CARRIER AIR CONDITIONING SUPERFUND SITE

FIVE-YEAR REVIEW

AUGUST 24, 2000

U.S. Environmental Protection Agency
Region IV

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Acronyms

µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
AF	Adherence factor
bgs	Below ground surface
BRA	Baseline Risk Assessment
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	Cubic feet per minute
CFR	Code of Federal Regulations
DCE	Dichloroethene
ED	Exposure duration
FS	Feasiblity study
gpm	Gallons per minute
HI	Hazard index
hp	Horsepower
ID	Inner diameter
ILCR	Incremental lifetime cancer risk
lbs/day	pounds per day
MCL	Maximum Contaminant Level
MGD	Million gallons per day
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MPA	Main Plant Area
NCP	National Contingency Plan
NRS	North Remediation System
O&M	Operations and maintenance
PCE	Tetrachloroethene
PVC	Polyvinyl chloride

RA	Remedial action
RAO	Remedial action objective
RBC	Risk-based criteria
RD	Remedial design
RfD	Reference dose
RI	Remedial investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SA	Surface area
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SVE	Soil vapor extraction
TCE	Trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
UCL	Upper confidence level
USEPA	U.S. Environmental Protection Agency

CARRIER AIR CONDITIONING
FIVE-YEAR REVIEW SIGNATURE COVER

SITE NAME, LOCATION, AND EPA ID
Carrier Air Conditioning
97 Byhalia Road
Collierville, Tennessee 38017

TND04406222

SITE STATUS
Carrier Air Conditioning was finalized on the National Priorities List in 1990. The remedy is complete. The Site was a PRP-lead RI/FS and is a PRP-lead RD/RA. The Site has continued operating a manufacturing facility during the Superfund investigation and cleanup. Some development has occurred adjacent to the Carrier Site; however, the physical conditions on the Site - and most importantly in the impacted areas - remain the same.

REVIEW STATUS
The Five-Year Review conducted at the Carrier Site is required by policy. Treatment is ongoing, and hazardous substances are still present on Site at concentrations above protective levels for unrestricted exposure and unlimited use. When the remedial action is complete, the remedy will achieve unlimited use and unrestricted exposure, but the remedial action will need more than five years to complete. The Preliminary Close Out Report, October 31, 1995 is considered the "trigger" for this five-year review. The next Five-Year Review will be required in 2005, five years from the completion date (i.e., signature date) of this Five-Year Review Report.

RECOMMENDATIONS AND REQUIRED ACTIONS
Routine maintenance will be conducted to continue optimum performance of the soil vapor extraction systems and the groundwater pump and treat system. Soil borings in the source areas, the Main Plant Area and the North Remediation System, will be collected and evaluated to determine if shutdown of the soil vapor extraction systems is viable.

PROTECTIVENESS STATEMENT
The remedy implemented at the Main Plant Area, North Remediation System, and Water Plant #2 at the Carrier Site are protective of human health and the environment. Results of the Five-Year Review indicate that:

- Mass removal at the two soil vapor extraction treatment areas is ongoing, and significant mass reduction has occurred since the systems were installed. Approximately 14,100

pounds of TCE have been removed from soils and shallow groundwater.

- Groundwater extraction rates are being maintained at levels sufficient to contain the TCE plume. The Collierville wells have maintained production at 1 MGD with little downtime. Approximately 3,719 pounds of TCE have been removed from the Memphis Sands since the system was installed.

Conditions at the Site are not expected to change in the near future, given the area's land use (industrial/commercial) and zoning controls currently in place. Access controls and surface conditions (e.g., pavement in the Main Plant Area) are adequate to prevent exposure.

28 AUG 00

Date

Richard D. Green
Waste Management Division Director

1.0 INTRODUCTION

A Five-Year Review of the soil and groundwater remedial actions implemented at the Carrier Air Conditioning (CAC) Superfund Site in Collierville, Tennessee. This review was conducted during June and July 2000, and is documented in this report.

The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify deficiencies found during the review, if any, and identify recommendations to address them.

This review is required by policy rather than statute. Policy reviews are five-year reviews that EPA believes should be conducted, as a matter of policy, although they are not expressly required by CERCLA Section 121 (c). While most policy reviews are of remedies selected prior to the enactment of the Superfund Amendments and Reauthorization Act (SARA), some are post-SARA remedies (e.g., response actions where, upon completion of the remedial action no hazardous substances will remain, but five or more years are required to reach that point.:

The remedy at the CAC Site includes three remediation systems:

- Soil vapor extraction (SVE) in the main plant area (MPA), completed in 1995.
- SVE in the North Remediation System (NRS), installed in 1989.
- Air stripping at the municipal water supply wells (the Town of Collierville's Water Plant #2) immediately northwest of the facility, implemented in 1990. The Water Plant #2 wells are used to contain contaminated groundwater migrating from the Site. This was formalized as the final remedy in the USEPA's Record of Decision (ROD) and subsequent design documents (1994).

Both the NRS and Water Plant #2 systems were completed before the remedial investigation and feasibility study (RI/FS). To document construction completion, USEPA prepared a

Preliminary Close Out Report (PCOR), October 31, 1995. The PCOR was written when the MPA system was completed in 1995. The PCOR is considered the "trigger" for this five-year review. Treatment is ongoing, and hazardous substances are still present onsite at concentrations above levels protective of unrestricted use.

Five-Year Review Report Format

The format for this review has been adopted from the USEPA *Draft Guidance for Conducting Five-Year Reviews* (April, 1999). Elements of the five-year review are presented as outlined below:

- Section 2 presents the site location information and the history of the CAC site, including a summary of the RI/FS and remedial design/remedial action (RD/RA).
-
- Section 3 summarizes the risk conclusions and cleanup goals developed during the RI/FS, and assesses the impact of any changes in risk information.

- Section 4 discusses the remedial actions implemented at the site, their performance, the site inspection of each remediation system, and conclusions regarding remedy effectiveness.

- Section 5 documents interviews conducted during the five-year review process, as well as identifies all documents reviewed.

- Section 6 presents the five-year review assessment with respect to the site-wide remedy.

- Section 7 documents deficiencies identified during the review, presents recommendations for site improvements, and recommends a timeframe for the next five-year review.

- Section 8 issues the protectiveness statement for the CAC Site.

2.0 SITE BACKGROUND

This location summarizes the Site's setting and history, including a summary of the RI/FS and remedial design/remedial action (RD/RA).

2.1 Physical Characteristics

The Carrier Site is located on the western side of the Town of Collierville, Shelby County, Tennessee (population approximately 30,000). The site, shown in Figure 2-1, is located near the intersection of U.S. Highway 72 and Byhalia Road with the nearest residential area being approximately 100 feet North of the Site boundary adjacent to the Collierville municipal well field.

The Site is in the Gulf Coastal Plain, which is a major physiographic subdivision distinguished by gently rolling topography and a characteristically thick layer of loess deposited during Pleistocene glaciation. Because of the gently rolling topography, the site has been graded and filled in various locations in order to change drainage patterns and adapt the land for manufacturing use.

Anomalous areas of loess deposition are associated with alluvial plains of Mississippi River tributaries that cross the area. These rivers include the Wolf River, the Loosahatchie River and Nonconnah Creek. Nonconnah Creek runs through the southern site boundary.

The nature of the Site is such that avian or terrestrial wildlife would not be drawn to the site. Any wildlife near the site is expected to be minimal, given the amount of development in the area. Since the impacted areas are within the working area of the manufacturing facility, wildlife is not expected to be present in impacted areas currently undergoing remedial actions.

2.2 Land and Resource Use

A site map is shown in Figure 2-2.

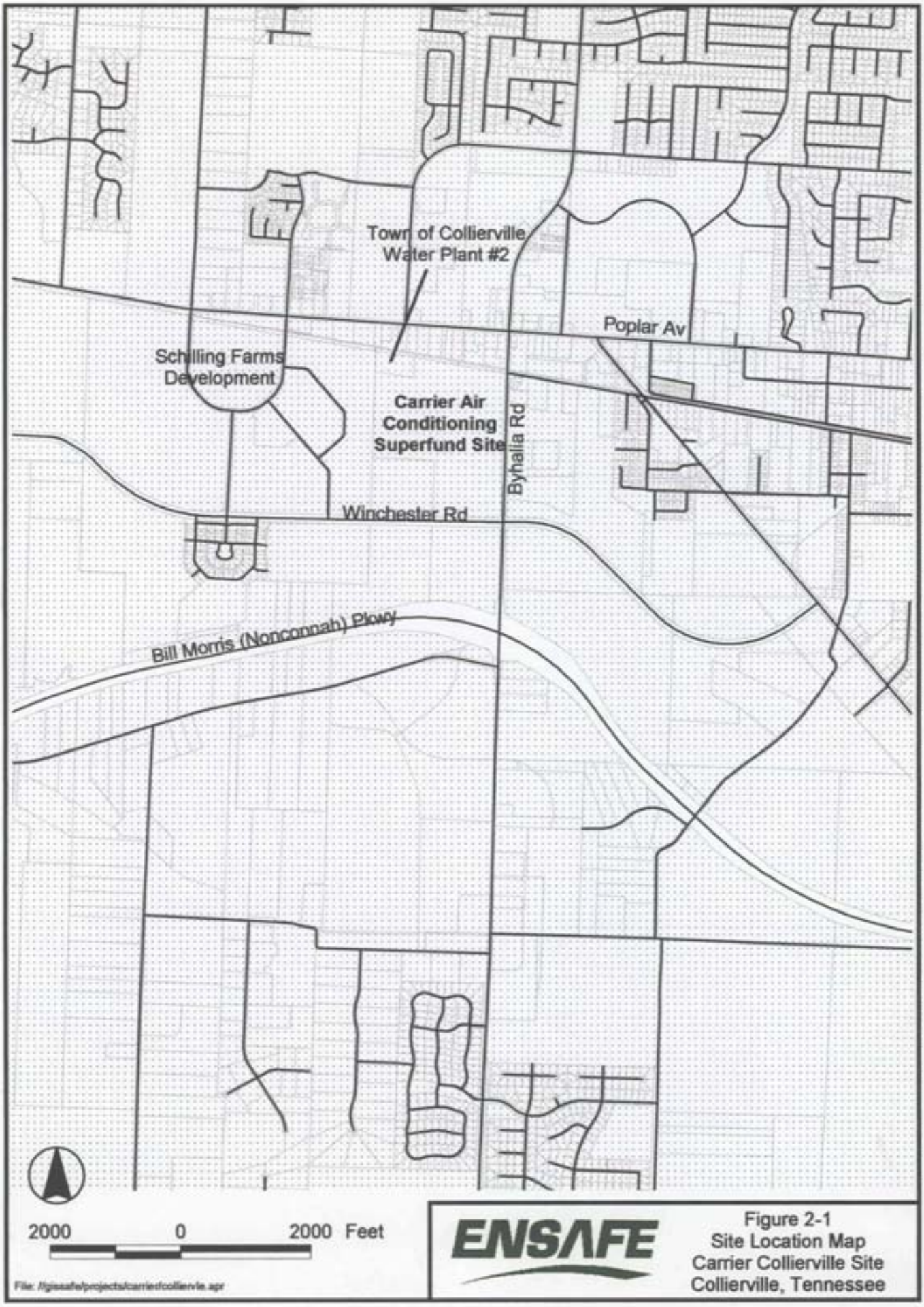
Prior to 1967, the Site consisted of maintained vegetation (i.e., grasses and trees). In 1967 the Town of Collierville purchased the property, constructed industrial buildings, and purchased industrial equipment for the Site. In March 1967, the property, buildings, and equipment were leased to Carrier Air Conditioning Corporation. Later the same year, Carrier began manufacturing residential heating and air conditioning units at the Site.

Also in 1967, the Town of Collierville installed a well field for potable water on the northwest corner of the Site. The operation, consisting of two extraction wells, a treatment plant, and a storage tank, is identified as Water Plant #2. Currently, under frequent monitoring, the wells provide up to 1.4 million gallons per day (MGD) of potable water to the Town of Collierville.

In 1987, Carrier purchased the facility from the Town of Collierville, excluding the northwest parcel on which Water Plant #2 is located.

