</u>
Aluminum, Al	360
Iron, Fe	342
Lead, Pb	<4
Manganese, Mn	51
Zinc, Zn	<1

In conjunction with the ambient water sampling, TDEC/DOE-O personnel collected sediment samples at stations #3, #6, and #7 during the 1/26/94 sampling event. During the 4/20/94 sampling event, sediment was collected at stations #3, #4, #5, #6, and #7 to determine if any trending was apparent or if the data results remained constant over time. Sediment samples will often reveal a contaminant at higher concentrations than water samples due to settling and most contaminants ability to bind with sediment particles. Sediments were taken with a petite Eckman Ponar dredge and collected according to EPA standards. Those data results are given in Tables 2.9-2.11.

TABLE 2.9

AMBIENT SEDIMENT DATA

1/27/94

	<u>UNITS</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>
aluminum, Al	mg/kg	11200	6880	5270
arsenic, As	mg/kg	6.8	3.7	18.8
barium, Ba	mg/kg	155	81	212
cadmium, Cd	mg/kg	0.4	0.3	0.4
calcium, Ca	mg/kg	5190	2080	3400
chromium, Cr	mg/kg	15	10	15
cobalt, Co	mg/kg	13	6	10
copper, Cu	mg/kg	17.8	17.4	19
iron, Fe	mg/kg	15700	11300	8260
lead, Pb	mg/kg	22	7	86
magnesium, Mg	mg/kg	2710	1430	1030
manganese, Mn	mg/kg	3200	1480	3440
mercury, Hg	mg/kg	< 0.1	< 0.1	< 0.1
nickel, Ni	mg/kg	19	9	13
potassium, K	mg/kg	1520	848	546
selenium, Se	mg/kg	0.5	0.3	0.4
silver, Ag	mg/kg	< 1	< 1	< 1
sodium, Na	mg/kg	80	< 10	35
zinc, Zn	mg/kg	108	48.6	68.2
cyanide, CN	mg/kg	< 1	< 1	< 1
boron, B	mg/kg	< 25	< 25	< 25
nitrogen, ammonia	mg/kg	176	130	137
nitrogen, NO2 & NO3	mg/kg	13.6	12.3	15
nitrogen, total kjeldahl	mg/kg	2980	1060	1430
phosphate, total	mg/kg	723	320	556
oil and grease	mg/g	12.9	12.8	11.2
hydrocarbons, total	mg/g	< 1	< 1	< 1
percent solids	%	47.8	67.7	67.4
phenols	mg/kg	< 1	< 1	< 1

TABLE 2.10
AMBIENT SEDIMENT DATA
4/20/94

	<u>UNITS</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
aluminum, Al	mg/kg	15300	12000	14400	3440	4430
arsenic, As	mg/kg	3.6	6.1	25.3	12.2	5.5
barium, Ba	mg/kg	148	120	530	37	58
cadmium, Cd	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
calcium, Ca	mg/kg	3730	3290	2780	713	891
chromium, Cr	mg/kg	18	14	30	23	16
cobalt, Co	mg/kg	14	12	22	10	9
copper, Cu	mg/kg	20	24	30.2	4.3	5.9
iron, Fe	mg/kg	23100	17800	30700	13900	8340
lead, Pb	mg/kg	33	21	62	18	< 5
magnesium, Mg	mg/kg	3510	2390	1730	563	823
manganese, Mn	mg/kg	3880	2740	7230	879	789
mercury, Hg	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.68
nickel, Ni	mg/kg	24	17	28	10	11
potassium, K	mg/kg	2490	1770	921	312	694
selenium, Se	mg/kg	0.4	0.6	0.3	< 0.2	< 0.2
silver, Ag	mg/kg	< 1	< 1	< 1	< 1	< 1
sodium, Na	mg/kg	49	52	37.9	13.9	< 10
zinc, Zn	mg/kg	119	73.4	129	29.2	38
cyanide, CN	mg/kg	< 1	< 1	< 1	< 1	< 1
boron, B	mg/kg	< 25	< 25	28.1	< 25	< 25
nitrogen, ammonia	mg/kg	175	157	127	109	115
nitrogen, NO ₂ & NO ₃	mg/kg	1.03	0.91	1.5	0.95	1.06
nitrogen, total kjeldal	mg/kg	1620	1450	1160	117	578
phosphate, total	mg/kg	162	489	502	218	322
oil and grease	mg/g	17.4	15.4	14.7	8.94	13.1
hydrocarbons, total	mg/g	1.89	2.78	< 1	< 1	2.56
percent solids	%	47.7	54.9	68.1	80.3	73.2
phenols	mg/kg	1.11	1.8	< 1	< 1	1.05

TABLE 2.11

SEDIMENT RADIOCHEMICAL ANALYSIS

4/20/94

	<u>units</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 3</u>	<u>Station 4</u>	<u>Station 5</u>
Gross alpha (total)	pCi/g	5.0 +/- 1.8	5.5 +/- 1.8	8.4 +/- 2.2	0.7 +/- 1.0	3.0 +/- 1.4
Gross beta (total)	pCi/g	34.9 +/- 2.9	30.8 +/- 2.7	30.6 +/- 2.7	5.7 +/- 1.6	14.2 +/- 2.0
Strontium 89	pCi/g	0.92 +/- 0.92	0.66 +/- 0.94	0.75 +/- 0.94	2.0 +/- 1.4	1.4 +/- 1.2
Strontium 90	pCi/g	-0.338 +/- 0.078	-0.27 +/- 0.094	-0.346 +/- 0.077	-0.52 +/- 0.10	-0.336 +/- 0.096
Thorium (total)	pCi/g	4.7 +/- 1.0	3.74 +/- 0.90	6.2 +/- 1.1	1.42 +/- 0.63	2.23 +/- 0.73
Uranium (total)	pCi/g	1.5 +/- 0.73	0.76 +/- 0.62	2.64 +/- 0.90	0.38 +/- 0.57	0.48 +/- 0.58
<u>Gamma Radionuclides</u>						
⁷ Be	pCi/g	•	0.96 +/- 0.22	•	•	•
⁶⁰ Co	pCi/g	•	•	•	0.106 +/- 0.024	0.106 +/- 0.026
¹³⁷ Cs	pCi/g	0.35 +/- 0.053	0.128 +/- 0.037	•	0.830 +/- 0.040	2.769 +/- 0.063
⁴⁰ K	pCi/g	23.9 +/- 1.0	22.24 +/- 0.92	10.93 +/- 0.81	5.16 +/- 0.35	5.60 +/- 0.38
²¹² Pb	pCi/g	2.054 +/- 0.078	1.732 +/- 0.067	2.479 +/- 0.087	0.598 +/- 0.032	0.551 +/- 0.034
²¹⁴ Pb	pCi/g	1.45 +/- 0.10	1.445 +/- 0.095	2.67 +/- 0.13	0.563 +/- 0.049	0.599 +/- 0.061
²¹² Bi	pCi/g	•	0.86 +/- 0.26	1.97 +/- 0.39	0.39 +/- 0.14	0.39 +/- 0.13
²¹⁴ Bi	pCi/g	1.29 +/- 0.11	1.062 +/- 0.088	2.07 +/- 0.12	0.458 +/- 0.050	0.499 +/- 0.038
²²⁸ Ac	pCi/g	1.97 +/- 0.20	1.89 +/- 0.18	3.49 +/- 0.25	0.51 +/- 0.10	0.561 +/- 0.089
²⁰⁸ Tl	pCi/g	0.603 +/- 0.058	0.523 +/- 0.050	0.740 +/- 0.068	0.206 +/- 0.023	0.153 +/- 0.023

• Not detected

Some projects were initiated that involved the Waste Management/Water Pollution Control (WM/WPC) section. One such project was a sampling event on East Fork Poplar Creek designed to screen for the presence of fecal coliform and fecal streptococci. Elevated concentrations of fecal coliform present a water contact hazard to humans. Raw sewage is known to flow to EFPC during rain events. This survey was initiated to determine the extent of potential impact to the stream and, therefore, the community. General Water Quality Criteria (Rule 1200-4-3-.03) states for recreational contact subparagraph (f) "Coliform-The concentration of a fecal coliform group shall not exceed 200 per 100 mL as a geometric mean based on a minimum of 10 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. The purposes of determining the geometric mean, individual samples having a concentration of less than 1 per 100 mL shall be considered as having a concentration of 1 per 100 mL. In addition, the concentration of the fecal coliform group in any individual samples shall not exceed 1,000 per 100 mL." Results from fecal sampling are reported in Table 2.12

Table 2.12

<u>Station #</u>	<u>Fecal Coliform</u> <u>per 100mL</u>	<u>Fecal Strep</u> <u>per 100mL</u>	<u>DO</u> <u>mg/L</u>	<u>Ratio</u> <u>F/S</u>
1	260	200	9.0	1.30
2	540	140	13.0	3.86
3	450	780	8.6	0.58
4	880	1050	8.4	0.84
5	270	370	8.7	0.73
6	2000	260	9.0	7.69
7	200	220	8.5	0.91
8	70	140	7.3	0.50
9	320	190	8.3	1.68

Ratios greater than 3.0 indicate the presence of human fecal material. Station #2, which is located near the Bissell Civic Center and Station #6 located at the Oak Ridge sewage treatment plant outfall showed evidence of human fecal material in the water. Only Station #6 exceeded the maximum concentration of 1000 per 100 mL for recreational water contact for an individual sample. From this data it was determined the signs posting "no water contact" were still necessary and the TDEC/DOE-O office would uphold that decision.

A sediment sample was taken on April 28, 1994, from the Oak Ridge tennis courts. During the previous two weeks, the Oak Ridge area had experienced flood-type rains and the banks of the East Fork Poplar Creek had overflowed considerably, washing up debris and sediment onto the tennis courts. A composite sample was collected

from two particularly large areas covered with sediment on the west side of the courts. The sample was collected and delivered to the Knoxville lab for mercury analysis. The data indicated a concentration of 18.5 mg/kg of mercury in the sediment. Based on the DOE Baseline Risk Assessment (DOE/OR/02-119&D2/R1) in the EFPC floodplain, the levels of mercury found in this sample is well below concentrations of mercury requiring a remedial action for sites with recreational use.

A private drinking water well was sampled offsite the reservation in an attempt to track any offsite migration of contamination. A full range of analytes was tested and with the exception of fecal coliform, reported at 10 per 100 mL, all were below detection limit or below the EPA primary and secondary drinking water MCL's.

Surface Water Effluent Monitoring

Waste Management (WM)

Water Pollution Control Section

The Water Pollution Control Section has major responsibility for many issues that involve surface waters; with major emphasis on monitoring activities related to the National Pollutant Discharge Elimination System (NPDES) permits held by the three sites on the Oak Ridge Reservation (ORR). Many of the tasks the section undertakes are conducted on a routine basis, such as review of the monthly Discharge Monitoring Reports, NPDES compliance inspections and Monthly Operating Reports (MOR); whereas other activities are dealt with as the need arises. The range of "unscheduled" activities includes fish kill and spill response, wetland identifications, aquatic resource alteration issues, stormwater evaluations, and other on-going or new projects that require the sections' input.

RESULTS:

During the May 1993 to May 1994 time frame, the section was involved with the following activities:

1. Discharge Monitoring Report reviews were completed each month for all three sites on the ORR. The reports were reviewed for completeness and to ensure that all reported values were within excepted water quality criteria. All non-compliances were reviewed to determine if significant violations had occurred and that they were being properly addressed by the permittee. In addition, loading factors of constituents such as sulfate and mercury discharged by waste water treatment facilities have been reviewed to determine potential instream effects on receiving stream ecosystems.

2. Additional time has been spent closely reviewing the "report only" data that centers primarily around storm drain outfalls. Storm drain categorization and identifications have been field verified by this section through extensive site walkovers at each of the three plant sites. As a result of these trips, some changes have been made at individual locations. Changes include; modification to parameters monitored, closure of outfalls, identification of new sources and general maintenance to prevent unwanted contamination from entering the storm water system.
3. NPDES Compliance Inspections were conducted at the three sites during late May, early June, 1994. Each inspection involved evaluation of flow monitoring, general waste water treatment facility operations, sampling procedures, stormwater and pollution prevention programs, lab analyses and DMR preparation. Effluent and instream samples were collected from each site to assess compliance conditions. A total of thirteen wastewater treatment facilities were inspected and evaluated as well as a multitude of storm drain and other offsite discharges. Detailed compliance reports were written and submitted to DOE, EPA and the division of water pollution control in Nashville. Minor deficiencies were noted at each site and discussed with DOE and MMES during close out meetings.
4. Separate toxicity test reports are included with DMRs for the months that the tests are conducted. These reports were checked for validity and to ensure that all NPDES permit conditions have been met. A few errors and inconsistencies were detected during the reviews. Incorrect dates, missing monitoring data and invalid controls have been noted. These deficiencies were pointed out to the individual plant sites and to the Environmental Sciences Division (ESD) at ORNL. Toxicity test failures have occurred at K25 (STP) and ORNL (WOC ambient station and STP) since June, 1993.
5. WM/WPC personnel performed a laboratory audit, in conjunction with MMES QA/QC personnel, at the ESD toxicity lab in August, 1993. TDEC/DOE-O findings were summarized in a report and submitted to DOE/MMES for their review. The findings of the report were also discussed during a close out meeting held by the MMES audit team leader on the final day of the audit.
6. K25 STP Monthly Operating Reports (MOR) were reviewed on a monthly basis for completeness and verification of information. Section personnel have worked closely with the plant operator to get this information reported correctly.