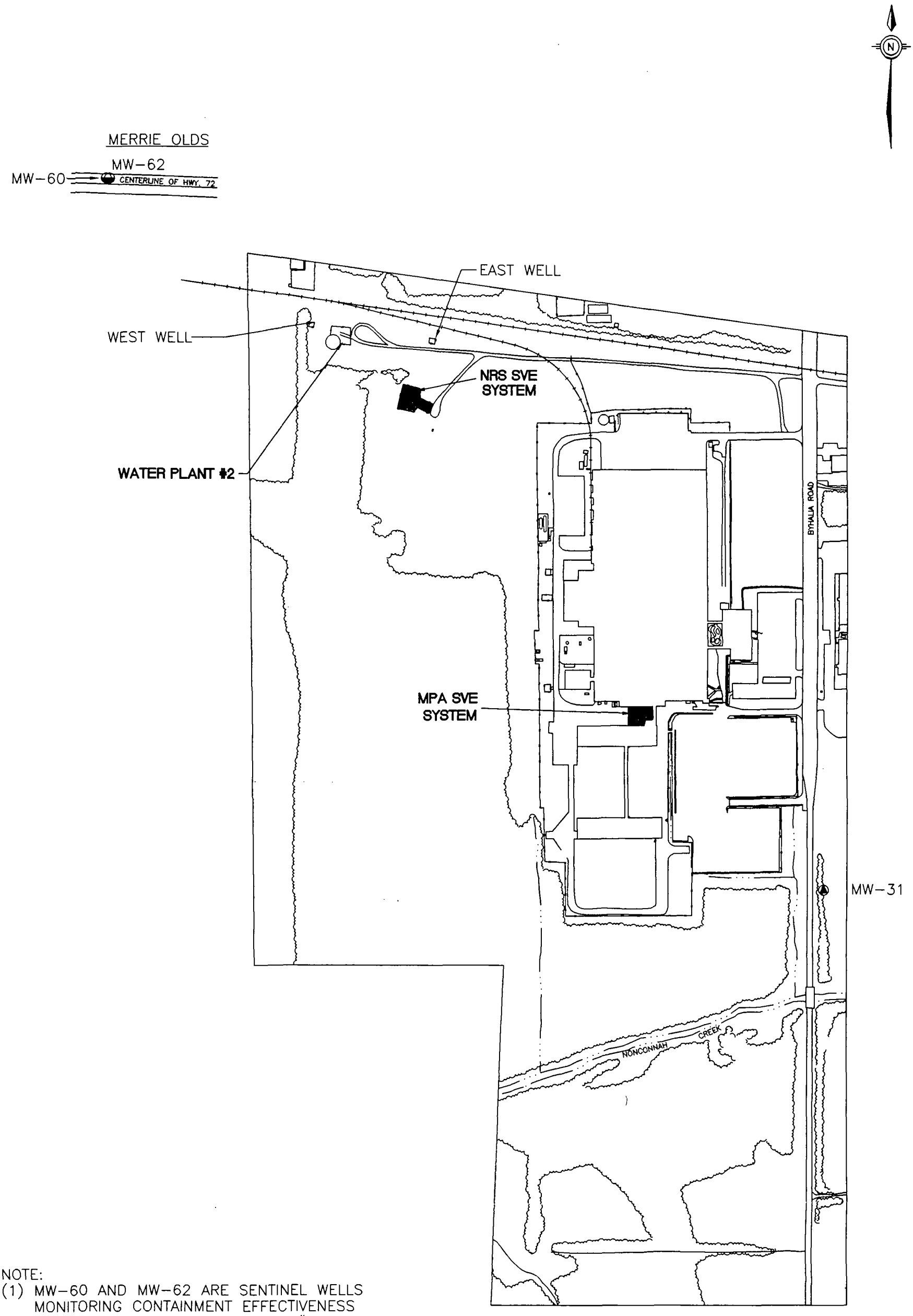
With the current strict zoning, the long term, future use of the Site would be for continued industrial use. The Site is an operating facility and will continue to be so for the foreseeable future.

With the exception of Nonconnah Creek, surface waters do not exist on Site or adjacent to the Site. Town and county ordinances restrict the use of the shallow water bearing zone and the Memphis Sand aquifer. The Memphis Sand aquifer is the primary drinking water source and is regulated by the Memphis Shelby County and the Town of Collierville to prohibit installation of wells in the Memphis Sand aquifer or shallow aquifer without a permit. Therefore, shallow groundwater is not currently used for domestic purposes in the immediate area. The nearest municipal well in the Memphis Sand aquifer, is located adjacent to the northwest corner of the Site.



ENSAFE

Figure 2-1
Site Location Map
Carrier Collierville Site
Collierville, Tennessee



NOTE:
(1) MW-60 AND MW-62 ARE SENTINEL WELLS MONITORING CONTAINMENT EFFECTIVENESS DOWNGRADIENT OF WATER PLANT #2.
(2) MW-31 MONITORS EFFECTIVENESS OF THE MPA SVE SYSTEM AND SHALLOW GROUNDWATER CONTRIBUTIONS TO THE MEMPHIS SAND.

LEGEND

- ◒ – MONITORING WELLS (DEEP)
- ◭ – MONITORING WELLS (SHALLOW)
- MW-62 – MONITORING WELL NUMBER
- NRS – NORTH REMEDIATION SITE
- MPA – MAIN PLANT AREA
- SVE – SOIL VAPOR EXTRACTION

400 0 400
SCALE FEET

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC CINCINNATI,OH DALLAS,TX JACKSON,TN KNOXVILLE,TN
LANCASTER,PA NASHVILLE,TN NORFOLK,VA PADUCAH,KY PENSACOLA,FL
LITTLE ROCK,AR JACKSON,MS CLEVELAND,OH

FIGURE 2-2
SITE MAP
CARRIER COLLIERVILLE SITE
COLLIERVILLE, TENNESSEE

DWG DATE: 07/19/00 | DWG NAME: 3133G013

Current groundwater pathways exist for the local residents supplied by the Collierville municipal water supply system. Actual exposure to groundwater contaminants (through the municipal system) is minimized (or eliminated) by engineering controls (i.e., air stripping of municipal well water prior to distribution).

2.3 History of Contamination

In the process of assembling air conditioning units, aluminum sheeting is stamped and assembled with copper tubing to form air heat exchangers. Stamping and forming oils and dirt are removed from these parts prior to final assembly. Until about 1986, trichloroethylene (TCE) was the primary solvent used to degrease and clean these parts.

Contamination Sources

In 1979 and 1985, TCE releases occurred from solvent storage systems to an area just south of the main manufacturing building. The approximate release areas are shown on Figure 2-2. The 1979 release, which occurred from a vent degreaser pipe, was estimated to be several thousand gallons. In 1985, approximately 500 gallons of TCE was released from a pipe associated with an aboveground storage tank in the same vicinity. Soil removals were performed by Carrier following both spills.

In the rear of the facility, a wastewater lagoon operated by the plant from 1972 to 1979 apparently received TCE- and zinc-contaminated waste sometime during its seven-year operational period that resulted in contamination of lagoon sediment. Impacted sediment was removed from the lagoon prior to closure, and in 1989 a soil and groundwater treatment system (the NRS) was installed.

As a result of the 1985 spill, monitoring wells were installed at the facility to monitor groundwater. Since 1985, the Tennessee Department of Environmental Conservation (TDEC)[1] required groundwater monitoring on a regular basis. In 1986, low levels of TCE were

[1] This agency was formerly known as Tennessee Department of Health and the Environment (TDHE).

detected in the groundwater from the two extraction wells in the Town of Collierville's Water Plant #2. No TCE was found in treated water (i.e., water just before it enters the Town's distribution system) from the two extraction wells. In 1990, air stripper treatment systems (packed aeration towers) were installed by Carrier at Water Plant #2 to provide additional assurance that the Town's drinking water supply would meet Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs).

In 1987 and 1988, under an agreement with TDEC, Carrier conducted an extensive Site investigation. Sampling indicated measurable amounts of TCE in the soils and smaller amounts in the groundwater at the Site. The Site investigation also confirmed the earlier finding of low TCE concentrations in the groundwater from Water Plant 2.

The Site was proposed for listing on the federal National Priorities List (NPL) in 1988. Carrier and USEPA signed a consent decree in 1989 to perform the RI/FS, and the Site was listed on the NPL in 1990.

Remedial Investigation

As a result of the spills, the USEPA ordered that an RI/FS be conducted to determine the extent of contamination from TCE source areas to groundwater, specifically shallow groundwater. The Remedial Investigation (RI) was performed in multiple phases during 1990 and 1991, with draft RIs submitted throughout 1991 and a final document (including a Baseline Risk Assessment (BRA) produced in 1992.

Previous investigations at the Site initiated by TDEC had resulted in the installation of fifty-five soil borings. Eighteen of these borings were completed as monitoring wells; ten in the fluvial terrace deposits above the Jackson clay and eight within the Memphis Sands aquifer beneath the Jackson clay layer. In order to complete the determination of extent of contamination, a series of thirty-two additional borings were augered on Site during the RI.

Contaminants found left on Site were TCE, cis-1,2-dichloroethylene (DCE), trans-1,2-dichloroethylene, tetrachloroethene (PCE), vinyl chloride, and zinc.

The RI verified the contaminants of concern at the Site, identified both the MPA and the former lagoon as primary source areas, and calculated soil cleanup goals protective of groundwater. The BRA (detailed in Section 3) concluded that there were no risks to onSite workers due to ingestion or direct contact of exposed, contaminated soil.

Hydrogeologic Setting

The RI also included an assessment of complex hydrogeologic setting of the Site. A shallow, non-potable aquifer (found in fluvial terrace deposits), usually only a few feet thick, was found across the Site. The RI postulated that this zone is primarily perched groundwater. The Jackson clay, which has since been referred to as the "Jackson/Upper Claiborne formation," underlies fluvial deposits. Silts and clays typical of the Jackson/Upper Claiborne sequence were not encountered in borings completed south and east of the Carrier facility. Rather, surficial loess and fluvial deposits were deposited directly over the primary drinking water aquifer in the Memphis area, the Memphis Sand. These data indicated that the perched groundwater zone encountered beneath the MPA was hydraulically connected with the Memphis Sand southeast and east of the Carrier facility. Groundwater in the Memphis Sand flows from the southeast, beneath the Carrier facility, and then to the northwest, to Water Plant #2.

Contaminants exceeding maximum contaminant levels (MCLs) were quantified in both shallow (fluvial deposit) and deep (Memphis Sand) wells during the RI. The RI postulated that contaminants had migrated from source areas along the top of clay "downslope" to the southeast, where the absence of the Jackson/Upper Claiborne unit allowed direct infiltration of contaminants into the Memphis Sand. Aquifer testing during the RI indicated that municipal

pumping at Water Plant #2 controls groundwater flow beneath the Site, and confirmed that there was indeed hydraulic connection between the two units where clay was absent.

The BRA for groundwater contamination resulted in risk ranges exceeding 1E-04. Given the proximity to Water Plant #2 and the presence of Site contaminants in the municipal water supply, the BRA was evaluated using a residential drinking water scenario. However, treatment of groundwater prior to entry to the Town's drinking water distribution system established at Water Plant #2 during 1990 was noted to eliminate this risk and reduce contaminant concentrations to below SDWA MCLs.

Carrier performed an FS for the Site in 1992. The FS discussed six remedial alternatives for the CAC Site. The need for remedial actions was identified in three areas: the former lagoon area, the MPA, and the Memphis Sand Aquifer. The document compared various remedies and treatment technologies for each of the three areas.

USEPA issued the final ROD for the Site in September 1992, which documented the selected remedy for the CAC Site. The remedy consisted of:

- Institutional controls limiting future land use at the Site to industrial, and limiting water well construction in the area which may adversely impact containment at Water Plant #2.

- Continuation of the SVE system at the NRS (installed in the former lagoon area).

- Installation of an SVE system in the MPA.

- Containment of the groundwater plume using Water Plant #2 wells, with ongoing treatment of extracted groundwater via air stripping.

Remedial design activities began at the Site in 1993.

2.4 Site Chronology

Table 2-1 is a chronology of events related to the Site investigation at the CAC Site.

Table 2-1
Chronology of Events

Date	Event	Additional Information
1967	Town of Collierville purchases the property, constructs industrial buildings, and purchases industrial equipment for the Site. Carrier Air Conditioning Corporation leases the property, buildings and equipment for use as a manufacturing facility. Town of Collierville installs two extraction wells (Water Plant 2) on the northwest corner of the Site to supply drinking water to residents.	
1972	Carrier installs wastewater lagoon (surface impoundment) north of plant.	Sometime between 1972 to 1979 the wastewater lagoon received TCE- and zinc-contaminated waste, resulting in contamination of lagoon sediment.
1979	Carrier takes wastewater lagoon out of service. Spill of an estimated several thousand gallons occurs at a vent degreaser pipe just south of the main manufacturing building.	Carrier removed asphalt pavement and underlying soil from the parking area in areas affected by spill.
1981	Wastewater lagoon is closed.	Carrier removes approximately one foot of contaminated sludge from the base of the lagoon for offSite disposal.
1982	Lease amended to exclude northwest portion of property where Town's well are located.	
1985	Spill of approximately 500 allons occurs from TCE aboveground storage tank south of main manufacturing building. Carrier installed monitoring wells at the Site to monitor groundwater.	Tank, associated piping, and up to 15 feet of contaminated soil was excavated and shipped offSite for disposal by Carrier. Groundwater monitoring at the Site continued on a regular basis.
1986	TDEC performed site assessment.	Low levels of TCE detected in the groundwater from the two

Table 2-1
Chronology of Events

Date	Event	Additional Information
		extraction wells in the Town of Collierville's Water Plant 2. No TCE was found in treated water (i.e., water just before it enters the Town's distribution system) from the two extraction wells. As a result, under frequent monitoring, operation continued.
1987	On December 14, Carrier purchased all the property in the lease from the Town of Collierville.	Carrier is still the current land owner.
	Site is placed on TDEC's List of Hazardous Substances Sites.	
	Carrier initiates an extensive, voluntary site investigation under an agreement with TDEC through 1988.	Sampling indicated measurable concentrations of TCE in soil and lower concentrations in groundwater. Sampling confirmed TDEC finding of low TCE concentrations in Water Plant 2 groundwater.
1988	Voluntary Site investigation report is released to TDEC and EPA	
	In June, the Site was proposed for inclusion on EPA's National Priorities List (NPL).	
1989	In September, Carrier and EPA sign CERCLA Consent Order.	Under this order, Carrier agrees to perform RI/FS to determine the type and extent of contamination at the Site and identify remedial action alternatives.
	Carrier installs a groundwater removal and treatment system and soil vapor extraction (SVE) system in the former wastewater lagoon (the North Remediation System, or NRS).	
1990	Placement of Site on NPL is finalized.	

Table 2-1
Chronology of Events

Date	Event	Additional Information
	Carrier commences remedial investigation (RI). Draft RI report submitted to EPA. Carrier installs air stripper treatment systems (packed aeration towers) at Water Plant 2 to provide additional assurance of the removal of trace amounts of TCE and its degradation products from the Town's raw water supply. Design, construction, and operation of system was coordinated with and approved by State, Town, and EPA agencies.	Water Plant 2 remains in continuous service, providing up to 1.4 MGD of potable water to the Town of Collierville.
1992	The RI/FS Reports and Proposed Plan for the Site are finalized and released to the public	The RI outlined investigation findings and the FS identified the need for remediation in three areas: (1) former lagoon area (to address impact of former discharges to lagoon) (2) main plaint area or MPA (to address impacts from the 1979 and 1985 TCE spills) (3) Memphis Sand aquifer (to contain onSite groundwater plume that had been impacted as a result of soil contamination). Six remedial alternatives for the Site were also presented.
1992 (Cont'd)	EPA Regional Administrator Greer C. Tidwell signs the Record of Decision (ROD) which documents the selected remedy for the Site.	Site remedy consisted of: • Institutional controls limiting future land use at the

Table 2-1
Chronology of Events

Date	Event	Additional Information
		site to industrial, and limiting water well construction in the area (restrict installation of wells which may adversely impact containment at Water Plant #2). • Continuation of the SVE system (NRS) in the former lagoon area. • Installation of an SVE system in the MPA to treat contamination that resulted from the 1979 and 1985 spills. • Containment of the groundwater plume using the municipal well field at Water Plant #2, with ongoing treatment of extracted groundwater via air stripping.
	Supplemental aquifer testing using the Town of Collierville's wellfield to support groundwater remedy design and to gauge the wellfield's adequacy to contain the contaminated Memphis Sand plume.	
1993	EPA issues a Unilateral Administrative Order and Scope of Work for completion of remedial action tasks.	
1994	MPA SVE Project Design and Groundwater Remedy Design documents were submitted.	
	Construction on the MPA SVE system was initiated.	The system was installed to treat contamination that resulted from the 1979 and 1985 spills.
	Installation of downgradient/point-of-compliance monitoring wells MW-60 and MW-62 occurred.	
1995	MPA SVE system construction was completed with the system beginning operation during March 1995. Final inspection of the MPA SVE system was performed on June 1, 1995.	Recurring problems with the regenerative blower used for the MPA system necessitated system shutdown in December followed by replacement with a positive displacement blower, which occurred in February 1996. Otherwise, treatment

Table 2-1
Chronology of Events

Date	Event	Additional Information
		system has been operating continuously since installation.
1996	Modifications to the MPA SVE system and testing of the new equipment were performed in February 1996, immediately followed by system re-start. Supplemental modeling of the degree of containment provided by Water Plant 2 was performed in July and August 1996, during a month-long shut down of the Town wells for maintenance.	
	Soil borings were completed at the NRS to assess effectiveness of the NRS SVE system in December.	Improvements that were determined as a result of the assessment were addressed in 1997.
1997	Based on the 1996 sampling event, modifications were made to NRS operation: deep wells were opened to act as passive vents while vapor extraction was continued in shallow wells. During summer months, ambient air was also introduced into the shallow well manifold to moderate temperatures in the blower and minimize operational problems. Carrier started abandonment of 55 monitoring and pilot study wells installed during the RI or RD investigation.	
1998	Abandonment of wells completed during the first quarter. All wells were closed in accordance with Shelby County Health Department regulations.	Appendix A contains tables with list of wells that have been closed and wells that have been left open. A figure illustrating the location of open wells is also included in Appendix A.
1998 (Cont'd)	NRS blower failure, replacement with a positive displacement blower capable of generating higher vacuum. TDOT begins expansion of adjacent roadway; monitoring well MW-16 is in the construction area. Request to abandon MW-16 due to TDOT construction; subsequent abandonment of MW-16	

Table 2-1
Chronology of Events

Date	Event	Additional Information
2000	CAC Site Five-Year Review.	

3.0 RISK EVALUATION

The RI/FS identified seven existing or possible contaminants of concern for Site soils and groundwater: TCE, DCE, vinyl chloride, PCE, dichloroethane (DCA), lead, and zinc. Of these, TCE (the chemical spilled onSite) and DCE (a common degradation product of TCE) were the most frequently detected and generally found at the highest concentrations. Vinyl chloride was not detected on Site in any media at a significant frequency, but is considered a common degradation product of TCE.

3.1 Baseline Risk Assessment

A human health BRA was conducted as a part of the RI/FS process to evaluate potential threats to human health and the environment from hazardous substances. BRAs are mandated by CERCLA (as amended by the Superfund Amendments and Reauthorization Act [SARA]) to assess the need for remedial action at NPL sites.

The BRA evaluated dermal contact pathways for Site soil, as well as ingestion/inhalation risks from onSite groundwater. Two land-use scenarios were considered: industrial use (the current and projected future use at the Site), and residential use (assumed under an "uncontrolled" setting).

The BRA concluded no significant direct inhalation exposure on Site would be expected as a large portion of the contaminated area is paved/covered. The unpaved areas of the Site are far less contaminated and are covered by maintained vegetation. Conservative estimates based on the total area of the Site which has surface contamination were used to assess current adult worker exposure to volatile contaminants of concern. The entire unpaved/uncovered area of the Site was used to assess the risk to adult workers posed by lead and zinc in the Site surface soils. In both instances, the workers were assumed to contact the Site uniformly.

To assess the risk posed by the Site to future Site residents, the BRA evaluated exposures to children. To evaluate exposure to future child residents, it was assumed that the entire Site would be unpaved/uncovered, and that all potential ingestion and dermal contact exposures would occur within the contaminated surface soil zones.

The results of the risk calculations for the major soil contaminants, using the above stated assumptions, are shown in Tables 3-1 and 3-2. Table 3-1 shows the potential risk to workers from the major contaminants of concern, and Table 3-2 shows the potential risk to future child residents. This data indicates that exposure to even the most contaminated surface soils does not pose an incremental lifetime cancer risk (ILCR) greater than the 1E-6 point of departure (one excess cancer death in a population of 1million) for current Site workers or future children on Site. Hazard indices (HI) were less than 1 for both scenarios, indicating no noncancer toxicity to Site workers or potential residents.

The most contaminated groundwater may pose a significant carcinogenic and non-carcinogenic risk if hypothetical, future residents were exposed. The ILCR to future residents posed by ingestion of groundwater is 2.5E-4. The HI values for lead and zinc were 4.1 and 0.82 respectively, under the future resident scenario. Groundwater cleanup goals were set using MCLs, which are ARARs under the NCP.

3.2 Review of Baseline Risk Assessment for CAC, Tennessee

In accordance with the five-year review guidance, the original BRA was reviewed to evaluate basic assumptions regarding risk to human health and determine if any assumptions have changed. Current USEPA Region IV guidance was considered during this evaluation. Because the major concern prompting this review involves the risk associated with exposure to TCE in surface soil, the review focuses on this exposure scenario. Because groundwater remediation is governed by MCLs, the groundwater patyway was omitted from this evaluation.

Approach

To conduct this review, risk was estimated following current USEPA Region IV guidance and the results were compared to risk estimates in the original 1992 report. Both intake parameters and toxicity values for TCE have changed since the initial BRA. Details regarding this assessment can be found in Appendix B.

Table 3-1
BRA Summary of Risks for Adult Workers from Oral and Dermal Exposure to Contaminants in Soil

Contaminant	Soil Contaminant Level (mg/kg)[a]	Upper Bound Risk Level[b]	Hazard Index
TCE	35[d]	1.0E-7	—
1,2-DCE	0.077[d]	—	7.2E-6
Vinyl Chloride	0	0[c]	—
DCA	0	0	—
PCE[d]	0.011	1.5E-10	1.0E-6
Lead	12[e]	—	2.8E-2
Zinc	51[e]	—	2.3E-4
		Sum cancer risk = 1.0E-7	Sum HI = 0.028

Notes:

a = The 90-95% upper confidence level was not calculated as the data are not normally distributed. The mean concentration was calculated for in all soils within surface contaminated areas. For metals the mean concentration was assumed to be in all unpaved/uncovered Site soils. TCE and 1,2-DCE concentrations are the means for all samples collected at depths of 0 to 5 feet, including screening data from Phase I.

b = HI of > 1 indicates potential non-cancer toxicity. The allowable risk range determined by USEPA is 1E-4 to 1E-6; risk within this range is considered on a case-by-case.

c = With these assumptions, approximately 89 mg/kg of vinyl chloride in soil at this Site would equal 1E-6 ILCR level.

d = PCE was identified in one soil sample.

e = Lead and zinc concentrations for all samples collected within five feet of ground surface were used to compute mean values.

Table 3-2
BRA Summary of Risks for Potential, Future Child Residents from Oral and Dermal Exposure to Contaminants in Soil

Contaminant	Soil Contaminant Level (mg/kg)[a]	Upper Bound Risk Level[b]	Hazard Index
TCE	35[d]	5.2E-7	—
1,2-DCE	0.077[d]	—	HI = 6.1E-6
Vinyl Chloride	0	0[c]	—
DCA	0	0	—
PCE	0.011	—	HI = 1.7E-6
Lead	12[e]	—	HI = 1.9E-1
Zinc	51[e]	—	HI = 3.9E-3
		Sum cancer risk = 5.2E-7	Sum HI = 0.19

Notes:

a = The mean concentration was calculated for all Site soil samples within five feet of ground surface where TCE and/or DCE has been identified; assumes 100% of Future Child Resident soil exposure is in contaminated area on Site.

b = HI of >1 indicates potential non-cancer toxicity. Upper bound ILCR levels between 1E-4 and 1E-6 are considered on a case-by-case basis as to their acceptability level by the USEPA.

c = 1E-6 ILCR (with these assumptions) in soil ~150 µg/kg vinyl chloride.

d = TCE and 1,2-DCE data from samples collected prior to the initiation of the Remedial Investigation were included. Below detection limit results were not used in the calculation of means.

e = Lead and zinc concentrations for all samples collected within five feet of ground surface were used to compute mean values.