7. Radiological Monitoring data is also routinely included in the DMRs. This data was directed, by WM/WPC, to the radiological monitoring section for their review. To date, no significant findings have been observed in these data.
8. WM/WPC personnel participated in a DOE Environmental audit at the K25 site. Each of the wastewater treatment facilities was visited. Audit reviews included general operations, record keeping, and standard compliance issues. Stormwater management and erosion control practices were also discussed with various groups across the site.
9. Six outfalls at the K25 site were sampled (by MMES in the presence of WM/PC personnel) to verify that K25 has met a NPDES compliance condition to reduce total chlorine residual (TCR) concentrations at these locations. The compliance condition was met.
10. Monitoring of the progress at the K25 Coal Ash Pile site continued with regular site visits to measure the pH of waters flowing off the site into Poplar Creek. pH values have met water quality criteria at outfall 994, seven out of eight field visits.
11. Outfall 17 at Y12 was sampled two times during the year and analyzed for ammonia. Elevated concentrations of ammonia in the contaminated groundwater flowing to the outfall caused a fish kill in Upper East Fork Poplar Creek. Outfall 17 will likely be placed under a compliance schedule in the new NPDES permit to correct the conditions.
12. There are eight ongoing wetland site projects on the ORR that the WPC section has been involved in. Each of the wetland sites has been walked over, at least once, by WPC personnel to determine the areal extent and characteristics of the wetland. Several meetings have been held with DOE contractors and subcontractors to discuss permit requirements, mitigation options and project goals.
13. Approximately thirteen separate aquatic resource alteration permit (ARAP) issues have been handled by the WPC section. Section involvement includes site walkovers, project audits, technical assistance and continual monitoring of "trouble" areas. A few projects have required a great deal of oversight to help keep the project in compliance with permit

conditions and water quality control standards. For instance, at least twelve visits were made to the Y12 SPAD landfill project.

14. Tributary 8 at the Bear Creek Burial Grounds (BCBG) was inspected four times during the year to evaluate the leachate collection system and twice in response to contaminated leachate that surfaced following large rain events. Samples of the leachate were collected and analyzed for VOA.
15. In September, 1993, WPC personnel responded to a reported hydraulic oil spill at Y12. None of the three to five gallons spilled reached waters of the State.
16. A release of heavy weight oil to UEFPC occurred in late December, 1993 from a sump line in building 9494-7. Several site visits were made to follow the remediation progress. The clean up was completed in March, 1994.
17. ORNL reported three minor spills in September, 1993. Two were waterline ruptures which resulted in chlorinated water reaching White Oak Creek (WOC) and its tributaries. The third was a minor release of fine cutting oil to WOC. No long term environmental impacts were noted.
18. In March, 1994 three leaks were discovered in an earthen dam of the 3513 pond at ORNL. In the past, the pond was used as a settling basin for process wastes which contained heavy metals, organics and radionuclides. The leaks created an unpermitted discharge to waters of the state. Average radioactivity of the released water, for Beta, was reported at 500 Bq/l. The leaks were repaired by May, 1994. A total of ten site visits were made by this section to monitor the corrective action progress made on the project.
19. The K25 sewage treatment plants' (STP) collection system is in need of extensive rehabilitation and restoration. In its present condition, the system suffers from inflow and infiltration (I&I), causing the STP to be hydraulically overloaded during rain events. Under such conditions, the biological treatment system is bypassed and relatively untreated waste is released to Poplar Creek. These bypass events have occurred a number of times at the STP since December, 1993. WPC personnel are notified during the events and provide technical assistance when possible.
20. WM/WPC personnel have reviewed engineering reports and plans for seven major projects located throughout the ORR. These included the west end treatment facility (WETF) head end modifications and Interim Mercury Treatment Facility projects at Y12; the K-1515 lagoon, the UV treatment unit

for the STP, the CNF collection system and facility modification all at K25, and the surge tanks for the process waste treatment facility (PWTF) at X10. Each of these projects has also included site visits to assess project progress and general site conditions.

21. A large portion of the environmental monitoring that is done through this section involves the review of documents and reports submitted by DOE for compliance purposes. The section has reviewed BMAP plans and final reports for each plant that has submitted them. Comments were drafted and discussed with DOE/MMES personnel for the 1992 BMAP proposal for K25.

Other reviews that have required comment preparation include waste water control and surveillance plans, best management practices plans - for approximately fifteen projects, storm water pollution prevention plans, proposed sampling plans and other miscellaneous reports that require review.

Radiological Monitoring and Oversight (RM/O)

Currently, TDEC's Division of Radiological Health (DRH) monitors surface water at nine locations surrounding the ORR. Location, frequency of sampling/analysis, and analytical parameters are provided in Table 2.13. Data available for fiscal year 1994 are contained in Table 2.14. Limited supplemental surface water sampling for radiological constituents by the Radiological Monitoring and Oversight Program's Water Section (RM/O-W) has occurred at Clinch River Mile (CRM) 18.1 and CRM 11.5 (Table 5.1) with expanded activities projected as additional staff are procured and appropriate locations identified.

Along with the data addressed above, RM/O-W reviews results of analysis from samples split by DRH and DOE/MMES on a monthly basis at White Oak Dam. Historically, information derived from these samples has not been shared nor compared and it is the intent of RM/O-W to facilitate its exchange.

Additional RM/O activities include: the review of the radiological components of the NPDES Monthly Discharge Reports (While no MCLs exist in this context, data are compared with appropriate standards); participation in NPDES compliance inspections of the three DOE-OR facilities and the investigation of leaks in the 3513 impoundment at ORNL; investigation of NPDES outfalls exhibiting radiological contamination in order to identify the genesis of radiological releases on the ORR and associated precautions (e.g., alarms, monitoring); and coordination of Division participation in the DOE Environment, Safety, and Health (ES&H) Appraisals of the K-25 facility and participation in the Y-12 DOE ES&H Appraisal.

Table 2.13

Division of Radiological Health Ambient Water Samples						
ID	FREQ	Gross Alpha and Beta	Gamma	H-3	SR-89/90	LOCATION
W07	Q	Q	Q	---	-----	Clinch R. M23 Melton Hill Dam
W08	Q	Q	Q	---	-----	Clinch R. M21.6 Melton Hill Bridge
W09	Q	Q	Q	Q	-----	Clinch R. M14 Gallaher Bridge
W10	Q	Q	Q	Q	-----	E. Fork Poplar Crk. @ Oak Ridge Turnpike
W11	Q	Q	Q	Q	QC	Clinch R. M48 Bull Run Steam Plant
W49	M	M	M	---	-----	E. Fork Poplar Crk. @ Gum Hollow Road
W50	Q	Q	Q	---	-----	Bear Creek @ Hwy. 95 across from old county road
W51	M	M	M	M	M	White Oak Crk. @ Dam
W58	M	M	M	M	M	Clinch R. M11.5 ORGDP Pumphouse
M = Monthly Q = Quarterly C = Composite						

Table 2.14

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
RADIOLOGICAL DATA FOR ORR AND ENVIRONS

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
Clinch River Mile (CRM) 23.0				
Gross Alpha	7/19/93	-0.8	2.4	pCi/L
	10/18/93	0.9	2.7	pCi/L
	1/24/94	0.6	2.4	pCi/L
	1/24/94*	0.3	2.3	pCi/L
Gross Beta	7/19/93	2.4	3.0	pCi/L
	10/18/93	4.9	3.0	pCi/L
	1/24/94	1.6	3.2	pCi/L
	1/24/94*	2.7	3.3	pCi/L
Gamma Scan				
Isotope				
NDA	7/19/93			
NDA	10/18/93			
Bi-214	1/24/94	44.0	14.0	pCi/L
CRM 21.6				
Gross Alpha	7/19/93	-1.8	2.3	pCi/L
	7/19/93*	0.0	2.7	pCi/L
	10/18/93	0.9	2.8	pCi/L
	1/24/94	-0.3	2.2	pCi/L
Gross Beta	7/19/93	3.2	3.1	pCi/L
	7/19/93*	1.7	3.0	pCi/L
	10/18/93	5.2	3.0	pCi/L
	1/24/94	2.9	3.4	pCi/L
Gamma Scan				

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
Isotope				
K-40	7/19/93	98.0	24.0	pCi/L
Pb-214		34.3	6.2	pCi/L
Bi-214		34.5	6.2	pCi/L
K-40	10/18/93	45.0	23.0	pCi/L
Pb-214		29.9	5.0	pCi/L
Bi-214		27.5	4.8	pCi/L
Bi-214	1/24/94	18.4	3.9	pCi/L
K-40		88.0	23.0	pCi/L
Pb-214		25.4	5.2	pCi/L
CRM 14.0				
Gross Alpha	7/19/93	-1.5	2.4	pCi/L
	10/18/93	2.1	2.4	pCi/L
	1/24/94	1.2	2.5	pCi/L
Gross Beta	7/19/93	3.5	3.1	pCi/L
	10/18/93	2.7	3.2	pCi/L
	1/24/94	1.3	3.2	pCi/L
Tritium	7/19/94	179.0	152.0	pCi/L
	7/19/93*	132.0	151.0	pCi/L
	10/18/93	-42.0	153.0	pCi/L
	1/24/94	-2.0	149.0	pCi/L
Gamma Scan				
Isotope				
Bi-214	7/19/93	23.6	7.1	pCi/L
NDA	10/18/93			
NDA	1/24/94			
East Fork Poplar Creek at Substation on Oak Ridge Turnpike				
Gross Alpha	7/19/93	5.2	4.4	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	10/18/93	5.5	3.4	pCi/L
	1/24/94	5.9	3.8	pCi/L
Gross Beta	7/19/93	7.4	3.5	pCi/L
	10/18/93	7.4	3.5	pCi/L
	1/24/94	7.1	3.7	pCi/L
Tritium	7/19/93	207.0	152.0	pCi/L
	10/18/93	-57.0	153.0	pCi/L
	1/24/94	220.0	154.0	pCi/L
Gamma Scan				
Isotope				
Pb-214	7/19/93	31.9	8.2	pCi/L
Bi-214		42.0	7.3	pCi/L
Pb-214	10/18/93	44.8	6.7	pCi/L
Bi-214		68.0	6.9	pCi/L
Bi-214	1/24/94	63.4	6.8	pCi/L
K-40		40.0	12.0	pCi/L
Pb-214		45.6	6.2	pCi/L
CRM 48.0				
Gross Alpha	7/19/93	0.6	2.9	pCi/L
	10/19/93	2.7	2.6	pCi/L
	1/25/94	0.6	2.4	pCi/L
Gross Beta	7/19/93	1.7	3.0	pCi/L
	10/19/93	3.1	3.2	pCi/L
	1/25/94	3.4	3.4	pCi/L
Tritium	7/19/93	-95.0	147.0	pCi/L
	10/ 9/93	-85.0	152.0	pCi/L
	1/25/94	174.0	153.0	pCi/L
	1/25/94*	74.0	151.0	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
Strontium 89	7/19/93	-0.2	1.3	pCi/L
	10/19/93	0.29	0.67	pCi/L
	1/25/94	0.34	0.69	pCi/L
Strontium 90	7/19/93	-0.05	0.052	pCi/L
	10/19/93	-0.116	0.082	pCi/L
	1/25/94	-0.0371	0.0016	pCi/L
Gamma Scan				
Isotope				
Bi-214	7/19/93	23.7	9.0	pCi/L
Bi-214	10/19/93	14.7	5.3	pCi/L
NDA	1/25/94			
East Fork Poplar Creek at Gum Hollow Road				
Gross Alpha	7/19/93	2.2	4.5	pCi/L
	8/16/93	6.9	5.0	pCi/L
	9/20/93	2.0	3.3	pCi/L
	10/18/93	3.8	3.1	pCi/L
	11/15/93	2.2	2.7	pCi/L
	12/13/93	5.2	3.3	pCi/L
	1/24/94	3.0	3.1	pCi/L
	2/22/94	3.6	3.0	pCi/L
	3/24/94	2.3	3.3	pCi/L
Gross Beta	7/19/93	11.9	4.0	pCi/L
	8/16/93	12.6	3.8	pCi/L
	9/20/93	6.7	3.6	pCi/L
	10/18/93	7.3	3.5	pCi/L
	11/15/93	6.8	3.3	pCi/L
	12/13/93	5.0	3.4	pCi/L
	1/24/94	5.5	3.5	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	2/22/94	5.9	3.2	pCi/L
	3/24/94	7.8	3.4	pCi/L
Gamma Scan				
Isotope				
Bi-214	7/19/93	52.0	12.0	pCi/L
NDA	8/16/93			
NDA	9/20/94			
NDA	10/18/93			
Pb-214	11/15/93	81.9	8.2	pCi/L
Bi-214		98.4	7.7	pCi/L
Pb-214	12/13/93	32.0	5.8	pCi/L
Bi-214		35.4	6.2	pCi/L
Bi-214	1/24/94	35.8	5.4	pCi/L
K-40		38.0	21.0	pCi/L
Pb-214		33.7	5.5	pCi/L
Bi-214	2/22/94	31.5	4.7	pCi/L
	2/22/94*	7.3	2.8	pCi/L
K-40		76.0	20.0	pCi/L
Pb-214		27.4	4.8	pCi/L
Bi-214	3/24/94	13.1	3.4	pCi/L
Bear Creek HWY 95 at Old County Road				
Gross Alpha	7/19/93	13.4	5.0	pCi/L
	7/19/93*	8.4	4.4	pCi/L
	10/18/93	13.8	4.7	pCi/L
	1/24/94	14.4	4.6	pCi/L
	1/24/94*	11.5	4.3	pCi/L
Gross Beta	7/19/93	10.2	3.7	pCi/L
	7/19/93*	8.5	3.6	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	10/18/93	19.7	4.4	pCi/L
	1/24/94	11.3	4.0	pCi/L
	1/24/94*	9.8	3.9	pCi/L
Gamma Scan				
Isotope				
Pb-214	7/19/93	48.6	6.8	pCi/L
Bi-214		74.2	7.8	pCi/L
Pb-214	10/18/93	35.2	6.3	pCi/L
Bi-214		59.5	5.8	pCi/L
Pb-214	10/18/93*	23.2	5.7	pCi/L
Bi-214		19.3	5.6	pCi/L
NDA	1/24/94			
White Oak Creek HWY 95 at White Oak Dam				
Gross Alpha	7/20/93	34.1	8.1	pCi/L
	8/17/93	24.6	7.0	pCi/L
	9/21/93	12.4	4.9	pCi/L
	10/19/93	10.2	4.3	pCi/L
	11/16/93	18.9	5.3	pCi/L
	12/14/93	25.0	5.9	pCi/L
	1/25/94	23.8	5.9	pCi/L
	2/22/94	30.6	6.3	pCi/L
	3/24/94	37.2	7.3	pCi/L
Gross Beta	7/20/93	379.0	15.0	pCi/L
	8/17/93	360.0	14.0	pCi/L
	9/21/93	253.0	12.0	pCi/L
	10/19/93	241.0	12.0	pCi/L
	11/16/93	389.0	15.0	pCi/L
	12/14/93	526.0	18.0	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	1/25/94	458.0	17.0	pCi/L
	2/22/94	416.0	16.0	pCi/L
	3/24/94	492.0	17.0	pCi/L
Tritium	7/20/93	79422.0	690.0	pCi/L
	8/17/93	70568.0	653.0	pCi/L
	9/21/93	69265.0	646.0	pCi/L
	10/19/93	78129.0	690.0	pCi/L
	11/16/93	106412.0	787.0	pCi/L
	12/14/93	203120.0	1104.0	pCi/L
	12/14/93*	204261.0	1107.0	pCi/L
	1/25/94	231375.0	1179.0	pCi/L
	2/22/94	167998.0	1007.0	pCi/L
	3/24/94	268093.0	1256.0	pCi/L
Strontium 89	7/20/93	3.6	2.8	pCi/L
	8/17/93	4.4	1.8	pCi/L
	8/17/93*	3.9	1.8	pCi/L
	9/21/93	6.0	1.2	pCi/L
	10/19/93	2.2	2.6	pCi/L
	11/16/93	7.3	1.4	pCi/L
	11/16/93*	8.8	1.5	pCi/L
	12/14/93	36.5	1.6	pCi/L
	1/25/94	-0.61	1.11	pCi/L
	2/22/94	-0.3	1.1	pCi/L
	3/24/94	14.0	1.0	pCi/L
Strontium 90	7/20/93	164.7	2.2	pCi/L
	8/17/93	155.2	2.1	pCi/L
	8/17/93*	152.0	2.1	pCi/L
	9/21/93	107.4	1.6	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	10/19/93	117.5	1.9	pCi/L
	11/16/93	166.3	2.1	pCi/L
	11/16/93*	166.8	2.2	pCi/L
	12/14/93	217.2	2.4	pCi/L
	1/25/94	210.4	2.5	pCi/L
	2/22/94	212.1	2.5	pCi/L
	3/24/94	233.7	2.5	pCi/L
Gamma Scan				
Isotope				
Pb-214	7/20/93	27.8	8.6	pCi/L
Bi-214		40.0	12.0	pCi/L
Cs-137	8/17/93	8.2	2.1	pCi/L
Pb-214		24.9	5.2	pCi/L
Bi-214		27.2	5.4	pCi/L
Pb-214	9/21/94	12.5	4.8	pCi/L
Bi-214		7.2	2.7	pCi/L
NDA	10/25/93			
NDA	11/16/93			
NDA	11/16/93*			
Cs-137	12/14/93	32.7	5.9	pCi/L
Bi-214		38.8	8.9	pCi/L
Cs-137	1/25/94	19.5	5.5	pCi L
Cs-137	2/22/94	10.9	2.8	pCi/L
Bi-214		13.1	3.4	pCi/L
Cs-137	3/24/94	13.1	2.8	pCi/L
Bi-214		15.4	4.7	pCi/L
CRM 11.5				
Gross Alpha	7/19/93	1.9	3.2	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	8/16/93	1.7	2.6	pCi/L
	9/20/93	0.6	2.6	pCi/L
	10/18/93	0.6	2.3	pCi/L
	11/15/93	-0.3	2.0	pCi/L
	12/13/93	0.6	2.0	pCi/L
	1/24/94	1.0	2.8	pCi/L
	2/21/94	0.3	2.2	pCi/L
	3/24/94	-0.3	2.5	pCi/L
Gross Beta	7/19/93	1.6	3.0	pCi/L
	8/16/93	7.4	3.1	pCi/L
	9/20/93	3.0	3.3	pCi/L
	10/18/93	3.1	3.1	pCi/L
	11/15/93	3.4	3.0	pCi/L
	12/13/93	1.9	3.2	pCi/L
	1/24/94	5.0	3.5	pCi/L
	2/21/94	5.9	3.2	pCi/L
	3/24/94	5.1	3.2	pCi/L
Tritium	7/19/93	94.0	150.0	pCi/L
	8/16/93	-33.0	149.0	pCi/L
	9/20/93	-65.0	147.0	pCi/L
	9/20/93*	-2.0	148.0	pCi/L
	10/18/93	-23.0	153.0	pCi/L
	11/15/93	230.0	147.0	pCi/L
	12/13/93	347.0	160.0	pCi/L
	1/24/94	490.0	159.0	pCi/L
	2/21/94	223.0	154.0	pCi/L
	3/24/94	324.0	153.0	pCi/L
Strontium 89	7/19/93	-0.4	1.4	pCi/L

DIVISION OF RADIOLOGICAL HEALTH AMBIENT WATER				
Analysis	Collection Date	Results	Error + or -	Units
	8/16/93	0.16	0.96	pCi/L
	9/20/93	1.29	0.55	pCi/L
	10/18/93	0.44	0.54	pCi/L
	10/18/93*	1.01	0.73	pCi/L
	11/15/93	-0.26	0.68	pCi/L
	12/13/93	-0.53	0.83	pCi/L
	1/24/94	-0.89	0.77	pCi/L
	2/21/94	-0.31	0.76	pCi/L
	3/24/94	-1.37	0.82	pCi/L
Strontium 90	7/19/93	0.92	0.14	pCi/L
	8/16/93	1.10	0.15	pCi/L
	9/20/93	-0.125	0.52	pCi/L
	10/18/93	-0.036	0.69	pCi/L
	10/18/93*	-0.184	0.080	pCi/L
	11/15/93	0.45	0.16	pCi/L
	12/13/93	1.38	0.19	pCi/L
	1/24/94	1.87	0.16	pCi/L
	2/21/94	1.11	0.16	pCi/L
	3/24/94	3.31	0.26	pCi/L
Gamma Scan				
Isotope				
Pb-214	7/19/93	25.1	6.1	pCi/L
Bi-214		20.5	4.5	pCi/L
NDA	8/16/93			
NDA	8/16/93*			
K-40	9/20/94	70.0	28.0	pCi/L
Bi-214		28.4	5.1	pCi/L
Bi-214	9/20/93*	8.1	3.7	pCi/L

3. SAFE DRINKING WATER ENVIRONMENTAL MONITORING PROGRAM

Environmental Monitoring and Compliance (EM/C)

There were twelve public water systems (PWS) previously identified by this office as having the potential to be adversely impacted by DOE activities on the ORR. However, the 1992 annual Environmental Report on page 1-17 identified two additional PWS, Soddy-Daisy and Dayton, as also being potentially affected. Five of these PWS have intakes located on the Clinch river within a close proximity of the ORR.

The intent of this monitoring effort is to conduct evaluations and collect samples in order to supplement the required sampling currently performed by PWS owners and DOE personnel. In order to accomplish this TDEC-DOE/O staff will work closely with local governments and public utilities with regards to operations, planning, sample collection, and analysis.

General Activities

The Safe Drinking Water staff member gathered information and participated in various training exercises. The information gathered largely consists of the Sanitary Survey, current sampling requirements, current sample data and current sampling exemptions on each of the PWS previously identified. This information is being gathered with the goal of comparison to contaminants known to be found in the source water. Current training of the Safe Drinking Water staff member consists of various field trips with the TDEC Knoxville Field Office, various in house training, and course work at Tennessee State's Flemming Center. The safe drinking water staff member also participated in the review of the DOE Annual Report and the draft of the DOE Environmental Monitoring Plan.

Sampling Activities

At present only one sample is being taken and that is drawn at the Anderson County Water Treatment Plant Intake as part of the Ambient Surface Water Monitoring Program. To date four samples have been taken all of which have met surface water source criteria under the Safe Drinking Water Act. Eventually a sample at each of the PWS intakes might be taken, this data could then be used in the Ambient Surface Water Monitoring Program as well as the Groundwater Monitoring Program. After further analysis, finished water at each of the PWS may be monitored. Cross connections are also being investigated on a complaint or request basis. As the Division finalizes the 'Potable Water MOU', it is

expected that more time will be invested in field evaluation of the written cross connection control plan and program implementation, on the ORR.

Safe Dam Activities

Environmental Monitoring and Compliance (EM/C)

TDEC-DOE/O does not recognize any direct TOA or FFA commitments in the area of dam safety. However the assurance of safe drinking water and water quality on the ORR, necessitates state involvement in dam safety issues since most dams on the ORR are used as retention structures for hazardous materials. To date this role has taken the form of general advisory role on various reports generated during the stability analysis of White Oak and Radder Dams. Earlier this year TDEC-DOE/O personnel observed both the FERC survey of White Oak and Radder dams and the independent survey of White Oak Dam performed by Ogden Environmental and Energy Services. TDEC-DOE/O personnel evaluated the proposed slope stability modification to be performed in December of 1993. TDEC-DOE/O personnel also observed and commented on the annual emergency drill performed at White Oak Dam, which simulates a worse case scenario dam failure.

4. Biological Fish and Wildlife Monitoring

Program Description

The Biological Fish and Wildlife Monitoring Subsection reviews Oak Ridge Reservation (ORR) monitoring reports and initiates independent biological monitoring and oversight to confirm ORR monitoring completeness. Stream health is a major concern of this subsection. Initially, two indices of stream health will be implemented. The "EPT richness index" measures the presence or absence of pollution intolerant macroinvertebrate species and the "Index of Biotic Integrity" (IBI) rates streams from very poor to excellent. Contaminant monitoring is another major concern. Contaminant monitoring will be accomplished by water, sediment, and fish flesh sampling. This section also assists the NEPA/Audits subsection with ecological/environmental indicators and the Radiological Monitoring section with deer and goose monitoring, during the annual hunts, designed to ensure the public health. In addition TDEC/DOE-O staff from this program continue to participate with various other agencies in conducting field and laboratory exercises. The cross training these activities afford is indispensable in carrying out our program goals.

Environmental Monitoring and Compliance (EM/C)

The Biological Monitoring Subsection is designing and implementing a program supplemental to the existing ORR biological monitoring program to provide a more complete assessment and fill in any possible data gaps. Ecological characterizations will be used to document ecological impacts of past and current operations and identify contaminant sources that adversely affect stream biota. Fish population and community studies and benthic macroinvertebrate community characterizations will be used to assess impacts on water quality and habitat.

Bioaccumulation and contaminant monitoring are major concerns on the ORR which are also tracked by the Biological Monitoring Subsection. The primary objectives of contaminant monitoring are to identify substances that accumulate to levels exceeding those observed in biota from nearby uncontaminated reference sites and evaluate the extent and significance of contamination by those substances. The primary objectives of bioaccumulation monitoring are to determine what materials accumulate to unacceptable levels in biota, identify specific sources of any observed contamination, and to compare water quality monitoring data against contaminant levels in biota. In order to meet these objectives, water, sediments, and fish flesh samples will be taken from various sites on and off the ORR for evaluation.

In addition to the above described biological monitoring, the Tennessee Department of Environment and Conservation, DOE Oversight Division (TDEC/DOE-O) has contracted with the Tennessee Wildlife Resource Agency (TWRA) for fish and wildlife monitoring activity. The assignment of biomonitoring is a listed subsection of the (A.2) Surface Water Monitoring section of the Tennessee Oversight Agreement (TOA).

TWRA contract work for the first 2 years of the contract (1992 and 1993) was submitted to TDEC/DOE-O this past summer (Tables 4.1-4.5). The approved work included mussel and fish tissue analysis for organics in and around the vicinity of the ORR. PCB's and dioxin were equivalent with or less than regional values. This does not indicate that DOE has no problems with these contaminants, but that DOE's problems are similar to other industries. In general the TWRA data shows somewhat higher concentrations of chlordane and lower concentrations of PCB's than did TVA and ORNL data. This is likely a matter of analytical interpretation since the distinction between PCB's and chlordane is sometimes not clear on chromatographs. Phthalate esters were common in the TWRA data set statewide as well as in the ORR vicinity. Phthalates are commonly used in industry and in the laboratory and are an environmental and possible laboratory contaminant. Peculiar to Poplar Creek was Pentachloroanisole (12.8 ppb), a compound of uncertain origin and toxicity. Some agricultural pesticides showed up in the data, most notably carbofuran. Carbofuran is thought to biodegrade and disappear in the natural environment. It's presence at Norris Reservoir (CRM 125) in channel catfish at a level of 301 ppb is not readily explained. It is not known at this point if DOE is contributing to the pesticide buildup and further investigation is needed. Relic byproducts of DDT (DDE) were observed in most of the samples. However, this outlaw pesticide is gradually disappearing across Tennessee. The TWRA data set have been shared with ORNL and are being used in the Clinch River and Watts Bar human and ecological risk assessments. These data combined with DOE and other data provide a more robust data package to support the Lower Watts Bar Reservoir Baseline Risk Assessment.