It was assumed that in the future the entire Site will be unpaved/uncovered. The shallow water bearing water zone is not currently used as a source of drinkable water nor is it anticipated to be used as a drinkable source in the future. Therefore, it was not considered a viable future exposure pathway.

Due to advancements in risk assessment methodology since the BRA was developed, several factors used in assessing risks due to TCE have been changed, including:

- Three intake parameters used to calculate the chronic daily intake (CDI) for the dermal contact exposure pathway were altered from values used in the original report. Two of these, the surface area of exposed skin (SA) and the exposure duration (ED), were adjusted upwards resulting in higher CDIs. The other, the soil-to-skin adherence factor (AF), was adjusted downwards, resulting in a lower CDI. Carcinogenic risk and

noncancer toxicity, therefore, would likely increase overall due to the more conservative assumptions now used.

- Oral and dermal reference doses (RfDs) for calculating noncarcinogenic risk from TCE exposure were not available at the time of the original report and are now available. HI contributions would therefore increase if the BRA was performed today.

- The method used for calculating the concentration term in the original report is not consistent with current Region IV guidance. The acceptable method is to use either the maximum detected concentration or 95% upper confidence level (UCL). In either case, the new concentration term would be much higher than the value used for TCE in the original report. Again, the Site risk posed by TCE would likely increase.

If a new BRA were performed, the overall effect of using current USEPA Region IV guidance is that both carcinogenic and noncarcinogenic risk estimates would be increased, by roughly one order of magnitude (from 1E-7 to 3E-6). While TCE was used as an example for the above assessment, this logic can be extended to other Site COCs: risks contributed by DCE, PCE, etc., will also change. It is expected that the overall (total) Site risk under an industrial scenario would fall within the range of 1E-6 to 1E-5, still well within the allowable risk range established by USEPA. Noncancer toxicity under an industrial scenario is still expected to fall within an acceptable range.

Secondly, it should be noted that inhalation pathway, which was not included in the 1992 BRA as impacted areas were beneath asphalt and concrete, may be evaluated under new risk assessment guidelines for specific exposure scenarios (e.g., short-term maintenance or utility work exposures). It is likely that consideration of the inhalation pathway would increase

overall Site risks; however, this five-year review analysis of risk parameters did not calculate the actual increases.

Finally, it is important to note that the lead analysis performed during the BRA compared Site concentrations assuming a HI. However, current methodology evaluates the 95% UCL (or maximum) lead concentrations using screening values (400 mg/kg for residential scenarios, 900 mg/kg for industrial scenarios). Lead can therefore be eliminated from the COC list as its maximum concentration is less than 400 mg/kg; no additional assessment would be required under current guidance.

3.3 Assessment and Conclusions

The risk review performed in conjunction with this five-year review indicates that risk guidance has changed significantly since 1991 and 1992, when the final RI was approved. Various assumptions and input parameters into the risk equations have been modified to reflect refinements in toxicology and environmental risk assessment. However, any changes in risk assessment assumptions are not expected to have an impact on the remedy at this Site given that the remedial goal selected for Site soil, based on protection of groundwater, is more conservative than human health targets based on either Site workers or theoretical future residents.

The ROD establishes a soil cleanup target for TCE of 0.533 mg/kg (or 533 μg/kg), based on protection of groundwater. MULTIMED was used to evaluate various soil cleanup standards which were protective of the underlying Memphis Sand aquifer system. The 0.533 mg/kg goal was selected as most protective. Therefore, soil remediation at the Site is targeted at source areas where soil concentrations exceed this goal.

Human-health based remediation goals, in contrast, are likely to be one- to two-orders of magnitude higher than the current ROD goal. Region IV currently uses Region IX Risk Based

Concentrations (RBC) as common "first cut" screening concentrations for Site constituents of concern, and are roughly representative of a 1E-6 threshold under conservative exposure conditions. These are presented here for comparative purposes, given that they account for all exposure pathways (ingestion, dermal contact, and inhalation). The RBC for TCE under an industrial-use scenario is 19 mg/kg, significantly higher than the current ROD goal. The residential-use RBC for is 5.7 mg/kg, or more than 10 times Carrier's onSite remedial goal.

Therefore, although risk standards have changed since the RI was approved in 1992, it is not necessary to re-calculate Site-specific risk at this Site. Remediation systems in the NRS and MPA are currently addressing source soils which exceed the lower, groundwater-protection based criterion of 0.533 mg/kg. As a result, remedies protective of groundwater, such as the NRS and MPA, are also protective of human health at the Carrier Site.

4.0 REMEDIAL ACTIONS

This section describes the operation of each remediation component of the Carrier Site remedy over the past five years. These components include:

- Institutional controls for land and groundwater use.
- The NRS SVE system.
- The MPA SVE system.
- Point-of-use controls at Water Plant #2.
- Containment of contaminated groundwater using Water Plant #2.

4.1 Institutional Controls

Land use at the CAC Site is zoned industrial. The Town of Collierville has indicated that long-range plans for the area anticipate land use will remain industrial/commercial.

Shelby County prohibits installation of drinking water wells within 0.5 miles of state or federal Superfund sites unless the well owner can demonstrate that the well will not enhance the migration of contaminants (Shelby County Well Construction Code, 4.01[C]).

4.2 North Remediation System (NRS)

The NRS was installed in the former lagoon area during pre-CERCLA response actions in 1989, and has operated continuously since then, except as noted below.

4.2.1 Original Design Specifications

The NRS began as a treatability study at the location of the former surface impoundment, north and west of the manufacturing buildings. Since the treatability test was successful as installed, operation was selected as the long-term Site remedy in this area.

Wells

Well configuration consists of an array of five, 4-inch diameter stainless steel wells installed to recover contaminated groundwater in the shallow aquifer and to allow vapor extraction from the unsaturated soil. The deep wells are screened from the top of the Jackson Clay through the lower 20 feet of the fluvial deposits. Each well has 20 feet of 0.010-inch slot well screen attached to a riser completed to ground surface. The deep wells serve as both SVE and groundwater extraction wells. Bottom-loading, pneumatic pumps deliver groundwater to a rectangular clarifier tank which overflows to one of two surge tanks.

Within the deep well network is an arrangement of four, 2-inch diameter stainless steel wells, screened from 15 to 25 feet below grade. The deep wells are constructed with a 10-foot section of 0.010-inch slot well screen attached to a section of stainless steel riser to ground surface. The shallow wells serve only as SVE wells and do not contain groundwater pumps.

Pumps

Bottom loading, pneumatic pumps were designed to deliver groundwater to a clarifier tank, which overflows into one of two surge tanks. Pump construction is stainless steel and Teflon. A 5-horsepower (hp) compressor at the equipment skid supplies air. Pump cycles are actuated from control-panel mounted pneumatic timers. Well-head solenoids stop air supply to pumps if a float switch does not sense a liquid level in the well.

Water is piped underground from the well vaults to the treatment system through a manifold of polypropylene tubing contained within a 4-inch diameter polypropylene pipe.

Air Stripper Columns

Water flows by gravity from the clarifier into the first surge tank, and is pumped to the top of a 12-inch diameter random packed stripping tower. Packing is 1-inch diameter Jaeger Tripacks, loaded to a bed height of 16 feet. A 2.5-hp blower provides countercurrent

airflow in the packing section at 167 cubic feet per minute (cfm), while water is circulated through the packing at a design flowrate of 10 gallons per minute (gpm).

Soil Vapor Extraction

Vapor recovery wells are connected to the central skid by a manifold of 2-inch polypropylene pipes. The deep and shallow wells are manifolded separately and each well head has an isolation valve. The deep and shallow well piping comes together at the surface where it was originally connected to a 5-hp, regenerative type air blower. This blower has since been replaced with a positive displacement blower capable of 180 cfm at 122 inches of water.

4.2.2 Remedial Action Objectives

The remedial action objective (RAO) at the NRS is to prevent migration of contaminants in soil, which would result in Memphis Sand aquifer contamination in excess of MCLs and applicable or relevant and appropriate requirements (ARARs). The 0.533 mg/kg TCE goal developed during the RI/FS and selected as the ROD goal for remediation of the MPA spill area was deemed conservative and therefore was selected as the goal for the NRS.

4.2.3 Current Operating Parameters

Currently the water side of the NRS is not in operation due to a lack of groundwater present in the wells. Once the initial dewatering phase was completed, the NRS well field has remained dry. However, the air stripping system is used to treat extracted groundwater collected at the MPA SVE system.

The SVE system currently operates with both the shallow and deep well manifolds open, however, more vacuum stress has recently been applied to the shallow wells. The regenerative blower was replaced with a positive displacement blower in the fall of 1998. Vacuums generated at the wellhead range from 70 to 120 inches of water, the higher vacuums being generated when the shallow wells were stressed by closing the deep well valve. Discharge

temperatures range from 90 to 125 degrees Fahrenheit depending on the outside temperature. Higher discharge temperatures were realized when the vacuum was increased on the shallow well side of the system. The flowrate from the shallow wells averages 25 to 30 cfm, and 100 to 110 cfm for the deep wells.

4.2.4 O&M Evaluation

Required O&M consists of maintenance on the blower only. Drive ends are greased monthly, and oil changed per manufacturer recommendations. The NRS SVE system has experienced very little downtime since it began operation. When it failed after 9 years of continuous operation, the original regenerative blower was replaced with a positive displacement blower in September of 1998.

4.2.5 NRS Site Inspection

Site inspections of the NRS system were performed on June 29, 2000. The objective was to inspect each component of the system and note any changes in operation, components not operating, and normal wear and tear. The NRS is currently operational.

Security

The entire NRS area is secured by a chain link fence with locking gates. The northern part of the fence has a hole in it, large enough for a person to enter. Both gates have locks on them, but can easily be pushed open. Each well is housed in a steel vault, with a steel cover. These vaults are not locked.

Wells

Inspection of each wellhead revealed no damage. All valves are operational. All piping is still in good condition. Down-well inspections were not included as part of this scope.

Pumps

Since the water-side of the NRS is currently not in operation, the pumps were not turned on.

Air Stripper Columns

A visual inspection of the packing material in each stripper column showed no major signs of fouling. However, if this system were to be put back in operation in the future, cleaning of the packing material with an acid wash would be recommended. Both stripper column blowers are operational and showed no signs of excessive vibration or excessive noise.

Soil Vapor Extraction

All wellhead-piping components of the SVE system are in good condition. Isolation valves at each wellhead are operational and sample ports still available. Piping at the equipment compound is in good condition, however, sample ports at the shallow and deep well manifold lines need replacing. The moisture separator was not holding any water at the time of inspection and all threaded connections and the drain valve is in good condition. The SVE blower was operating within its specified range at the time of inspection. The system was turned off and routine O&M performed on the blower. This consisted of greasing of each drive end, checking the oil in the blower, and inspecting the motor belt for wear. Discharge piping after the blower is in good condition.

4.2.6 Permit Compliance

All air permitting at the Carrier facility was performed under Title V (SRC083). Air emissions at the NRS are typically less than 1 pound per day (lb/day) TCE, and the NRS has been identified as an insignificant source area under the Title V permit.

4.2.7 Performance to Date

Operation of the NRS SVE system has resulted in near complete removal of TCE soil contamination from soil identified during the RI. Based on system discharge data, 11,476 lbs of TCE have been removed by vapor extraction since January 1992.

Since January of 1994, vapor samples have been collected quarterly from the NRS. Prior to this date it is estimated that approximately 11,000 lbs of TCE were removed by the system. The reduction in mass removed over the past 6 years (approximately 475 lbs) is typical of SVE system operation where concentrations reach an asymptotic level. A slight increase in mass removed over past years is noticeable since the focus has shifted to the shallow wells. Table 4-1 shows mass removed by quarter at the NRS.