1994 activities for TWRA included mussel sampling at three stations in the Clinch River proximate to the ORR. Full analyte lists are being applied to the soft and hard tissue samples as practical. Sediment samples were also collected at the mussel sampling stations. The data will be correlated against tissue and mussel community and habitat information, if tissue analysis show significant amounts of contaminants.

1992 TWRA CHANNEL CATFISH DATA

			TABLE 4.1				
CHANNEL CATFISH	WBTRM 545	WBTRM 600	MHCRM 51	FLTRM 624	FBRM 32	CRHRM 12	
Monochlorobiphenyls		3	3.5				
Trichlorobiphenyls	7.5			4.5			
Pentachlorobiphenyls	56.1	53.6		51.5		9.5	
Hexachlorobiphenyls		3		4			
Heptachlorobiphenyls		8.5					
cis-Chlordane	22	34.6	5.530.5		11.1	5.5	
trans-Chlordane		15		34	11.9		
cis-Nonachlor	52.6	61.2		14.5			
Oxychlordane		29.1				8	
Butachlor		4.5		3		4.5	
Dieldrin		57.6					
trans-Nonachlor	92.3	78.7		78.5	21.4		
Pentachloroanisole		4					
Triphenyl Phosphate		3.5	3.5	30			
Methyl Parathion		171.9	54.2	106.5		13	
Di-n-butylphthalate		69.2	25.6	23.5		9.5	
Dinoseb		18.3	23.3				
Diphenyl Disulfide	3						
Chlorpyrifos	15.5						
Cyanazine	8.53		27.9	33.6			
Alpha-BHC			6	8.5	11.1		
p,p' DDE	99.2					21	
Carbaryl			76		19.5		
Picloram			96.1			31.3	
Disulfoton				6.5			
Nitrofen					4		
Dielorin					43.6		
Aciflourfen					40.5		
Lindane						9.5	
2378 TCDF (ppt)	1.44	1.66			1.11		
2378 TCDD (ppt)	2.07	3.09		1.93		4.39	
WBTRM = Watts Bar, Tennessee River Mile			CRHRM = Chickamauga Reservoir, Hiwassee River Mile				
MHCRM = Melton Hill, Clinch River Mile			Values in parts per billion unless otherwise noted.				
FLTRM = Fort Loudon, Tennessee River Mile			Data from 1992.				
FBRM = French Broad River Mile							

1992 TWRA MUSSEL TISSUE DATA

			TABLE 4.2					
MUSSEL TISSUE	WBTRM 598.7	FLTRM 650.5	WBTHS 39	WBTHS 40	CR-KF	WBTHS 37	WBTHS 38	
Monochlorobiphenyls	7.5	3	5	6.5	0	3	4	
Oxychlorodane					5			
Methyl Parathion		18				40.6	39.1	
Di-n-butylphthalate	13.5	23	23	26		27.1	11	
Chlorpyrifos			8.5	6.5				
Alpha-BHC		7	10	6.5	9		9	
Carbaryl				17.1			13.2	
Picloram	57.5							
Disulfoton				5.5		5		
Nitrofen				4				
Simazine		14.5						
Diethylphthalate							12.5	
2378 TCDF (ppt)	2.21		1.17	1.55		1.35	1.41	
WBTRM = Watts Bar, Tennessee River Mile								
FLTRM = Fort Loudon, Tennessee River Mile								
WBTHS = Watts Bar Tailwaters, Hunter Shoals								
CR-KF = Clinch River, Kyles Ford								
Values in parts per billion unless otherwise noted.								
Data from 1992.								

1992 TWRA PADDLEFISH ROE DATA

	TABLE 4.3		
PADDLEFISH ROE	WBRFLT	NRCR	CCCRLB
Monochlorobiphenyls	8.7	3.3	11.3
Oxychlordane		15	
Dieldrin			13
Triphenyl Phosphate			11.3
Methyl Parathion		118	
Di-n-butylphthalate			139.4
Chlorpyrifos	8	3.3	
Alpha-BHC	17.4	30	
p,p' DDE	10.4		
Picloram	211.1		51.9
Nitrofen			9.1
Biphenyl		3.3	
Chlorobenzilate			29.2
2378 TCDF (ppt)	12	2.12	2.75
WBRFLT = Watts Bar Reservoir, Fort Loudon Tailwa			
NRCR = Norris Reservoir, Clinch River			
CCCRLB = Cross Creeks WMA, Cumberland River, Lak			
Values in parts per billion unless otherwise not			
Data from 1992.			

1993 TWRA CHANNEL CATFISH DATA

			TABLE 4.4			
CHANNEL CATFISH	NRTRM 425	WBTRM 560	WBTRM 601	MHCRM 39	FLTRM 624	CRTRM 526
Trichlorobiphenyls		5.8	10.4	10.4	7	
Pentachlorobiphenyls	8	38.8	61.6	61.6	51.6	6.3
Hexachlorobiphenyls		28.2	5.9	5.9		
cis-Chlordane	18	47.5	331.5	23.7	17	17
trans-Chlordane	12.4	54.4	31	30.1	19	23.1
cis-Nonachlor			24	14.1	14	
Oxychlordane				6.4		
Dieldrin		16.5				24.3
trans-Nonachlor		10.3				
Triphenyl Phosphate				14.1	15	
Methyl Parathion	10.1					
Di-n-butylphthalate	11.8	14.5	6	9.6	5.5	14.6
Alpha-BHC		31.7	12	12.8	10	
p,p' DDE	25.3	145.3	143.1	30.1	60.5	32.8
Nitrofen	41.5	6.9				
Dicofol/Kelthane	7.3					
Pentachloronitro Benzene	6.2					
2, 4D				6.9	4	
2378 TCDF (ppt)	1.5	1.78	1.43			7.02
2378 TCDD (ppt)	2.02	1.51	2.09			2.08
NRTRM = Nickajack Reservoir, Tennessee River Mile						
WBTRM = Watts Bar, Tennessee River Mile						
MHCRM = Melton Hill, Clinch River Mile						
FLTRM = Fort Loudon, Tennessee River Mile						
CRTRM = Chickamauga Reservoir ²⁴ , Tennessee River Mile						
Values in parts per billion unless otherwise noted.						
Data from 1993.						

1993 TWRA CHANNEL CATFISH DATA (Cont.)

CHANNEL CATFISH	TRLTRM 11	NRCRM 125	TABLE 4.4 (Cont.) NRPRM 30	WBTRM 545	WBCRM 1	PCM 1
Trichlorobiphenyls						13.1
Pentachlorobiphenyls	11				21.3	53.9
Hexachlorobiphenyls						23.5
cis-Chlordane	28.4	6.7	6.5	7	21	50.7
trans-Chlordane	29.7	7.8	7.6	8	25.5	71.5
cis-Nonachlor	19.6			6	18.5	17.1
Oxychlordane				10.5		15.3
Dieldrin	7	16.5				24.4
trans-Nonachlor		10.3				49.5
Triphenyl Phosphate	12.6	7.8	25.3		20	
Methyl Parathion	7	7.8				
Di-n-butylphthalate	21.5	24.1	17		9	13.4
Alpha-BHC		10.6	18.2	9.5		
p,p' DDE	114.4	16.2	7.1	21.5	61.6	37.3
Gamma BHC (Lindane)				5.5		
Heptachlor Epoxide					13.5	11.6
2, 4D						
Pentachloroanisole						12.8
2378 TCDF (ppt)	1.69				1.17	
2378 TCDD (ppt)	2.09				1.86	
WBTRM = Watts Bar, Tennessee River Mile						
NRPRM = Norris Reservoir, Powell River Mile						
PCM = Poplar Creek Mile						
TRLTRM = Tellico Reservoir, Little Tennessee River Mile						
WBCRM = Watts Bar, Clinch River Mile						
NRCRM = Norris Reservoir, Clinch River Mile						
Values in parts per billion unless otherwise noted.						
Data from 1993.						

1993 TWRA MUSSEL TISSUE DATA

		TABLE 4.5				
MUSSEL TISSUE	WBTHSA	WBTHSA	WBTHSA	FLTRM 597.5		
Oxychlorthane	5					
Methyl Parathion		14		8		
Di-n-butylphthalate	73.9	42.6	16.4	16		
Alpha-BHC				9		
Heptachlor Epoxide	9.5	23.1				
Gamma-BHC (Lindane)				9		
2378 TCDF (ppt)	2.13	1.83	1.83	2.21		
WBTHSA = Watts Bar Tailwaters, Hunter Shoals Area						
FLTRM = Fort Loudon, Tennessee River Mile						
Values in parts per billion unless otherwise noted.						
Data from 1993.						

TDEC/DOE-O staff retained 5 blue catfish from TRM 560 while assisting TVA collect fish for flesh samples. The blue catfish were chosen because there were many more blues captured in the gill nets than channel catfish which were the TVA target fish. The blue catfish from this one 5 fish composite showed 0.5 ppm PCB's, which is less than channel catfish from the same area.

Fish consumption is affected by relative abundance and subsequent harvest of these catfishes. True human health risk may be less than that estimated by channel catfish depending on the consumption scenario.

Aquatic systems serve as transport pathways and reservoirs for most of the contaminants known to be present on the ORR. A wide variety of terrestrial organisms feed on aquatic organisms and may accumulate contaminants from aquatic prey. The Belted Kingfisher is just such a piscivorous and territorial avian species that may be a suitable indicator of contaminant accumulation at specific sites on the ORR.

As part of the biota studies component of the WAG 2 remedial investigation, an investigation by X-10's Environmental Surveillance Division into the efficiency of using the Kingfisher as an ecological indicator of aquatic contaminants on the ORR was initiated. In 1993, work was intended to include surveying of Kingfisher burrows with a special probe developed for that purpose. Completion of the probe was delayed until early 1994, so no burrow surveys were conducted in 1993. However, three Kingfisher carcasses were recovered from different areas of the ORR. These carcasses were necropsied, and samples were sent to an outside analytical lab for trace metals analyses. All three birds contained measurable levels of cadmium and mercury in their internal organs. These limited data show that feathers are an excellent tissue in which to monitor Cd, Hg, Pb, and Se.

TDEC/DOE-O staff went out with X-10 Environmental Surveillance Division staff (ESD) to observe the Kingfisher burrow probe. This trip was very successful in that enough feathers were recovered to run duplicate samples in the laboratory analysis. This office plans to accompany the project leader on at least one more sampling excursion collecting at onsite locations. The data gathered in this study will prove valuable in determining the extent that certain contaminants are passed up the food chain. Staff are now waiting for the written report on the project and the laboratory results on the feather analysis. The X-10 ESD team has shut the project down until next spring when the birds will return to their burrows.

TDEC/DOE-O staff observed X-10 ESD staff sampling the fish community at several locations in East Fork Poplar Creek. The results of the sampling will be reported in the next BMAP.

TDEC/DOE-O staff also went out with biologists, water pollution control, and office of surface mining staff from the KFO. Arrow darters and blackside dace have been found in the Claiborne Co. area, which are federally protected species. Above the site of impact we found diverse, numerous macroinvertebrates but only creek chubs as representative fish species. Below the site of impact we found few inverts and only about half the numbers of creek chubs. The creek (in Claiborne Co.), exhibited high flow, and below the impact site we found high sediment loading and reddish-black algae covering the substrate.

Environmental Monitoring and Compliance (EM\C) staff participated in the annual goose roundup held by Oak Ridge National Lab (ORNL), the Tennessee Wildlife Resources Agency (TWRA), and the University of Tennessee, Knoxville (UTK). Collection sites included K-25, X-10, Y-12, Melton Hill Dam, Solway Park, Melton Lake Park, Clark Center Park, and an unsuccessful attempt at Lake Reality.

Canada Geese have been rounded up and banded annually since 1988 on and around the Oak Ridge Reservation. Currently the large data set generated by these roundups is being analyzed using the Jolly-Seber model to examine the dynamics of the ORR Canada Goose population in terms of estimates of population size, survival rates, recapture probabilities, and recruitment.

Birds from each sample site were sent to the TWRA game checking station on Bethyl Valley Road for whole body counting to check for possible radiological contamination. The radioactivity is calculated using an estimated weight of ten pounds per bird.

Samples of breasts, liver, and bone from five geese collected at the K-25 site and five from a reference site in (Norris Lake), September and October, 1993, were analyzed for PCBs. These geese had no detectable levels of PCBs in any of these tissues.

This years goose roundup was held on June 28 and 29. The geese were captured at each site by herding them into a large chicken wire pen. The geese with collars and tags from previous years were picked out first and the numbers on the collars and tags were recorded. Next, the untagged geese were sexed, tagged, and released.

Of the geese sent for whole body count, only two (from Swan Pond at X-10) showed any contamination above baseline. The tissues of these geese were taken for further analysis. Staff are now waiting for the complete data set from the 1994 goose roundup to be compiled and sent to us.

Radiological Monitoring and Oversight (RM/O)

RM/O's Environmental Restoration Section provides radiological support to EM/C and the Tennessee Wildlife Resources Agency (TWRA). In this capacity, RM/O personnel observed the radiological assay of deer and geese during a DOE authorized hunt in December of 1993. Staff were advised of four hundred deer harvested in that year, seven exhibited radiological contamination above screening levels and were confiscated. Additionally, RM/O staff coordinated and participated in the Clinch River TWRA mussel survey previously addressed in this section.

5. GROUNDWATER MONITORING

Program Description

The Groundwater Monitoring Section, under the terms of the Tennessee Oversight Agreement (TOA), continues to be directed toward evaluation and assessment of DOE's groundwater monitoring activities, both on-site and off-site. These have been realized as sampling and analysis of selected wells, regular monitoring of selected springs, participating in review of DOE's groundwater-related documents (particularly workplans), and site visits/aerial reconnaissance. Oversight is incorporated into the two main phases of this program as (1) assuring compliance with existing regulations, and (2) co-tracking of releases and other potential impacts on health and/or environment.