Table 4-1
TCE Mass Removal at NRS

Time Period	Mass Removed (lbs of TCE)
1989 through 2nd Quarter 1995	11,000
3rd 1995	21
4th 1995	14
1st 1996	21
2nd 1996	16
3rd 1996	14
4th 1996	18
1st 1997	12
2nd 1997	18
3rd 1997	15
4th 1997	12
1st 1998	10
2nd 1998	0

Table 4-1
TCE Mass Removal at NRS

Time Period	Mass Removed (lbs of TCE)
3rd 1998	22
4th 1998	95
1st 1999	58
2nd 1999	19
3rd 1999	4
4th 1999	57
1st 2000	52
Total Mass Removed — NRS	**11,476**

Confirmatory soil sampling at the NRS was conducted on December 19 and 20, 1996 at the request of the Site owner. Results indicate the TCE concentration in the soil was generally below the TCE cleanup standard of 0.533 mg/kg. Biased soil sampling was conducted at four locations chosen to present the worst case, at nine depths. Only two samples out of 36 contained TCE concentration in excess of the soil cleanup goal. A singularly high result came in a sample collected at 15 feet below ground surface (bgs) in the northwest corner of the NRS area. The results of the confirmatory samples prompted a focus on the shallow wells, or stressing the shallow soils as opposed to the deeper soils.

4.2.8 NRS Conclusions

Treatment systems at the NRS are functioning as designed. Figure 4-1 shows the mass removed per quarter for the NRS. Mass removal at the NRS area had been decreasing steadily since system modifications were made in 1996; performance was enhanced by addition of a positive displacement pump in 1998.

Evaluation of cumulative mass removal since 1995 is shown in Figure 4-2. The cumulative mass removal graph clearly indicates the NRS system has approached asymptotic conditions several times. Because the 1996 sampling event indicated a majority of samples (34 out of 36) met the 0.533 mg/kg goal at the NRS, and because of the additional mass removal which has

FIGURE 4-1
NRS MASS REMOVED PER QUARTER SINCE 1995

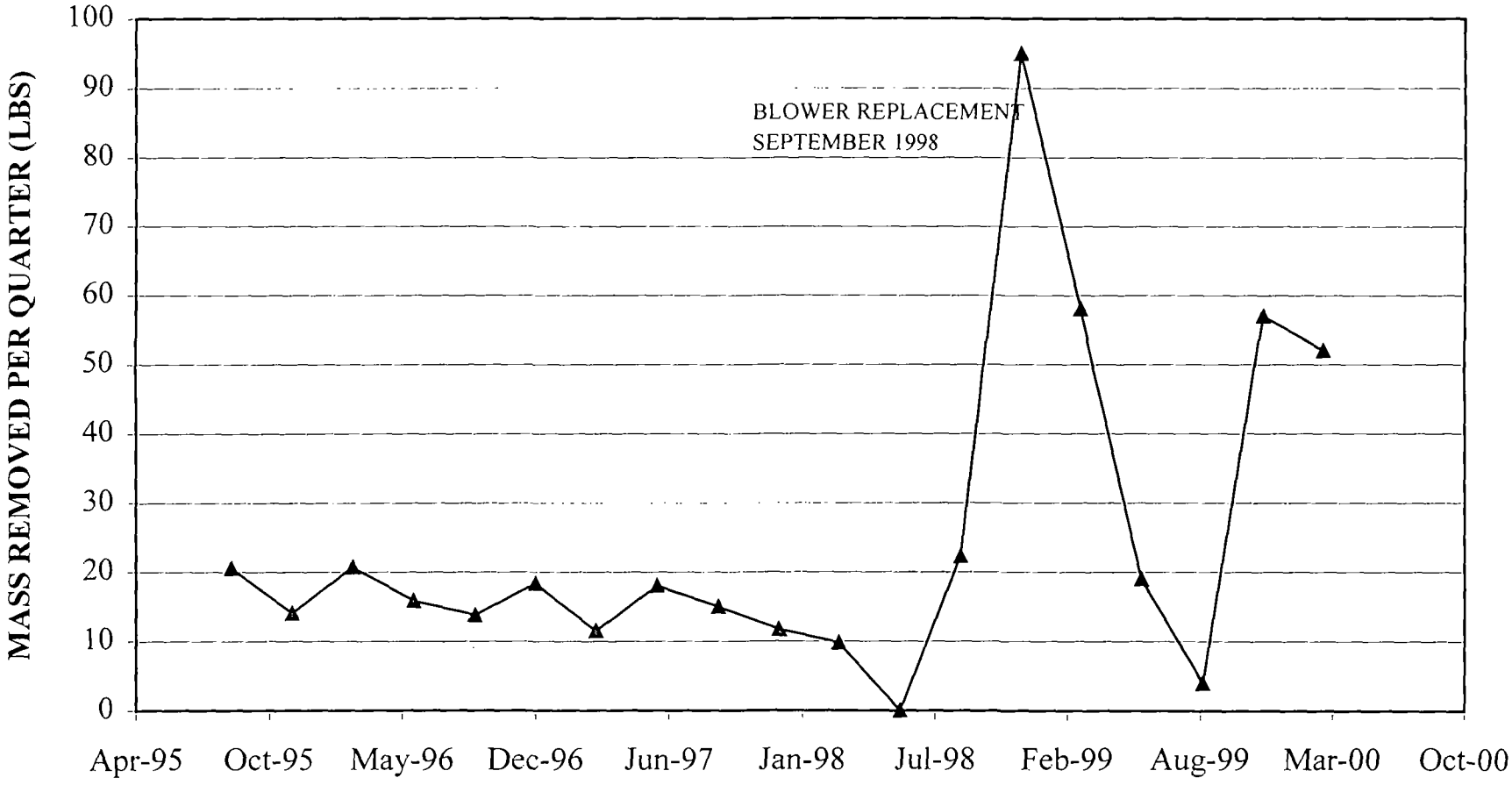
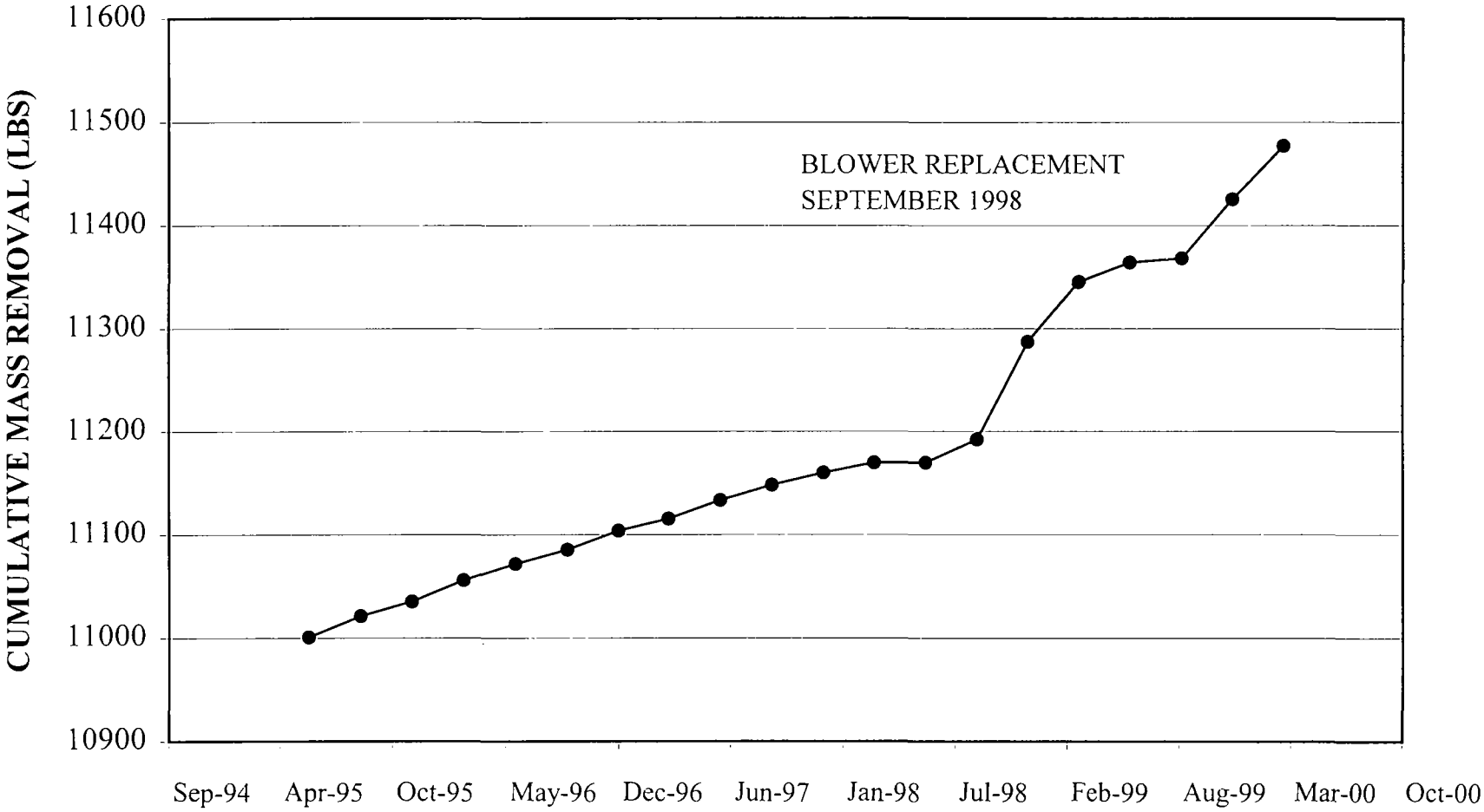


FIGURE 4-2
NRS CUMULATIVE MASS REMOVAL SINCE 1995



occurred since then, additional sampling is recommended at both the NRS area to evaluate the progress of SVE to date.

4.3 Main Plant Area (MPA)

The MPA system was installed during 1994 and 1995, and has been operating continuously since startup, except as noted below.

4.3.1 Original Design Specifications

The SVE system installed in the MPA area was more complex than that installed at the NRS. Its components are described below.

Wells

The MPA SVE system consists of six shallow (depth to 20 feet bgs) wells; one deep (depth to 40 feet bgs) well, and two horizontal extraction wells.

Each vertical SVE well is constructed of 2-inch schedule (SCH) 40 polyvinyl chloride (PVC) piping, with 15-feet of 0.010-inch slotted well screen and riser pipe. The horizontal wells, which run the length of the building from the breezeway east to the edge of the concrete cover, also are constructed of 0.010-inch slotted well screen. Shallow and deep SVE wells are manifolded separately to the equipment compound, where each manifold is fitted with a 4-inch valve for operation. The horizontal wells are also separately manifolded to the equipment compound and contain 4-inch valves for independent operation. The horizontal wells also contain 1-inch valves which can be open to the atmosphere to serve as a passive air inlet when not being used for extraction.

Moisture Separator

Extracted soil vapors first pass through a 40-gallon moisture separator to remove entrained water vapor from the airstream before it passes through the carbon vessels or the vacuum blower. A high-level shutdown addresses situations where too much water has been collected. A drain is manually opened to remove this water from the separator into drums. The contents are then discharged to the air stripper at the NRS for treatment on an as-needed basis before entering the sanitary sewer system.

In-Line Flowmeter

Soil vapor passes through a 4-inch flowmeter. The flowmeter is calibrated to read airflow rate from 10 to 100 cfm. Individual line or well flow can be measured by opening/closing the appropriate manifold valve.

In-Line Heater

Before entering the carbon vessels, soil vapor passes through the in-line heater to diminish the negative effect of relative humidity on carbon adsorption capacity. The heater is operational when the main heater control is on and air is passing through the duct. The heater automatically shuts down by operation of an airflow switch when no air is passing through the duct. A temperature indicator downstream of the heater is used to monitor air inlet temperature into the carbon vessels.

Gas-Phase Carbon Adsorbers

Soil vapor is directed to two skid-mounted gas-phase carbon adsorbers. Each adsorber holds 2,000 lbs of 4 x 10 reactivated carbon, and has 6-inch inner diameter (ID) inlet and outlet flanges and manways for removal/addition of carbon. Vacuum gauges located upstream, between, and downstream of the carbon units are used to monitor pressure drops across the adsorbers.

In-Line Air Filter

The soil vapor passes through a high-efficiency particulate air filter to remove fine-particle solids from the airstream. Pressure gauges located upstream and downstream of the unit are used to monitor the pressure drop across the filter.

Vacuum Relief Valve

The vacuum relief valve is installed to prevent excessive system vacuum. The valve is set to release when line pressure just upstream of the vacuum blower exceeds 170 inches of water.

Air Intake Valve

A provision for dilution air is provided through a filtered intake at the blower. A gate valve is positioned to precisely regulate the amount of make-up air that is fed into the system. Make-up air is necessary for starting the vacuum system under no-load conditions and for operating the system at variable levels of vacuum and vapor flow.

Vacuum Blower

The vacuum blower originally in operation at the MPA was a regenerative pump capable of providing at least 384 cfm under no-load conditions, and capable of operating up to a vacuum of 174 inches of water or 163 inches of water during continuous operation. However, this blower failed on two occasions and was sent back to the manufacturer. The cause, as determined by the manufacturer, was ingestion of foreign material causing the blower to lock (probably very fine soil particulates). After the second failure, the blower was replaced with a 5-hp, positive displacement blower capable of providing 125 cfm at 41 inches of water, or 50 cfm at 190 inches of water.

A high-level signal from the liquid level sensor in the moisture separator will shut down the vacuum blower. A temperature indicator on the discharge piping allows monitoring of the physical conditions of the air discharge stream.

Process Instrumentation and Control

The SVE system can be operated on a timer. Various points in the process are monitored and can actuate a system shutdown, including:

- High water levels in the moisture separator
- Excessive pressure upstream of the vacuum blower

4.3.2 Remedial Action Objectives

The RAO at the MPA is to prevent migration of contaminants in soil, which would result in Memphis Sand aquifer contamination in excess of MCLs and ARARs. The target levels for soil cleanup to prevent soil-to-groundwater transfers is 0.533 mg/kg TCE.

4.3.3 Current Operating Parameters

Based on data from the RI and from installation of the SVE wells, the majority of contamination lies in the shallow, finer-grained soils at the MPA. Therefore, the shallow well manifold is in operation more than the deep well or the horizontal wells. The deep well is only operated occasionally, to degas the sand and gravel zone. From 1995 until June 2000, the shallow wells have operated 861 days, the deep well 228 days, and the shallow and deep well simultaneously 184 days, and the horizontal wells 88 days.

Current operating parameters for each manifold are shown in Table 4-2.

Table 4-2
MPA System Operating Parameters

	Flowrate (cfm)	Vacuum at Blower (in H_2O)	Discharge Temperature (deg F)	Radius of Influence (ft)
Shallow Wells	20 - 25	120 - 130	100 - 170	20
Deep Well	35 - 40	100 - 110	100 - 150	100
Horizontal Wells	25 - 30	100 - 110	100 - 150	Not measured

Air flow is lower in the shallow wells as compared to the deep because the shallow soils consist of silty clays and clayey silts to about 25 feet bgs. This material is underlain by fine- to medium-grained sands to about 40 feet bgs. Permeability data further illustrates why flowrates differ: permeability data from a depth of 13 to 15 feet bgs at the MPA was 3.6×10^{-7} cm/sec, and was 1.1×10^{-3} cm/sec at a depth of 32 to 33 feet bgs. The horizontal wells were installed parallel with the building and completed about 1.5 feet bgs in fill material, and have much longer screen lengths, therefore flow recorded from these wells is also higher than the shallow well network.

4.3.4 O&M Evaluation

Routine O&M of the blower includes monthly greasing of each drive end and changing the oil in the blower. Also, vacuum gauge and flowmeter readings are recorded and compared to previous readings to check for changes. If changes are noticed, the system is adjusted. Table 4-3 shows reasons for the system being shut down, other than routine O&M.

Table 4-3
MPA Downtime Record

Quarter	Downtime Reason
2nd Quarter 1995	Water problem
3rd Quarter 1995	Water problem
4th Quarter 1995	Carbon change
3rd Quarter 1995	Regenerative blower failure; system restarted
1st Quarter 1996	Regenerative blower failure; new positive displacement blower installed
4th Quarter 1996	Carbon change
2nd Quarter 1997	Water problem
3rd Quarter 1997	Carbon change

Table 4-3
MPA Downtime Record

Quarter	Downtime Reason
4th Quarter 1997	Blower belt broken
4th Quarter 1998	Water problem
1st Quarter 1999	Carbon change
2nd Quarter 2000	Water problem

4.3.5 MPA Site Inspection

Site inspections of the MPA system was performed on June 29, 2000. The objective was to inspect each component of the system and note any changes in operation, components not operating, and normal wear and tear. The MPA system is currently shut down due to water entering the wells and manifold piping. The system was turned on for the inspection.

Security

The equipment compound is secured by chain link fencing with a locking gate. Manifold piping from below ground surface is outside of the fencing, but since the area is limited to only plant personnel and Site contractors, it does not appear to have been tampered with. Shallow wells and the deep well are covered with non-locking steel vaults. The wells do not appear damaged.

Wells

A visual inspection of the deep well and shallow wells revealed no significant damage, other than normal wear. All isolation valves within the vaults are operational, and sample ports intact. One shallow well (2D) is bent just above the well vault, however it is still operational.

The horizontal wells were not inspected because they do not have any above ground features/vaults.

Manifold Piping and Valves

Manifold piping from the shallow wells, the horizontal wells, and the deep well are all functional. Each manifold valve is operational. The two air intake valves located on the horizontal wells are operational.

Moisture Separator

The moisture separator lid was removed and the inside of the separator inspected. About 1 to 2 inches of silt or sludge has accumulated inside the separator. Although this does not affect the performance of the separator, this material should be removed. No leaks were noticed on the separator.

In-Line Flowmeter

The system was activated to test the flowmeter. The flowmeter was functional when the deep well was isolated, and flow rates are within the normal range for the deep well. The flowmeter registered slightly when the shallow wells were in operation. However, this is typical of the past performance of the shallow wells. Flows from the shallow wells are typically measured at each shallow wellhead. Again, the flowmeter only registered slightly when the horizontal wells were in operation. This is attributed to water within the line not allowing air flow. Continued operation of the horizontal wells allowed some water to enter the separator, at which time the flowmeter did register.

In-Line Heater

The heater is operating. The downstream temperature gauge was used to check the efficiency of the heater. Initially, the thermostat inside the heater was set to 90 degrees Fahrenheit and the temperature gauge monitored to record when the heater shut down. The heater shut off at approximately 94 degrees Fahrenheit.

Carbon Vessels

No leaks were found in the piping going into and out of the carbon vessels. The carbon is scheduled to be replaced within the next 2 weeks. The pressure differential before and after the carbon vessels remains at about 6 to 7 inches of water. Valves on the bottom of each vessel were opened to check for water inside. No water was noticed in either carbon vessel.

In-Line Air Filter

The air filter cartridge was removed and found to be in good condition. There were no traces of water or other foreign material inside of the filter housing. The pressure drop across the air filter ranges from 4 to 5 inches of water.

Dilution Valve and Filter

The air dilution valve is operational. The filter housing was removed, and the filter inspected and cleaned. After replacement of the carbon, and the system is turned back on, this filter should be replaced.

SVE Blower

Routine O&M was performed on the blower during the inspection. This included greasing each drive end, and checking the oil level. The motor belt was inspected and found to be in good condition. During the inspection, the dilution valve was completely shut to allow a maximum vacuum condition at the blower. During this operation, there were no signs of leaks or excessive noises or vibrations from the blower.

Alarms

The system was allowed to operate at a vacuum rate of 120 inches of water, as measured at the blower, while the shallow wells were open. During the inspection, water was being extracted

and trapped in the moisture separator. After about 1 hour, the separator filled and the system automatically shut down. The system was reset and turned back on.

The blower disconnect was also checked while the system was in operation, and did shut down the blower when turned to the off position.

4.3.6 Permit Compliance

Air emissions at the MPA have been typically less than 1 lb/day TCE, but all emissions are treated with carbon prior to discharge. As noted previously, all air emissions at the CAC facility are permitted through the Title V process (SRC083); the MPA has been identified as an insignificant source.

4.3.7 Performance to Date

The system has operated approximately 74% of the time since the startup of the MPA SVE system on June 1, 1995. The main reason for downtime of the system is the extraction of water that is collected in the moisture separator, temporarily shutting the system down. Since 1995, 716 gallons of water have been extracted by the SVE system. The majority of the water was collected in 1995 (493 gallons) during initial operation of the shallow wells. This water is drained into drums and treated at the NRS air stripper. Extracted water is thought to be coming from underneath the building (Main Plant) and finding its way into the wells and piping trenches of the system.

Soil vapor samples have been collected since the start of the system. Samples were collected monthly from June 1995 through January 1997, then every other month thereafter. On occasion, additional samples were collected to test rebound effects after reactivation of the system if it was shut down, or to assess carbon breakthrough. Since activation of the system, approximately 2,597 lbs of TCE have been removed by the system. Broken down by

manifold, this equates to 2,421 lbs from the shallow wells, 142 lbs from the deep well, 34 lbs from the horizontal wells and 0.03 lbs from extracted groundwater. Table 4-4 summarizes the mass removed by the MPA SVE system.

Table 4-4
MPA Mass Removal

Quarter	Shallow Wells (lbs mass)	Deep Well (lbs mass)	Horizontal Wells (lbs mass)	Total
2nd 1995	482.00	0.00	0.00	482
3rd 1995	826.52	2.85	5.48	835
4th 1995	222.00	000	0.00	222
1st 1996	3.04	1.81	0.00	5
2nd 1996	21.04	.97	0.00	22
3rd 1996	14.90	0.00	1.40	16
4th 1996	124.50	11.00	0.00	136
1st 1997	181.00	0.00	0.00	181
2nd 1997	50.00	0.00	0.00	50
3rd 1997	45.00	0.00	0.00	45
4th 1997	37.70	0.00	0.00	38
1st 1998	8.00	0.00	20.14	28
2nd 1998	2.30	2.80	0.00	5
3rd 1998	0.00	0.00	4.00	4
4th 1998	0.97	3.31	3.11	7
1st 1999	66.00	19.00	0.00	85
2nd 1999	16.00	51.00	0.00	67
3rd 1999	149.00	0.00	0.00	149
4th 1999	171.00	0.00	0.00	171
1st 2000	0.00	49.00	0.00	49
Cumulative Total	**2,421**	**142**	**34**	**2,597**

Shallow Groundwater Concentrations

MW-31 is used as an indicator well to measure eventual effectiveness of the soil remediation system in place at the MPA. MW-31 was installed at a depth of 50 feet bgs. The Jackson/Upper Claiborne is absent at this location, indicating the confining unit "pinches out" to the northwest of MW-31. The top of clay contours of the Jackson Clay indicate it slopes radially with a prominent downgradient direction toward the east-southeast (toward MW-31) and to the west. Therefore, contaminants entering the shallow groundwater near the main plant would migrate in a direction toward MW-31.

Groundwater data from MW-31 indicate an overall downward trend since quarterly monitoring began in 1995, and an overall decline in concentration since the RI. Results of quarterly sampling of MW-31 are shown in Table 4-5.

Table 4-5
MW-31 Concentrations

Quarter	TCE (µg/L)
3rd 1995	53
4th 1995	140
1st 1996	170
2nd 1996	19
3rd 1996	67
4th 1996	110
1st 1997	65
2nd 1997	25
3rd 1997	21
4th 1997	65
1st 1998	Not sampled
2nd 1998	14
3rd 1998	52
2nd 1999	19
3rd 1999	45
4th 1999	80
1st 2000	82

4.3.8 MPA Conclusions

The MPA treatment system is functioning as designed. Figure 4-3 shows the mass removed per quarter for the MPA area. Mass removal rates at the MPA have been tailing off since 1996; periodic modifications to the vapor extraction well pattern have augmented removal for the past several years.

Evaluation of cumulative mass removal since 1995, shown in Figure 4-4 indicates the system has approached asymptotic conditions several times. Moreover, decreases in TCE concentrations in MW-31 since the RI indicate that mass contributions to the Memphis Sand from shallow groundwater have been significantly reduced since the installation of the MPA system. Figure 4-5 shows concentration decreases over time.