Environmental Monitoring and Compliance (EM/C)

Review and Assessment

The Environmental Monitoring and Compliance (EM/C) Program, formerly the Corrective Action and Compliance Section, has continued its activities of requesting and reviewing DOE data on monitoring wells and piezometers throughout the ORR and adjacent areas. A preliminary inventory of these has been developed from data provided by DOE, and efforts are underway to incorporate them into a single electronic database. The data has already allowed the evaluation of the status of DOE's plugging and abandonment program.

In addition, EM/C has participated in the review and comment process for the following documents.

- Phase II Remedial Investigation Workplan for Groundwater at Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- ORNL Remedial Investigation Workplan.

Field Activities

Selected springs in the East Chestnut Ridge area have been monitored during the summer months to acquire a base of background values for pH, conductivity, and temperature. This, combined with rainfall records provided by NOAA, will be used to assist in evaluating groundwater movement at/near the traditionally accepted hydrologic boundary east of the Y-12 facility, and will also be used in future efforts to track contaminant migration.

By reviewing existing document/reports and by participating in the sampling of selected monitoring wells, EM/C has been instrumental in the identification of a groundwater contaminant plume. The plume appears to be moving out of the ORR, and additional efforts to further delineate it are required.

Additional Activities

EM/C has reviewed and contributed to DOE's groundwater model for the ORR, and recommended that they consider Karst hydrologic investigations as an integral part of the overall groundwater investigation. Our assistance to DOE in the development of a comprehensive groundwater plan is provided for by sections A.4.1 and A.4.2 of the TOA.

Radiological Monitoring and Oversight (RM/O)

With the significance of offsite contamination of groundwaters, RM/O's Water Section (RM/O-W) in collaboration with EM/C and WM has attempted to focus its activities on: developing an understanding of the hydrogeology of the ORR; assessment of the effectiveness of DOE monitoring programs; the development of information relative to areas most vulnerable to radiological contaminant migration; appropriate locations for RM/O water monitoring activities; and the review of DOE's exit pathway and offsite groundwater sampling programs.

That the hydrogeology of the ORR is extremely complex has been documented in various DOE/MMES publications. The U.S. Department of Energy's Tiger Team Environment, Safety, and Health Assessment of the Oak Ridge National Laboratory (1990) states:

The hydrogeologic regime underlying ORNL has not been adequately characterized to define aquifer characteristics and boundaries, aquifer communication between geologic formations, vertical and horizontal extent of contamination, and local groundwater flow paths and velocities in accordance with best management practices.¹³

The Hydrogeologic Characterization Plan for the Oak Ridge K-25 Site, Oak Ridge, Tennessee (1992) further advises:

The hydrogeology, geologic structure, and stratigraphy of the Oak Ridge K-25 Site are complex and poorly understood. Groundwater investigations, to date, have focused on localized site-specific remedial investigations at Solid Waste Management Units. These areally limited investigations, initiated in 1978, have only started to acquire the information required to assess the nature and extent of groundwater flow and contaminant transport.¹⁰

Characterization of groundwater flow and quality are complicated by anisotropy, heterogeneity, fracture flow, karstic features, and preferred hydrological pathways that have developed as a result of man's activities (e.g., large scale cut and fill, underground utilities). These conditions make the identification of groundwater exit pathways, the proper placement of monitoring wells, and determinations of adequate sampling frequencies difficult. The conditions also render traditional monitoring techniques inadequate to define groundwater flow systems in many areas of the ORR and monitoring methods developed for similar hydrogeological settings (e.g., karstic terrains) more appropriate. MMES has initiated activities directed toward the development of more effective monitoring techniques and TDEC/DOE-O staff continue to express their recommendations concerning same.

Given the uncertainty associated with aspects of the hydrology of the ORR, Division groundwater personnel have coordinated their efforts in an ongoing review of DOE exit pathway and offsite groundwater monitoring systems. In association with these activities, RM/O-W has attempted to identify exit pathway wells exhibiting elevated levels of radiological contaminants with the intent to co-sample these wells in order to validate DOE data and characterize radiological constituents. As a result of the review, various exit pathway wells were identified as appropriate locations for co-sampling activities including GW-169 and GW-206 both part of Y-12's exit pathway monitoring program.

GW-169 is an unconsolidated groundwater well located in Union Valley approximately 1500 meters east of the Y-12 facility. Approximately 46 feet deep, GW-169 is part of a three well cluster used for exit pathway monitoring in the Maynardville Limestone. GW-169 exceeded screening levels for gross alpha (15 pCi/L) sporadically from 1991 through 1993 and the screening level for gross beta (50 pCi/L) during the fourth quarter of 1993^{4,5,6} (Figure 5.1). In 1993, gross alpha averaged 32 pCi/L and gross beta averaged 33.15 pCi/L. Of the associated wells in the three well cluster, GW-170 and GW-232, GW-170 was noted to have elevated levels of VOCs.

The RM/O and EM/C Programs co-sampled these wells with DOE/MMES in the first quarter of 1994. It should be noted that DOE subsequently announced VOCs in GW-170 were associated with a contaminant plume identified as migrating from the Y-12 facility. While results presented in Table 5.1 show insignificant levels of radiological constituents, water levels in well GW-169 during this period were extremely high and it is hypothesized that in the regolith any radiological components (if present) may have been diluted beyond detection by the above average rainfall. RM/O-W hopes to be able to sample GW-169 during a dry period to

test the rainfall correlation thesis, as well as determine whether radiological components are natural, artificial, or the result of anomalous data.

GW-206 is a shallow (approximately 17 feet deep) exit pathway monitoring well emplaced within the water table interval above the Rome Formation. It is located north of the Y-12 facility near Scarboro Road. Data review revealed GW-206 exceeded gross alpha screening levels during the fourth quarter of 1991, second and fourth quarters of 1992, and first and fourth quarters of 1993. Gross beta exceeded screening levels during the second and fourth quarters of 1992, and first and fourth quarters of 1993^{4,5,6} (Figure 5.2). Gross alpha averaged 34 pCi/L and gross beta averaged 100 pCi/L in 1993. During the second quarter of 1994, RM/O-W co-sampled GW-206 with results yet to be returned. Analysis will include gross alpha, gross beta, gamma scan, strontium-90, technetium-99, and other radionuclide analysis as appropriate. RM/O-W will continue to sample GW-206 until an understanding is obtained for the previous gross alpha and gross beta data.

Offsite Groundwater Monitoring Programs

Prior to 1989, available data concerning the investigation of possible contamination of offsite drinking water wells appears to be limited to short term studies conducted in the 1980s. In 1989, Oak Ridge National Laboratory implemented an offsite residential drinking water quality monitoring program in conjunction with the DOE Environmental Protection Division "to document water quality from groundwater sources near the ORR and to monitor the potential impact of DOE Oak Ridge Operations Office (DOE-ORO) operations on the quality of these groundwater sources"⁸. Initially, 21 wells/springs were sampled semiannually for parameters which included gross alpha, gross beta, total radioactive strontium, technetium, tritium, and radionuclides observed in a gamma scan. Two US Geological Survey wells (GW-206 previously discussed and GW-167) have since been dropped from the program and included in Y-12's perimeter monitoring system.

Problematic in the review and assessment of the offsite groundwater monitoring program are: an agreement between ORNL/MMES and property owners participating in the program prohibiting the public disclosure of specific information relative to derived data; the lack of established background levels for natural and man-made radionuclides; the uncertainty associated with data related error; and the inability to extensively investigate the appropriateness of sampling locations and to validate data (co-sample). Concerns and recommendations have been expressed to DOE/MMES in meetings and Division comments on DOE's Environmental Monitoring Plan.

Figure 5.1
Gross Alpha & Beta
GW-169

Figure 5.2
Gross Alpha & Beta
GW-206

In association with the above, RM/O has procured water and sediment samples for radiological analysis from springs (natural convergence points for groundwater in karstic terrains) in Sugar Grove Valley (north of K-25), Scarboro Creek (east of Y-12), and Bacon Springs (a public drinking water source north of ORR). Analytes are determined on a site specific basis and include gross alpha, gross beta, and radionuclides observed in a gamma scan. Strontium, technetium, tritium, total uranium, and other radionuclide analysis are performed as appropriate. Results reviewed to date (Table 5.1) are not indicative of radiological contaminant migration.

Associated Activities

- Initiated investigation into the contents of Blair Road Landfill located on Black Oak Ridge north of the K-25 facility. This landfill was omitted from Appendix C of the Federal Facilities Agreement and was identified as a consequence of the review of the Offsite Residential Drinking Water Program. The ER Program is pursuing its characterization.
- Initiated the assessment of the hydrogeologic suitability of the ORR for spent fuel disposal. RM/O is preparing comments on DOE's Draft Environmental Impact Statement.
- Initiated the investigation into the consequences of deep well injection at ORNL.
- Assisted in the assessment of the suitability of various proposed sites for Class C landfills.
- Investigated elevated alpha readings at the well head of GW-157 located near the Chestnut Ridge Sediment Disposal Basin at Y-12. The alpha was reported to be naturally occurring (radon gas).
- Explored caves on Black Oak Ridge in order to better understand potential pathways for contaminant migration in karstic terrains and in association with the Blair Road Landfill investigation.
- Conducted an ongoing investigation to determine the concentrations of fission products in groundwater as a result of global fallout, as well as background levels on the ORR and environs for natural radiological constituents.
- Investigated allegations that high dissolved/total suspended solids add such a degree of uncertainty for gross alpha analysis that the results may be discounted.

Table 5.1

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
RADIOLOGICAL DATA FOR ORR AND ENVIRONS

DIVISION OF THE DEPARTMENT OF ENERGY OVERSIGHT				
Analysis	Collection Date	Results	Error + or -	Units
Ambient Surface Water				
Clinch River Mile (CRM) 11.5				
Gross Alpha	4/20/94	1.2	2.2	pCi/L
Gross Beta	4/20/94	3.7	3.0	pCi/L
Gamma Scan				
Isotope				
Bi-214	4/20/94	26.8	5.2	pCi/L
Pb-214		23.5	5.3	pCi/L
CRM 18.1				
Gross Alpha	4/20/94	0.6	2.0	pCi/L
Gross Beta	4/20/94	4.4	3.0	pCi/L
Gamma Scan				
Isotope				
Bi-214	4/20/94	47.0	11.0	pCi/L
Groundwater (Wells)				
GW-169 (Union Valley)				
Gross Alpha	1/31/94	0.9	1.7	pCi/L
Gross Beta	1/31/94	1.6	2.9	pCi/L
Strontium 89	1/31/94	0.59	0.54	pCi/L
Strontium 90	1/31/94	-0.090	0.043	pCi/L
Tritium	1/31/94	189.0	151.0	pCi/L
Uranium (total)	1/31/94	-0.31	0.40	pCi/L
Technetium 99	1/31/94	8.8	4.5	pCi/L

DIVISION OF THE DEPARTMENT OF ENERGY OVERSIGHT				
Analysis	Collection Date	Results	Error + or -	Units
Gamma Scan				
Isotope				
K-40	1/31/94	58.0	26.0	pCi/L
K-40	1/31/94*	98.0	28.0	pCi/L
Pb-214	1/31/94	100.6	7.4	pCi/L
Pb-214	1/31/94*	78.5	7.0	pCi/L
Bi-214	1/31/94	93.6	7.5	pCi/L
Bi-214	1/31/94*	89.2	7.0	pCi/L
GW-170 (Union Valley)				
Gross Alpha	2/2/94	3.9	2.7	pCi/L
	2/2/94*	2.9	2.5	pCi/L
Gross Beta	2/2/94	4.2	3.1	pCi/L
	2/2/94*	1.0	2.8	pCi/L
Tritium	2/2/94	91.0	149.0	pCi/L
	2/2/94*	273.0	153.0	pCi/L
Gamma Scan				
Isotope				
K-40	2/2/94	46.0	25.0	pCi/L
Pb-214		77.1	7.5	pCi/L
Bi-214		69.7	5.9	pCi/L
GW-206 (Scarboro Gap)				
Gross Alpha	6/15/94	3.5	5.3	pCi/L
Gross Beta	6/15/94	9.6	6.2	pCi/L
Technetium 99	6/15/94	analysis incomplete		
Gamma Scan				
Isotope				
K-40	6/15/94	145.0	92.0	pCi/L

DIVISION OF THE DEPARTMENT OF ENERGY OVERSIGHT				
Analysis	Collection Date	Results	Error + or -	Units
Pb-214		30.6	8.2	pCi/L
Bi-214		45.0	9.0	pCi/L
GW-232 (Union Valley)				
Gross Alpha	2/1/94	2.7	4.1	pCi/L
Gross Beta	2/1/94	3.0	5.1	pCi/L
Technetium 99	2/1/94	NDA		
Gamma Scan				
Isotope				
Pb-214	2/1/94	33.0	12.0	pCi/L
Bi-214		48.0	11.0	pCi/L
Springs				
Bacon Springs (Water)				
Gross Alpha	5/5/94	-0.3	2.4	pCi/L
Gross beta	5/5/94	2.2	3.0	pCi/L
Gamma Scan				
Isotope				
Pb-214	5/5/94	68.7	7.2	pCi/L
Bi-214		68.9	6.8	pCi/L
Sugar Grove Valley #1 (Water)				
Gross Alpha	2/24/94	1.8	2.3	pCi/L
	5/5/94	-0.6	2.4	pCi/L
Gross Beta	2/24/94	0.9	3.0	pCi/L
	5/5/94	1.0	2.9	pCi/L
Gamma Scan				
Isotope				
Pb-214	2/24/94	43.0	5.7	pCi/L
Bi-214		37.7	5.1	pCi/L
Pb-214	5/5/94	87.0	13.0	pCi/L