FIGURE 4-3
MPA MASS REMOVAL PER QUARTER SINCE 1995

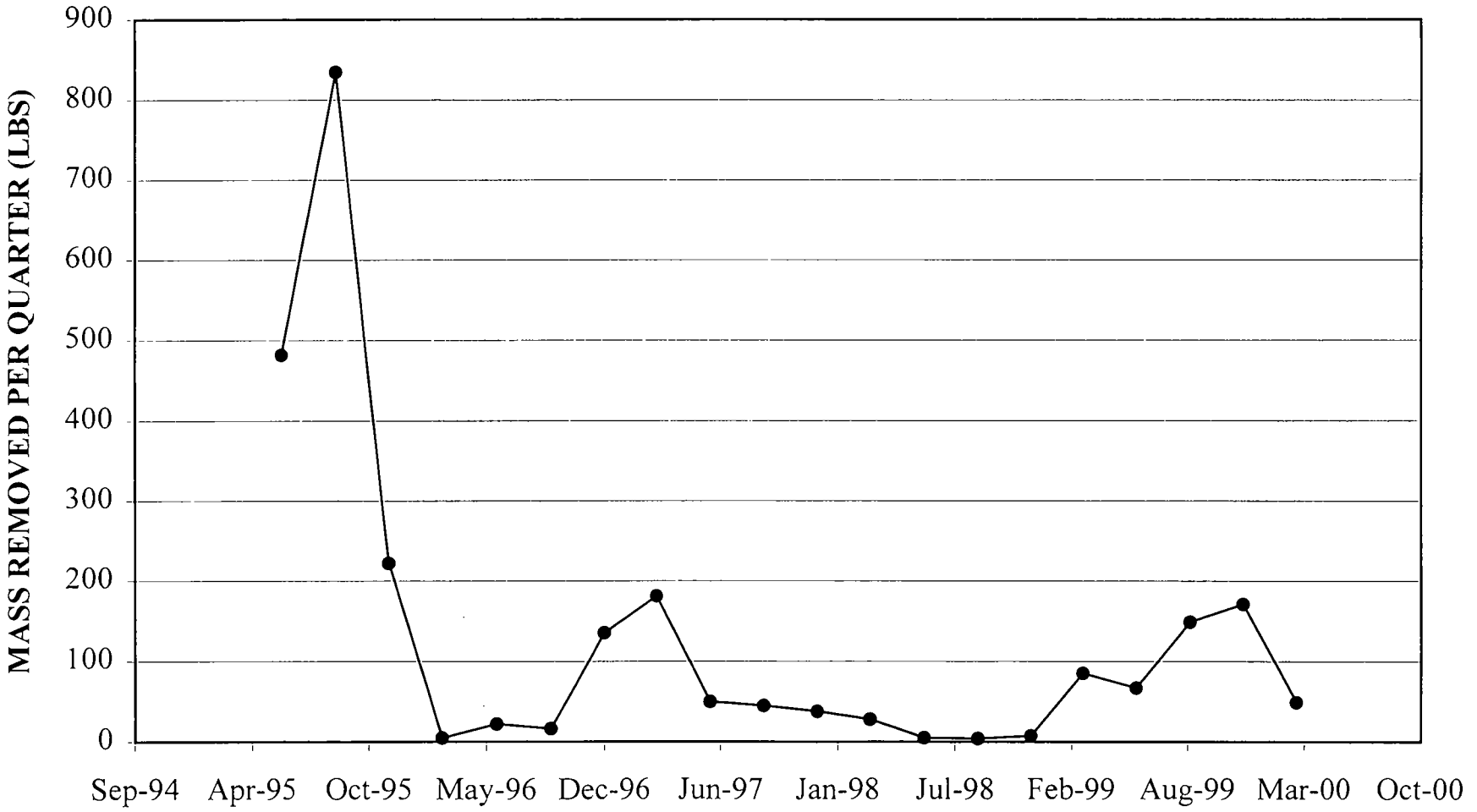


FIGURE 4-4
MPA CUMULATIVE MASS REMOVAL SINCE 1995

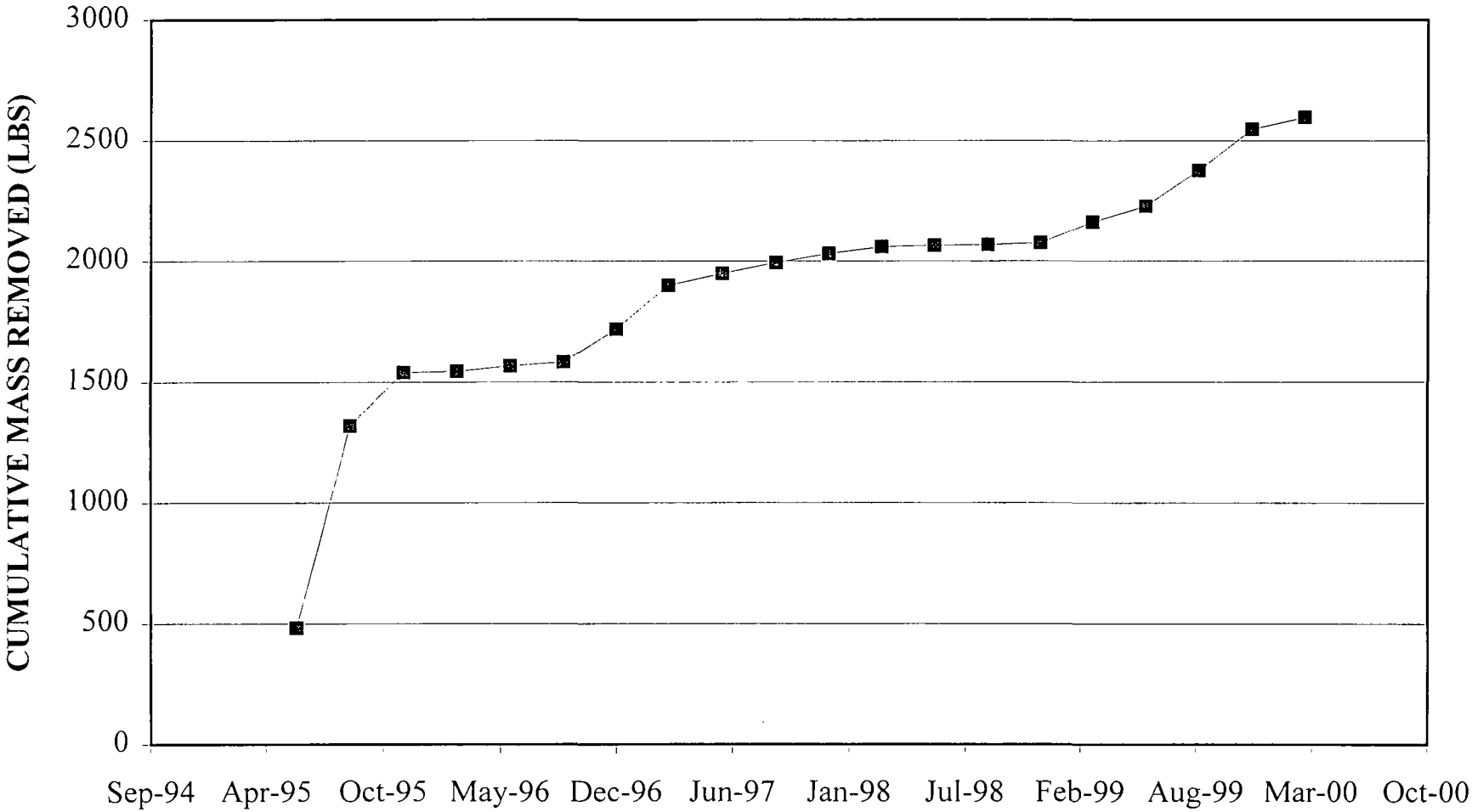
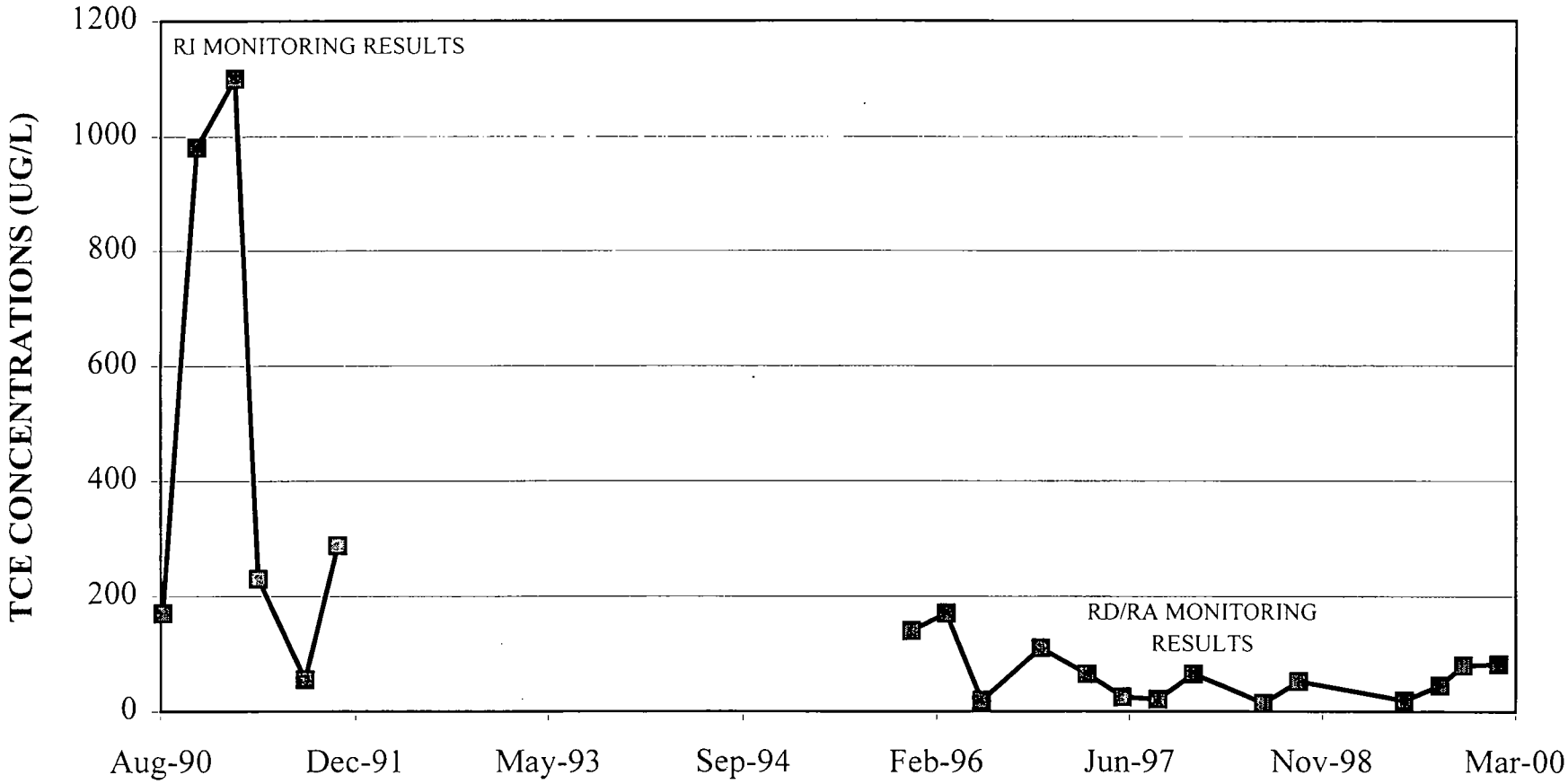


FIGURE 4-5
MW-31 TCE CONCENTRATION TRENDS
AUGUST 1990 THROUGH FEBRUARY 2000



These data indicate that the quantity of TCE being introduced into the Memphis Sand has been reduced by at least one order-of-magnitude since the RI in 1990/1991.

4.4 Groundwater Treatment System (Water Plant #2)

The groundwater treatment system at Water Plant #2 was installed during 1990 to remove TCE from groundwater before it enters the municipal water supply. It has been operating continuously since installation, except as noted below.

4.4.1 Original Design Specifications

In 1990, Carrier and the Town of Collierville designed and installed an air-stripping tower system at Water Plant #2 to treat contaminated groundwater that had reached the Memphis Sand aquifer. This 1.5 MGD system removes TCE from raw water before it enters the chlorination system and allows the town to use Water Plant #2 fully. The treatment system was designed to handle incoming TCE concentrations of up to 300 µg/L. Parameters included for design were based on the operation of one air stripper and are summarized in Table 4-6.