DIVISION OF THE DEPARTMENT OF ENERGY OVERSIGHT				
Analysis	Collection Date	Results	Error + or -	Units
Pb-214	5/5/94*	68.0	13.0	pCi/L
Bi-214	5/5/94	109.0	11.0	pCi/L
Bi-214	5/5/94*	45.0	11.0	pCi/L
Sugar Grove Valley #2 (Water)				
Gross Alpha	2/24/94	0.6	1.9	pCi/L
	2/24/94*	0.7	3.0	pCi/L
Gross Beta	2/24/94	0.7	3.0	pCi/L
	2/24/94*	2.2	3.0	pCi/L
Gamma Scan				
Isotope				
Pb-214	2/24/94	34.0	15.0	pCi/L
Pb-214	2/24/94*	58.0	16.0	pCi/L
Sediment				
Sugar Grove Valley #1 (Sediment)				
Gross Alpha	2/24/94	7.2	2.1	pCi/g
Gross Beta	2/24/94	34.7	2.9	pCi/g
Gamma Scan				
Isotope				
K-40	2/24/94	31.2	2.4	pCi/g
Pb-214		1.48	0.19	pCi/g
Bi-214		1.45	0.13	pCi/g
Pb-212		1.8	0.11	pCi/g
Ac-228		1.68	0.24	pCi/g
Tl-208		0.497	0.064	pCi/g
Sugar Grove Valley #2 (Sediment)				
Gross Alpha	2/24/94	5.0	1.8	pCi/g
Gross Beta	2/24/94	19.4	2.3	pCi/g
Gamma Scan				

DIVISION OF THE DEPARTMENT OF ENERGY OVERSIGHT				
Analysis	Collection Date	Results	Error + or -	Units
Isotope				
Cs-137	2/24/94	0.081	0.081	pCi/g
K-40		8.47	0.47	pCi/g
Pb-214		0.847	0.06	pCi/g
Bi-214 *		0.634	0.052	pCi/g
Pb-212		0.926	0.04	pCi/g
Ac-228		0.85	0.1	pCi/g
Tl-208		0.285	0.03	pCi/g
Bi-212		0.59	0.17	pCi/g
* = Duplicate Analysis				
NDA = No Detectable Activity				

Underground Storage Tanks

Environmental Monitoring and Compliance (EM/C)

The purpose of the TDEC/DOE-O Underground Storage Tank (UST) program is to assure compliance with all applicable state and federal regulations and provide oversight to the UST program at the Oak Ridge National Laboratory (ORNL), Y-12, K-25 and other facilities on the Oak Ridge Reservation. To provide these services, the TDEC/DOE-O conducts monthly UST meetings and frequent telephone conversations to track progress on leaking UST sites and discuss UST issues. The TDEC/DOE-O provides information on UST policies and procedures and new regulations through educational workshops and continued communication with DOE, MMES, and their contractors.

Activities and Results

In 1993 and 1994, the TDEC/DOE-O collected soil samples for analysis at four underground storage tank (UST) sites at ORNL, one UST site at the K-25 plant, and one UST site at the Y-12 plant. TDEC/DOE-O collected groundwater samples for analysis at one UST site at the K-25 site. MMES staff collected replicate samples at the same time for analysis. The above samples were collected during UST removal and were taken from the bottom of the excavation using a backhoe bucket. The TDEC/DOE-O samples were shipped to the State of Tennessee Analytical Chemistry Laboratory and were analyzed for Total Petroleum Hydrocarbons

(TPH) and Benzene, Toluene, and Xylene (BTX). Analytical results from samples taken by the TDEC/DOE-O and MMES showed no major discrepancies.

In March 1994, TDEC/DOE-O initiated certificate audits on the ORR. These audits were performed at the ORNL, K-25 site, and the Y-12 plant. No violations of the Division of UST regulations, policies, and procedures were observed during these audits.

6. AIR QUALITY MONITORING

Program Description

The objective of the Air Quality Monitoring Group is to monitor the general air quality of the Oak Ridge Reservation (ORR). The purpose of this is to help insure the health of the citizens of Tennessee and the protection of the environment. This objective is met through environmental monitoring, the review of existing data generated by DOE and MMES air monitoring activities, surveillance, source inspections, audits, and observation of some asbestos removal projects, and other applicable projects.

The objective, activities, and results of TDEC/DOE-O's air quality monitoring for radiological parameters are described in the Radiological Monitoring section of this report.

Activities and Results

Environmental Monitoring and Compliance (EM/C)

The majority of the activities performed by the Environmental Monitoring and Compliance subsection for air quality monitoring encompassed radiological parameters. These efforts are discussed in the Radiological Monitoring section of this report.

Other activities performed by this subsection have supported activities performed with the Waste Management subsection which are included in this report. Some of these activities were source inspections and stack Visible Emissions Evaluations (VEE). The results of these activities are reported in the Waste Management subsection. The Environmental Monitoring and Compliance subsection participated in the stack VEEs and source inspections to help evaluate the need for ambient air sampling of non-radiological, as well as radiological parameters. The non-radiological parameters will be discussed in this section of the report. These non-radiological parameters include the criteria pollutants and hazardous air pollutants (HAP's). The criteria pollutants are listed in the Tennessee Air Pollution Control Rules, chapter 1200-3-3 (See Figure 6.1). The hazardous air pollutants are addressed in the Tennessee Air Pollution Control Rules, Chapter 1200-3-11.

Figure 6.1

1200-3-3-.03 TENNESSEE'S AMBIENT AIR QUALITY STANDARDS

Ambient air quality standards are applicable throughout Tennessee.

TENNESSEE AMBIENT AIR QUALITY STANDARDS for Total Suspended Particulates (TSP), PM^{10} , Sulfur Dioxide, Carbon Monoxide, Ozone, Nitrogen Dioxide, and Lead.

All values other than annual values are maximum concentrations not to be exceeded more than once per year. Parts per million (PPM) values are approximate only. All concentrations relate to air at standard conditions of 25 degrees centigrade temperature and 760 millimeters mercury pressure.

$\mu g/m^3$ - Micrograms per cubic meter

AGM - Annual geometric mean

AAM - Annual arithmetic mean

Contaminants	Primary Standard Concentration			Averaging Interval	Secondary Standard Concentration			Averaging Interval
Note:	Notes continued on next page							
1								
	µg/m³		ppm by vol		µg/m³		ppm by vol	
Total Suspended Particulates	75		--	AGM	60		--	AGM
	260		--	24 hr.	150		--	24 hr.
2								
PM ¹⁰	50			AGM	50			AGM
	150			24 hr.	150			24 hr.
Sulfur	80		0.03	AAM	1,300		0.5	3 hr.
Diox' de	365		0.14	24 hr.				
Carbon	10,000		9.0	8 hr.	10,000		9.0	8 hr.
Monoxide	40,000		35.0	1 hr.	40,000		35.0	1 hr.
3								
Ozone	235		0.12	1 hr.	235		0.12	1 hr.

Nitrogen	100		0.05	AAM	100		0.05	AAM
Dioxide								
Lead	1.5		--	Calendar quarter	1.5		--	Calendar quarter

NOTE:

1. This value of 60 for an AGM for particulate matter is a guide to be used in addressing implementation plans to achieve the 24-hour standard.
2. The 24-hour standards are attained when the expected number of days per calendar year with a 24-hour average concentration above $150 \mu\text{g}/\text{m}^3$, as determined by Appendix K in Federal Register, Volume 52, No. 126, July 1, 1987, is equal to or less than one. The annual standards are attained when the expected annual arithmetic mean concentration, as determined in accordance with Appendix K as cited above, is less than or equal to $50 \mu\text{g}/\text{m}^3$.
3. The standard is attained when the expected number of days per calendar year with maximum hourly concentration above 0.12 ppm ($235 \mu\text{g}/\text{m}^3$) is equal to or less than one as determined by the Federal Register, Volume 44, No. 28, February 8, 1979, Part V, Appendix H.

There is a large amount of existing data concerning the environmental air quality of the Oak Ridge Reservation (ORR). This information is reviewed on a continuing basis to help evaluate the general air quality of the ORR. A large quantity of the data is produced by process monitoring, stack monitoring, perimeter ambient air monitoring, and ORR ambient air monitoring. Only a small percentage of the ambient air monitoring is performed for non-radiological parameters. Other data which is reviewed include information from various DOE, and EPA audits. Some of the sources of the data which is being reviewed by the Environmental Monitoring and Compliance subsection are listed below:

1. Oak Ridge Reservation Environmental Reports 1989-1992
2. U.S. DOE Environment, Safety, and Health Tiger Team Assessments...
 - a. K-25 12/91
 - b. ORNL 11/90
3. U.S. DOE Environment, Safety, and Health Compliance Assessment of the Oak Ridge Y-12 Plant 10/89

Reviews of the ambient air monitoring data from the Oak Ridge

Environmental Monitoring Reports 1989-1992 showed that there were no major problems with any of the pollutants that were monitored. The review of the stack data which was listed in these reports for the three sites indicated that there were no violations of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for the hazardous air pollutants (HAPs) that were monitored.

Ambient air monitoring for criteria pollutants is not presently required for the ORR because it is located in an attainment area. Although this monitoring is not required, Y-12 has been performing ambient air monitoring for some of the criteria pollutants⁴ and fluoride as a best management practice (BMP). These pollutants are listed in table 6.1 along with their Tennessee Primary Standards (See table 6.1). It should be noted that the fluoride sampling has not been performed using the

TABLE 6.1

Pollutant	Sample Period	K-25	Y-12	Tennessee Primary Standard
Units	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Total Suspended Solids	**AGM	25.0	NA	75
	*24 hr.	106.46	73.02	260
PM10 ***	**AGM	19.24	NA	50
	*24 hr.	56.87	29.14	150
Lead	Calendar Quarter	<0.0612	_____	1.5
Fluoride	*7-day average	_____	0.2804	1.6
Mercury	30-day average	_____	0.056	****1.0

* The values listed for these sample periods were the maximum values reported in the 1992 Oak Ridge Environmental Report

** AGM- Annual Geometric Mean

*** PM10- Particulate Matter with a diameter > 10 microns

**** This value is a NESHAP standard

method which is approved by the Tennessee Air Pollution Control Rules, chapter 1200-3-12-.02 (ASTM 3266). Therefore, this sampling data cannot be used to verify compliance with the Tennessee Primary Standard for ambient air fluoride sampling unless the alternate method has been approved by the TDEC/APC technical secretary. Y-12 has proposed to discontinue this sampling along with all of the Total Suspended Particulate (TSP) and PM10 sampling, and most of their ambient air sampling for uranium particulates. This sampling may be discontinued as a result of cuts in funding for non-regulatory sampling. At this time, the processes capable of emitting any fluoride compounds are not on line. The need for fluoride sampling will be evaluated as the processes are brought back on line. If Y-12's production increases to the amount of production experienced in the mid-80's the need for TSP, and PM10 sampling will be evaluated. There have been meetings and some correspondence between Y-12 and TDEC/DOE-O concerning the systems which were proposed to be discontinued. No final decision has been made. Y-12 will continue to perform ambient air monitoring for mercury; this monitoring was not included in the proposal as a system to be discontinued.

The K-25 plant site also samples for some of the criteria pollutants (See table 6.1). At K-25 various metals are included in their ambient air monitoring program. These metals include nickel, lead, beryllium, arsenic, uranium, and cadmium. Lead is the only metal listed which has an ambient air quality standard. Chromium has recently been dropped from the sampling parameters. K-25 also has two samplers which are capable of sampling for PCB's, furans, hexachlorbenzene, and dioxin. These two monitors (TSCA 1,2) are only operated in the event of a TRV (thermal release valve opening). There needs to be a group meeting set up between K-25 and TDEC/DOE-O concerning the operational practices of these monitors as well as the location of the TSCA1 monitoring station. It should be noted that an operational monitoring baseline is not being established for these monitors. TDEC/DOE-O feels that this is poor monitoring practice. An operational baseline needs to be established in order to adequately assess the effects of a TRV should it occur. TDEC/DOE-O also feels that the TSCA1 monitoring station is poorly located. Although these monitors are not required by EPA or the State of Tennessee Air Pollution Control Division, DOE orders require them (5400.1). It has been stated by MMES, that the monitoring station was located by evaluating the "nearest exposed individual", and the "nearest exposed community". MMES modeling has shown that the location of the TSCA1 monitoring station would hardly ever, if at all, be impacted by a TSCA incinerator release. It has also been stated by MMES that the monitoring station meets all of the siting criteria for a station. DOE Order OR 5400.1 states,

"4. POLICY.ORO and its contractors endeavor to comply with both the letter and the spirit of applicable environmental statutes, regulations, standards, and DOE orders."

It is TDEC/DOE-O's opinion that the location of this station does not meet this policy. Although it may meet the letter of environmental DOE orders, it does not meet the spirit of the orders. TDEC/DOE-O believes that if a TRV or some catastrophe should occur at the TSCA incinerator, this monitoring station would be impacted very little if at all. It is out of the direction of the main wind pattern, it is masked by the general terrain, and it is basically located in a hole off the side of the road. This problem has been discussed before. It was discussed with TDEC/DOE-O when the relocation of the TSCA2 monitoring station was discussed in December of 1992. Yet, there has been no action taken to correct this problem. One reason that the TSCA2 monitoring station was relocated was because of an alleged possibility of high readings caused by interference from other local incinerators (SEG and IT). Note that, as stated before, there was no operational baseline to support this possibility. There was no historical ambient air data showing the effects on the environment that the other incinerators had as far as TDEC/DOE-O knows. The TSCA1 monitoring station should be moved because of the possibility of obscured measurements created from the problems already discussed. The primary reason that the TSCA2 monitoring station was moved was because of the possibility of vandalism. This possibility is just as real for the TSCA1 monitoring station. The TSCA1 monitoring station should be given the same priority that the TSCA2 monitoring station received.

There are three steam plants located on the Oak Ridge Reservation. The types of fuel each plant uses are listed in table 6.2. The plants which use coal for fuel are the only ones capable of emitting large amounts of sulfur dioxide. All of the fuels have the capability of emitting nitrogen oxides. The stacks for the steam plants have opacity monitors which monitor the emissions when coal or fuel oil is being burned. The Waste Management section has performed EPA method 9 stack reading for the steam plants at ORNL and K-25. These results are included in the Waste Management subsection of this report. Both steam plants passed the inspection. The need for performing ambient air sampling for sulphur dioxide and nitrogen oxides is not necessary since the ORR is located in an attainment area, and since these steam plants are in compliance with their operating permits.

Ozone is another criteria pollutant. It is formed primarily by nitrogen dioxide (NO_2), and volatile organic compounds (VOCs) in the presence of sunlight. There is no problem on the Oak Ridge Reservation with either of these pollutants. Also, in consideration of the fact that the ORR is in an attainment area ozone does not need to be monitored. Ozone, when it is in the air

which we breath (troposphere), creates a health problem. It is the major chemical found in smog. Yet, when the ozone in the upper atmosphere (stratosphere) is destroyed another health problem is created from ultraviolet light. The stratospheric ozone layer is being depleted by synthetic organic compounds such as chlorofluorocarbons (CFCs), and halons. There has been an extreme effort by MMES/DOE in reducing the amount of CFCs being used on the Oak Ridge Reservation.

TABLE 6.2

Site	Primary Fuel	Secondary Fuel
Y-12	Coal	Natural Gas
ORNL	Coal	Fuel Oil
K-25	Natural Gas	Fuel Oil

Carbon monoxide (CO) is also a criteria pollutant. It is formed from incomplete combustion of fuel. The major sources of CO are mobile sources such as automobiles. Other sources of CO on the ORR are the steam plants and incinerators. Since the ORR is in an attainment area there is no need for performing ambient air monitoring for carbon monoxide.

There are seven major hazardous air pollutants (HAPs) listed in the Tennessee Air Pollution Control Rules, chapter 1200-3-11-.01-(3a):

1. Asbestos
2. Beryllium
3. Mercury
4. Vinyl Chloride
5. Benzene
6. Radionuclides
7. Inorganic Arsenic

The Radiological Monitoring Section of TDEC/DOE-O has the primary responsibility in this Division of reviewing the radionuclide air compliance and monitoring issues. The other HAPs have not yet been reviewed in great detail by TDEC/DOE-O. TDEC/DOE-O plans on reviewing these other HAPs in more detail during the upcoming year. TDEC/DOE-O recognizes that there are significant uses of

beryllium, asbestos, mercury, and possibly inorganic arsenic on the reservation. Asbestos is used in buildings throughout the reservation. The primary ways it is emitted to the atmosphere is through asbestos removal projects and D&D projects. The major asbestos removal projects and the D&D projects are reviewed by the Waste Management section of TDEC/DOE-O, and the D&D projects are reviewed by the Radiological Monitoring section of

TDEC/DOE-O.

The possibilities of beryllium emissions are primarily from the Y-12 site and the TSCA incinerator at K-25. The beryllium is monitored by process monitoring and some stack monitoring at Y-12. K-25 also monitors for beryllium with their perimeter air monitors. The review of this data has not yet been performed by TDEC/DOE-O. The majority of the sources operating under Tennessee Air Pollution Control Operating Permits will be reviewed in the coming year. The Waste Management section of TDEC/DOE-O has the primary responsibility in this Division for this source review.

The possibility of mercury emission is from the Y-12 site and fugitive emissions. The mercury is monitored by ambient air monitors located on site. The yearly data resulting from these monitors is reported in the Oak Ridge Reservation Environmental Monitoring Reports. The data has been reviewed and shows no major problems with mercury in the ambient air at the Y-12 site. The mercury monitoring system will be reviewed next year along with more current data as it becomes available.

TDEC/DOE-O has recently been informed of ambient air monitoring for arsenic and cadmium at the K-25 site. This system and the resulting data will be reviewed as it becomes available.

Waste Management (WM)

The majority of monitoring activities performed by this subsection centered around compliance inspections. A total of five compliance inspections were conducted during the previous year. Both ORNL and K-25 were inspected twice while Y-12 was inspected once during the past year. Each site was inspected in July, 1992. At that time, only the major sources were reviewed at each site. The inspections at K-25 and ORNL occurring in 1993 included all the state permitted sources. The sources reviewed during these inspections are listed in Appendix A. During these inspections, input logs and stack monitoring data were reviewed to insure compliance. Also, visible emissions evaluations were conducted at all three sites. The sources where visible emissions evaluations were conducted include the steam plants at each site, TSCA incinerator, carpenter shops, and selected number of boilers. The number of audits performed at each site are listed in Table 6.3 along with the number of reviewed sources and violations. No violations were observed during the initial audits

at any of the plant sites. As TDEC/DOE-O employees gain more experience more thorough audits will be performed.

TABLE 6.3

Site	# of Audits Performed	# of Sources Reviewed	Compliance Violations
K-25	2	11-active 17-standby 20-cancelled permits	zero
Y-12	1	9-major sources viewed out of 97-active	zero
ORNL	2	32-active 6-exempt 5-cancelled	zero

Furthermore, this section has conducted inspections of sources being constructed, modified, or removed from service. These inspections consist of visual inspections as well as data review. Emissions data is reviewed in order to accurately assess the effect these changes may have on the environment. Also, construction permit applications and operating permit modifications were reviewed during this process. Members of this section observed a source test conducted on a new boiler which was brought on-line at the K-25 steam plant.

A review of the Oak Ridge Reservation's Open Burn Plan was conducted. During October, 1993, an open burn involving sodium-potassium alloy was observed by members of this section.

Also, one asbestos abatement project was observed by members of this section. The section reviewed notifications detailing each major asbestos abatement project occurring on the Reservation. A major abatement project is defined as the disturbance of 160 square feet, 260 linear feet, and 35 cubic feet of asbestos.

Finally, members of this section attended monthly TSCA

incinerator operations meetings. These meetings were developed to keep the Division informed of all activities occurring at the incinerator as they occur.

Radiological Monitoring and Oversight (RM/O)

In 1993-1994 monitoring efforts were focused toward the review of existing data (e.g., stack emissions, ambient air monitoring, and milk sampling). The review of the stack emissions data for source 7911, the High Flux Isotope Reactor, from the 1992 Oak Ridge Reservation Environmental Report⁸ created some concern because of the large amount of curies reported for Noble gas emissions. This concern was followed up by calling a meeting to explain the reported data and the existing radionuclide gas sampling system for stack 7911. An overview of this system was also performed. Through this meeting and overview, TDEC/DOE-O's concerns were presently laid to rest, with some possible added follow-up field visits in the future. There were no obvious concerns raised by the review of the ambient air monitoring data. There are, however, concerns about the proposed discontinuation of perimeter ambient air monitoring at Y-12. TDEC/DOE-O favors consideration for possible upgrades for selected portions of the existing system and a continuance of useful parts of the ambient perimeter monitoring and sampling. This issue is being actively worked, with TDEC/DOE-O awaiting more input on perimeter locations most likely to be useful, and about the present adequacy of the ORR wide ambient system. RM/O, Soil and Air Monitoring (SAM) is also following the relocation of the TSCA #1 air sampling station and the expansion of the K-25 ambient perimeter air sampling network.

Efforts continue to develop an independent TDEC/DOE-O ambient air sampling system. Acquisition of air sampling equipment and enrollment in EPA's Environmental Radiation Monitoring Systems are also being pursued. The results of the radiological oversight, monitoring, and sampling will be more complete in the June-December 1994 Annual Report.

7. Waste Management

Solid Waste Section

Activities of this section are centered around RCRA concerns on the Oak Ridge Reservation which includes reviews and comments on RCRA permit applications; reviews, comments, and certifications of RCRA closures; and oversight of RCRA post-closure activities. Sites of major focus have been the K-25 Pond Waste, Y-12 landfills and burial grounds, the S-3 Ponds, Kerr Hollow Quarry, and WAGs 5, 6, and 13 at X-10. Quarterly and annual Groundwater Quality Assessment Reports have also been a priority for review and comment.

Major activities have included reviews and comments on waste minimization and source reduction/zero discharge plans. Decontamination and decommissioning surveillance program and waste/residue characterization.

During the 5/93 to 5/94 calendar year our personnel participated in the annual RCRA inspections at X-10, Y-12, and K-25. Other activities include oversight of cesium soil removal to storage at WAG 6, oversight of WAG 5 coring, and oversight of construction of landfills 5 and 7 on Chestnut Ridge.

RESULTS:

1. Reviewed 20 annual and quarterly Groundwater Quality Assessment Reports (GWQAR) for compliance and comments (1989-1994).
2. Scheduled meetings with ORR representatives for groundwater to resolve issues from GWQAR reviews (well construction and placement, analytical and statistical results).
3. Reviewed 64 documents for information on specific sites (Kerr Hollow Quarry, S-3 Ponds, etc.) to determine if adequate hydrogeological data is available.
4. Reviewed 12 Closure and Occurrence Reports for potential effects on groundwater quality and submitted comments.
5. Reviewed 15 documents and/or reports focused on hydrogeological characteristics of a facility on the ORR and determined the monitoring effectiveness.
6. Made 8 monthly trips to WAGs at X-10 to check progress of cesium soil storage and corehole logging and submitted trip reports.

7. Made 9 monthly trips to Landfills 5 and 7 to check progress of construction and view installation of drainage, holding tanks, liners, vents, etc., and submitted reports. Assisted Knoxville Field Office personnel in official inspections.
8. Made 3 trips to information centers (IRC, TVA, library, SCS) to procure maps and aerial photographs of ORR. Also procured flyover radiometric and magnetic maps from X-10.
9. Reviewed waste minimization related documents (5) of ORR activities, and provided comments.
10. Made 5 trips to K-25 and immediate vicinity to verify findings of unreported landfill found on aerial photos.

Monthly and quarterly meetings are attended for briefings and project updates with ORR personnel. Conferences and seminars on RCRA and computer training (Map Info, OREIS) are ongoing. The Waste Tracking System is progressing and the Waste Minimization Program is being monitored.

Engineering Support Section

The Engineering Support Section is responsible for the environmental monitoring and review of data and information related to various design, construction operations, and D&D activities. These responsibilities include all DOE-Oak Ridge facilities which generate, handle, store, treat and/or dispose hazardous, mixed hazardous, radioactive, and solely radioactive waste and materials.

RESULTS:

Conducted various field trips to inspect and observe construction activities to assure proper construction methods and quality control, such as:

1. Made numerous field trips to ORNL - IWMF to inspect and follow the progress of construction activities for Tumulus Pad #4 and the corresponding drainage tunnel. These visits were to observe the adherence to specifications and quality of work with regard to grading, formwork, rebar, and finally, placement of concrete. Follow-up trips were made to verify proper curing, form removal, and final cleanup.
2. Conducted several site visits to south side of SWSA 6 near the Demonstration Tumulus Pads to witness the unloading, loading, and storage of various types of silos, tumulus boxes, and concrete vaults. During these visits we were able to observe the unloading, movement, and placement of the 13'x9'x13' concrete silos being used for storing of cesium contaminated soil from WAG 13. After observing the placement

of the subject silos, TDEC/DOE-O made recommendation regarding a revised placement method for installing the vaults. The revised method of installation will ensure a better bearing surface between the bottom of the vaults and the excavated holes in which the silos are being placed.

3. Visited ORNL-Melton Valley and Bethel Valley-Low Level Liquid Waste Lines-replacement activities. The purpose of the trip was to witness the location of the various pipelines, and as a follow-up, a review is ongoing of the mechanical drawings to ensure that all piping and valve pits for the active research labs have been upgraded or replaced to provide a safe double-walled containment.
4. Visited proposed site for K-15115-F replacement lagoon.
5. Visited K-25 Drum Storage Yard to inspect and assure proper procedures are being implemented in the cleanup operations.
6. Conducted regular field trips to Y-12 West End Treatment Facility. Modifications/additions to existing facility to ensure work is being performed according to previously reviewed design drawings and specifications.

In addition to various site visits, the Engineering Support Section has provided engineering reviews and evaluations of various design packages, permits, environmental assessments, feasibility studies, and other miscellaneous DOE policies and procedures, such as:

1. WETF Modifications to existing facility.
2. Review of stormwater control plans, permit applications for D&D of Powerhouse and Cooling Tower Demolition at K-25.
3. Reviewed and provided comments with regard to DOE's Progress Tracking System.
4. In process of reviewing Liquid Low-Level Radioactive Waste Tank Systems.
5. Reviewing Design Assessment of Melton Liquid Low-Level Waste Collection and Transfer System Upgrade.
6. Process Waste Surge Tank Project at ORNL.
7. K-1515-F Lagoon.

Participated in meetings and discussions, reviewed various documents, and provided comments to items such as performance evaluations, radiological controls of solid waste, solid radiological waste disposal practices, waste acceptance criteria, various DOE Orders, etc.

Coordinated and participated in reviewing D&D activities, including:

1. Accelerated D&D plans, strategy, purpose, assumptions, and documentation.
2. D&D prioritization.
3. Latest D&D program facility inventory baseline.
4. Formal request to transfer a facility to D&D list or requested to drop facility from D&D inventory.

Members of the Engineering Support Section are serving as members of accelerated D&D Working Groups for K-25 Powerhouse and Cooling Towers assisting DOE in:

1. Coordination of State reviews and facilitating comments and approvals.
2. Oversight of decontamination activities.
3. Oversight of construction management.
4. Oversight of site preparation.
5. Oversight of demolition material removal.
6. Coordination of oversight for demolition material storage and disposal.

8. Radiological Monitoring

In contrast to most environmental and public health legislation, the Atomic Energy Act (AEA), enacted in 1954, exempts DOE from certain regulations pertaining to radiation and delegates to DOE the authority to manage radiological materials generated at its facilities. The Tennessee Oversight Agreement (TOA) is intended to assure the health, safety, and environment of the State are protected and that DOE complies with all applicable laws, regulations, and orders.

The goals of TDEC/DOE-O's radiological monitoring activities are: to evaluate and affect DOE compliance with applicable laws, regulations, agreements (i.e., TOA, FFA), DOE Orders, administrative policies, procedures, and guidelines; to assess the effectiveness of radiological controls implemented on the ORR by DOE and its contractors; to characterize radiological contaminants and determine the impact and/or potential impact of DOE activities on the health of the environment and the citizens of the State; and to facilitate corrective measures necessary to provide a healthful environment for the citizens of the State.

It is the Division's intent as prescribed by the TOA (A.6 and C.3): to review all DOE-OR radiological surveillance programs and make recommendations where appropriate; to participate with DOE in sampling and analysis of pathway indicators (crops, milk, wildlife) as necessary to characterize and evaluate onsite control measures; to develop radiological monitoring programs addressing all media (soil, air, and water) that will compliment and verify DOE radiological monitoring activities; to assess hazards associated with DOE operations (past and present); to identify potential risks posed by decontamination and decommissioning (D&D) of contaminated facilities and environmental remediation (ER); and to facilitate the development of programs to warn of and respond to emergency conditions.

The above requires the application of a variety of disciplines (e.g., Health Physics, Geology, Hydrology, Meteorology, Biology, Waste Management, Engineering) and the contribution of all TDEC/DOE-O Programs. The Radiological Monitoring and Oversight Program has been designated as radiological support for the remaining TDEC/DOE-O programs and its organization reflects that of the Division. RM/O program activities are developed in concert with WM, EM/C, and ER and integrated with these programs. Where activities have previously been addressed in this Environmental Monitoring Report (EMR), they will not be reiterated except where necessary for clarity.

It should be noted that during fiscal year 1994, much RM/O activity has been directed toward acquiring appropriately trained/experienced personnel (where possible) and providing supplemental instruction as necessary in the development of

competent, confident staff, and a comprehensive radiological monitoring program. With the varied responsibilities delegated by the TOA and the access requirements specified by OSHA, instruction has included health physics, environmental monitoring, hydrology, geology, emergency response, hazardous waste operations, and radiological worker training.

Water

RM/O's Water Section (RM/O-W) has been tasked with the radiological support of the surface and groundwater monitoring components of the Division and the implementation of the radiological water monitoring requirements of the TOA. All TDEC/DOE-O programs and the Division of Radiological Health have contributed in addressing the specific radiological water monitoring responsibilities of that document. Activities are addressed in the Surface Water, and Groundwater sections of this EMR.

Air, Soil, Vegetation, and Milk

The objective of RM/O's Soil and Air Monitoring (SAM) Section is to provide radiological monitoring and oversight of air, soils, milk, vegetation, and wildlife (For additional RM/O air activities, please refer to the Air Quality Monitoring Section). This objective is realized through TDEC/DOE-O environmental monitoring, surveillance, and review of DOE and Martin Marietta Energy Systems' environmental monitoring programs.

Oversight of DOE radiological sampling was initiated during the first quarter of 1993. Oversight of air and milk sampling was conducted through observation of DOE/MMES monitoring staff. Representatives of SAM also accompanied EPA Region IV personnel on their annual inspections of ORR facilities. SAM will continue oversight of DOE/MMES air and milk environmental sampling programs and expand the scope of their operation to include the oversight of wildlife, vegetation, and soil as resources permit. As a result of high personnel turnover, the section was reduced to an effective strength of one person for most of the reporting period and much of the work performed was with the assistance of the EM/C and WM programs. SAM anticipates independent monitoring will be initiated in the near future.

There were concerns raised by the review of milk sampling data from the Oak Ridge Environmental Reports for 1987-1992. The data of concern is listed in table 8.2. The total rad. strontium level for some of the samples appear to be high. The safe drinking water Maximum Contaminate Level (MCL) for strontium is 8 pCi/l. The range of intake for total rad. strontium, assuming that 1 liter/day would be the intake, for milk was 0-20 pCi/l. This means that 20 pCi/l should be the maximum allowable intake concentration. In an effort to evaluate TDEC/DOE-O's possibility

of performing milk sampling, information on all of the dairies in the surrounding counties and their locations has been compiled.

Table 8.1

Strontium		
Year	Maximum Reading	Average Reading
Units	pCi/l	pCi/l
1987	25	6.1
1988	24	4.4
1989	12	2.9
1990	17	3.8
1991	11	4.3
1992	8.1	4.5

Terrestrial and Aquatic Biota

RM/O Environmental Restoration (RM/O-ER) provides radiological support to EM/C and TWRA as addressed in the Biological/Fish and Wildlife monitoring chapter of this EMR.

External Gamma Radiation

RM/O oversight in this area has consisted of review of MMES generated data and observation of collection of that data. To date, that data has been within acceptable limits. RM/O has recommended that some currently inactive ambient gamma monitors be brought back in service. RM/O will continue to address this issue. RM/O is also in the process of investigating the possibility of an independent ambient gamma monitoring system. Currently under consideration are portable real time monitoring devices similar to the ion chamber instruments currently co-located at the ORR ambient air monitoring sites, devices similar to drive through vehicle monitors, and passive monitoring devices. The passive devices are similar to personal dosimeters. TDEC/DOE-O expects to have some type of system in operation within the next year, resources permitting.

Environmental Restoration (ER)

RM/O's Environmental Restoration Section (RM/O-ER) is designated as radiological support for the Environmental Restoration Program. RM/O-ER's main objective is to provide radiological

expertise and assistance in the characterization and remediation of sites exhibiting radiological contamination. RM/O-ER is currently in review of Appendix C of the Federal Facilities Agreement in order to prioritize sites based on radiological constituents and contaminant migration.

While RM/O-ER is in the process of acquiring and training staff, it has been able to initiate the evaluation of radionuclides associated with specific operable units (OU) (decay schemes, equilibrium states, and nuclide half life evaluations in relation to institutional controls); the evaluation of information relative to the Lower East Fork Poplar Creek OU and the Plutonium Vulnerability Assessment; and the investigation of incidences involving radiological contamination.

Radiological Materials Management (MM)

The Waste Management Program has provided expertise and oversight in the generation, handling, storage, disposal, treatment, and monitoring of radioactive materials and mixed/radioactive wastes. Activities include the review/comment on numerous documents (e.g., plans, hydrological data, performance evaluations, waste disposal practices, waste acceptance criteria, etc.) and the inspection of waste handling facilities. In conjunction with WM, RM/O-Materials Management Section (RM/O-MM) has initiated investigations into the environmental impact of the storage, disposal, treatment, and transport of low level waste, spent nuclear fuel, high level waste, transuranic wastes, plutonium, and surplus enriched uranium. Additionally, RM/O-MM is coordinating the review and comment on DOE's Draft Environmental Impact Statement for the proposed storage of spent nuclear fuel on the ORR.

Site and Facility Evaluation (SAFE)

RM/O's Site and Facility Evaluation Section (RM/O-SAFE) has dedicated much of its resources in the last year to the development of the Radiological Facility Survey Program which is scheduled for implementation on July 20, 1994. It will include the review of environmental monitoring information, radiation surveys of all facilities on the ORR, and the evaluation of avenues through which contaminants might enter the environment (e.g., sink drains, utility lines, and underground storage tanks). Its primary goal is to identify potential problem areas so that appropriate precautions/corrections can be implemented.

RM/O-SAFE has also served as liaison between TDEC/DOE-O and the Divisions of Superfund and Radiological Health. In this role RM/O-SAFE has assisted TDEC/DOE-O's sister agencies in the development of relevant information, review and comment on sampling plans, tracking of environmental monitoring activities,

and oversight of the remediation of Atomic City Auto Parts, CSX Railroad, and the Roscoe Fields Solway Site.

Emergency Response

The Tennessee Emergency Management Agency (TEMA) has been contracted to manage development of programs that will enable state and local governments to respond to protect the citizens of Tennessee from emergencies that could develop on the ORR (e.g., accidental radiological releases). RM/O-SAFE interfaces with TEMA in the development of activities related to TDEC/DOE-O responsibilities in the event of catastrophic scenarios, and necessary precautions to protect the public welfare and the environment.

At the present time, the Division's role is to provide technical support (expertise) in the control of accidental releases of hazardous/radioactive contaminants on the ORR and environs. Preparation for these activities include: appropriate training (RM/O staff have completed Radiological Response Team Training and are researching avenues for further instructional opportunities); development of information relative to emergency response (e.g., RM/O-SAFE recently attended the Hazardous Materials Conference in Nashville); collaboration with DOE and its contractors; and coordination with state and local emergency response personnel. RM/O-SAFE staff will attend the Emergency Coordinator Conference in August, 1994 to further define Division responsibilities.

9. Health Study Agreement

DOE HEALTH STUDIES

In July 1991, the Tennessee Department of Health and the United States Department of Energy initiated the Health Studies Agreement. The project's purpose is to carry out independent studies of possible health effects in people living in the vicinity of the Oak Ridge Reservation (ORR). The focus in these studies will be the effects that could result from exposures to chemicals and radioactivity released at the Reservation since 1942.

Phase I began in May 1992 and was completed in September 1993. The studies evaluation was the focus of the Feasibility Study (FS), which identified releases that should be studied in detail in Phase II. The Phase I or Dose Reconstruction FS was guided by the Oak Ridge Health Agreement Steering Panel (a group of experts and local citizens). Phase I was a preliminary evaluation to determine the feasibility and direction of future effort. Information about past off-site releases of some harmful substances from the ORR plants (X-10, Y-12, K-25, and the former S-50) was obtained by the researchers to conduct the study. Further investigations of possible adverse health effects in the vicinity of the ORR were recommended by the Panel. The FS brought into focus further investigations of possible adverse effects in the vicinity of the ORR. The following are the steps completed in the FS:

- 1.Described the ORR operations
- 2.Examined information about past water, air, and soil sampling.
- 3.Summarized current information on harmful substances.
- 4.Looked at who would most likely have been affected.
- 5.Explored which pathways had the greatest potential for affecting people living downwind or downstream from the ORR.
- 6.Evaluated human exposure pathways for harmful substances to find the most important ones.
- 7.Reached several conclusions: The researchers found four types of releases to have the highest potential to have been health hazards to people living around the ORR.

Phase II will lead to estimates of the amounts or "doses" of contaminants that people have received. The Phase II efforts will be focused on the following topics:

- radioactive iodine releases from Radioactive Lanthanum (RaLa) processing at X-10, during 1944-1956.

- cesium-137 releases to streams and lakes from various chemical separation processes from 1943 through the 1960s.

- mercury releases from lithium enrichment operation at Y-12 during 1955-1963.

- PCBs releases primarily from electrical transformers at K-25 and from machining operations at Y-12 (the largest releases probably occurred more than ten years ago).

The Panel will continue the review of other releases from the ORR to assess their importance and the need for additional detailed evaluations.

References

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4. HSW 1992 "Groundwater Quality Assessment for the Upper East Fork Poplar Creek Hydrogeologic Regime at the Y-12 Plant" Y/SUB/93-YP507C/2/P2
5. HSW 1993, "Groundwater Quality Assessment for the Upper East Fork Poplar Creek Hydrogeologic Regime at the Y-12 Plant" Y/SUB/93-YP507C/2/P2
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7. Martin Marietta Energy Systems, Inc. 1989b "Off-site Residential Drinking Water Program"
8. Martin Marietta Energy Systems, Inc. 1993 "Oak Ridge Reservation Environmental Report for 1992" Vol. 1 ES/ESH-31/V1
9. Murphy, J.B. 1990 "Results of the Off-site Well Water Sampling Program" K-25 Environmental Management Document Report No. 90:01441
10. Poling, R.S., Rubin, P.A., and Lemiski, P.J. 1992 "Hydrologic Characterization Plan for the Oak Ridge K-25 Site, Oak Ridge, Tennessee" Report No. K/EM-1
11. Tennessee Department of Health and Environment 1986 "Bradbury and Poplar Springs Residents Well Water Samples" Report No. 801266
12. U.S. Department of Energy 1992 "Environmental Monitoring Plan for the Oak Ridge Reservation" DOE/OR-066
13. U.S. Department of Energy 1990 "Environmental, Safety, and Health Tiger Team Assessment of the Oak Ridge National Laboratory" DOE/EH-0148

APPENDIX A

ACTIVE PERMITTED SOURCES ON THE ORR

K-25

Permit #	Building
732346P	K-1200
032930P	K-1401
734461P	K-1095
934193P	K-1401
016309P	K-25
016312P	K-1501
029902F	K-1501
035063P	K-1414
037113P	K-1414
937114F	K-1501
025655P	K-1024
024105P	K-1435-C
029895P	K-1425
032449I	K-1435
033203P	K-1202
034392P	K-1202
034619P	K-1420

ORNL

030284P	2519
024114P	2522
030835P	2525
027257P	2525
024151P	2525
031062P	2525
024949P	2525
028439P	2547
035494P	3039
036689P	3500
030881P	3502
027194P	3502
023808P	3502
023807P	3502
036053P	3502
730468P	3544
029830P	3587
730489P	3608
732645P	4508
024306P	4508
025282P	6010
030980P	7002
024118P	7005
030824P	7007