Table 4-6
Design Parameters for Water Plant #2 Air Strippers

Influent Concentration	300 µg/L TCE
Effluent Concentration	≤ 1 µg/L TCE
Liquid Flow	500 gpm (each)
Air Flow	4,500 cfm
Temperature	≥ 50 degrees Fahrenheit
Packing Material	3.5-inch diameter Jaeger Tri-Pack
Tower Height	29 feet
Tower Diameter	5 feet

Wells/Pumps

Groundwater is continually pumped from the two Town of Collierville wells each of which uses a 20-hp, vertical turbine pump rated at 500 gpm. Conditions that stop these pumps include: air stripper blower pressure falls below 0.5 inches water column (indicating blower failure), water in the air stripper sump exceeds 40 inches, or high water levels in the Water Plant #2 above ground storage tank.

Treatment

Once groundwater is pumped from the wells, it is routed to a 10-inch diameter combined influent header, which splits the flow to the two air strippers, depending upon whether both well pumps are running or just one. If both pumps are operating, the combined flow is split between the two air strippers, otherwise flow is directed to only one air stripper. Once pumped water has reached the top of each stripping tower, it enters a distributor to disperse the water over the entire surface area of the packing medium. The water then gravity flows through the packing as air blows in through the bottom of each tower, creating a mass transfer of contaminants from a liquid phase to a gaseous phase, where it discharges through the top of the air strippers.

Treated water is pumped underground to the original water plant equipment. While being injected with chlorine, water is gravity fed from the aeration tower to a 300,000-gallon ground storage tank. Finally, two 800-gpm service pumps distribute the final treated water to the distribution system.

4.4.2 Remedial Action Objectives

The goal of the remedial action is to contain TCE-contaminated groundwater onSite, until cleanup levels for the contaminants of concern are reached throughout the attainment area

(e.g., the plume boundary). Cleanup goals for the Site, as established by USEPA and presented in the ROD, are shown in Table 4-7.

Table 4-7
Groundwater Cleanup Levels

Contaminant	Goal (µg/L)
Trichloroethene	5
Cis-1,2-Dichloroethylene	70
Trans-1,2-Dichloroethylene	100
Tetrachloroethene	5
Vinyl Chloride	2
Lead	15
Zinc	5,000

Since quarterly monitoring began in 1995, only TCE has been detected in the Collierville wells; all other volatile organics have not been detected above the method detection limit. Concentrations of lead in the Collierville wells have not been detected above 15 µg/L, and have been below the method detection limit over the past 6 sampling events. Concentrations of zinc have been as high as 68.8 µg/L, however, this may be attributed to the galvanized steel sampling point where the samples are collected and is significantly less than the 5,000 µg/L remedial goal.

4.4.3 Current Operating Parameters

There has been no change in operation of the treatment system at Water Plant #2. Raw and treated water concentrations at the wellheads are monitored quarterly.

4.4.4 O&M Evaluation

Very little maintenance is required of the air strippers and associated equipment, but under an agreement with Carrier maintenance is the responsibility of the Town of Collierville Public Works Department.

4.4.5 Water Plant #2 Site Inspection

The Site inspection of the Water Plant #2 system was performed on June 29, 2000. The objective was to inspect each component of the system and note any changes in operation, components not operating, and normal wear and tear. Only components related to groundwater contaminant removal were inspected, specifically the Town of Collierville wells, air stripper columns, and piping inside the equipment building.

Security

Chain link fencing with locking gates secures both production wells and the treatment building.

Production Wells

A visual inspection of the wells was performed during this inspection. They appear to be in good condition.

Air Stripper Columns

Each air stripper column is equipped with manways to allow inspection of the packing material. During this inspection, only the northern most stripper was checked. The packing material is showing signs of algae fouling, which was noted in 1993. This is not expected to decrease system effectiveness.

Piping and valving inside the equipment building appear to be in good condition. There were no visible signs of leakage. Air stripper blowers are operational and are not creating any excessive noise or vibration.

High/low sump control and blower malfunction safety features were not tested during the inspection.

4.4.6 Permit Compliance

With the exception of ARARs, there are no permits in force to operate Water Plant #2. Approximately 1 lb/day TCE is released to the atmosphere from the air strippers. Emissions from Water Plant #2 are covered under Carrier's Title V permit (SRC083). Water Plant #2 is identified as an insignificant source in the Title V permit.

4.4.7 Performance to Date

Contaminant concentrations in the Collierville wells have been monitored since June of 1990. TCE levels in the Town wells consistently exhibit the same pattern: concentrations in the west well are higher than concentrations in the east well. Raw water concentrations have been slowly increasing in both wells since quarterly monitoring began. Excepting some highs and lows, this upward trend has remained constant, as shown in Figure 4-6.

Mass Removal

Mass removed by Water Plant #2 is calculated from influent concentrations from the Collierville wells, the combined flow from the wells, and the assumption that the air stripper removes 100% of TCE from influent groundwater. Based on these assumptions, Water Plant #2 has removed 3,719 lbs of TCE since the system was installed. Table 4-8 shows pounds of TCE removed per quarter.

FIGURE 4-6
TCE CONCENTRATIONS AT WATER PLANT #2
SINCE SYSTEM STARTUP

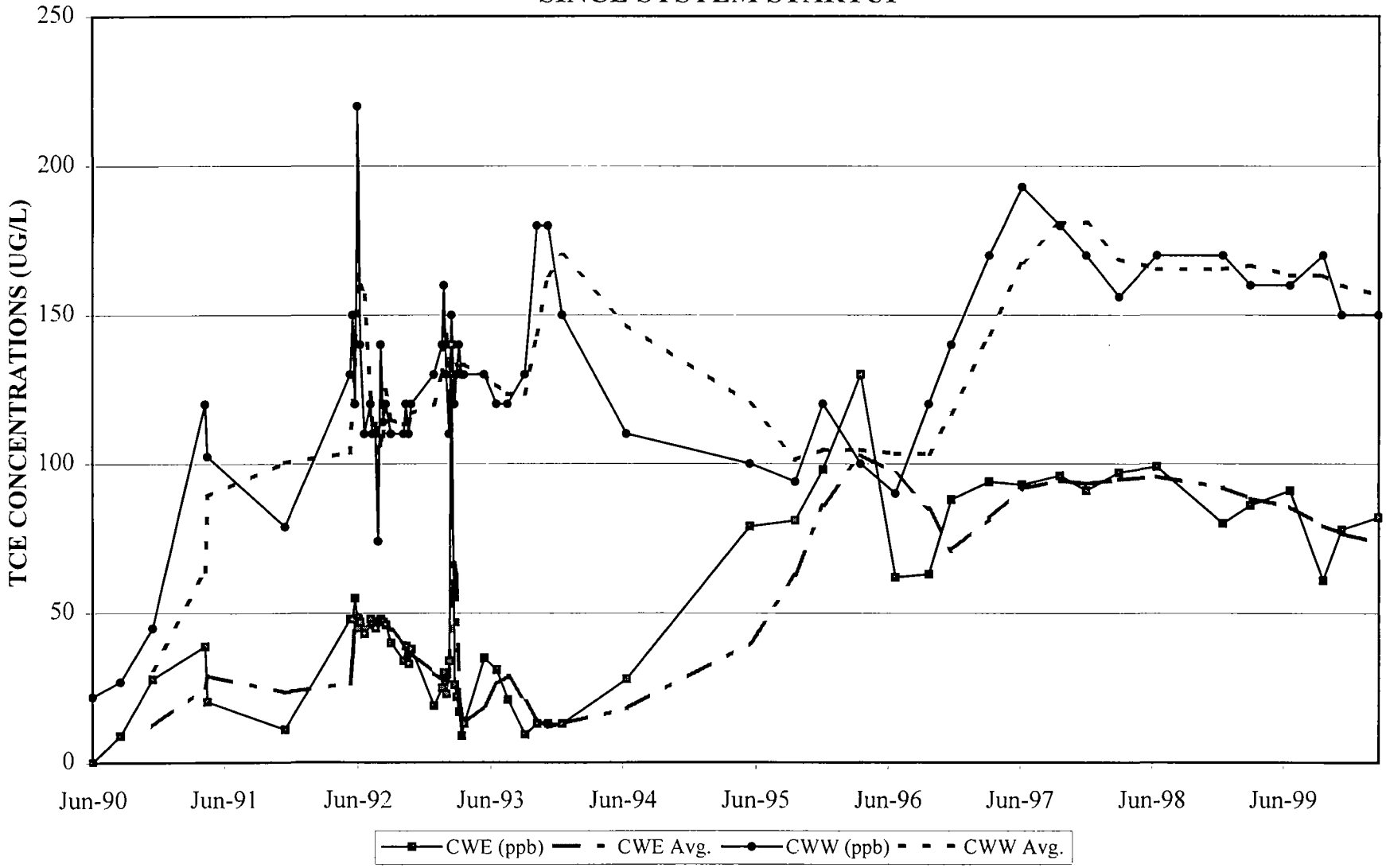


Table 4-8
Water Plant #2 Mass Removal Data

Quarter	Flow Rate (MGD)	Mass Removed (lbs)	Cumulative Mass Removed (lbs)
Pre-1992	Not Available	1,479	1,479
Jun-92	90.7	76	1,555
Sep-92	90.7	60	1,615
Dec-92	90.7	57	1,672
Mar-93	90.7	55	1,727
Jun-93	90.7	58	1,785
Sep-93	90.7	54	1,839
Dec-93	90.7	69	1,908
Mar-94	90.7	Not Available	1,908
Jun-94	90.7	62	1,970
Sep-94	90.7	Not Available	1,970
Dec-94	90.7	Not Available	1,970
Mar-95	90.7	Not Available	1,970
Jun-95	90.7	61	2,031
Sep-95	90.7	62	2,093
Dec-95	90.7	72	2,165
Mar-96	90.7	79	2,244
Jun-96	90.7	76	2,320
Sep-96	90.7	71	2,391
Dec-96	90.7	71	2,462
Mar-97	90.7	85	2,547
Jun-97	90.7	98.1	2,645
Sep-97	90.7	104.1	2,749
Dec-97	85.3	98	2,847
Mar-98	85.9	94	2,941
Jun-98	95.9	104	3,045
Sep-98	96.2	103	3,148
Dec-98	87.9	94	3,242
Mar-99	93	99	3,341
Jun-99	94.9	98	3,439
Sep-99	96.2	97	3,536
Dec-99	97	96	3,632
Mar-00	92.6	87	3,719

Note:
Flow data are not available for pre-August 1997. Estimated, average flow rates of 90.7 MGD were used for these calculations.

4.4.8 Water Plant #2 Performance/Conclusions

The treatment system at Water Plant #2 is functioning as designed; TCE is being removed to concentrations below the MCL by the air stripper system. Figures 4-7 and 4-8 present the mass removal per quarter and the cumulative mass removal at Water Plant #2 for the past 8 to 10 years. These data show mass removal rates are increasing, due to both the increasing contaminant concentrations and the increasing flow rates quantified at Water Plant #2.

4.5 Groundwater Containment

The remedy for the CAC Site uses the existing municipal wells at Water Plant #2 to contain contaminated groundwater in the Memphis Sand beneath the plant. The daily production rate from these wells, during the remedial design, averaged approximately 750 gpm (combined flow), for a total daily flowrate of approximately 1.1 MGD.

4.5.1 Containment Objectives

Modeling performed in 1994 indicated that by maintaining groundwater extraction at Water Plant #2 at these levels, groundwater in impacted areas would be contained. This assessment also evaluated whether groundwater monitoring wells MW-60 and MW-62 (installed downgradient of Water Plant #2) would detect any contamination if containment to the west of the Site was not adequate.

MW-60 was completed to a depth of 385 feet, with a 20-foot screened interval which was completed between 70 and 86 feet below the Town wells' screens. MW-62 was completed to a depth of 200 feet, with a 20-foot screened interval, between 39 and 75 feet above the top of the Town wells' screens. The Town wells are approximately 1,500 feet upgradient of the MW-60/MW-62 pair.

FIGURE 4-7
TCE MASS REMOVAL AT WATER PLANT #2
PER QUARTER SINCE 1992

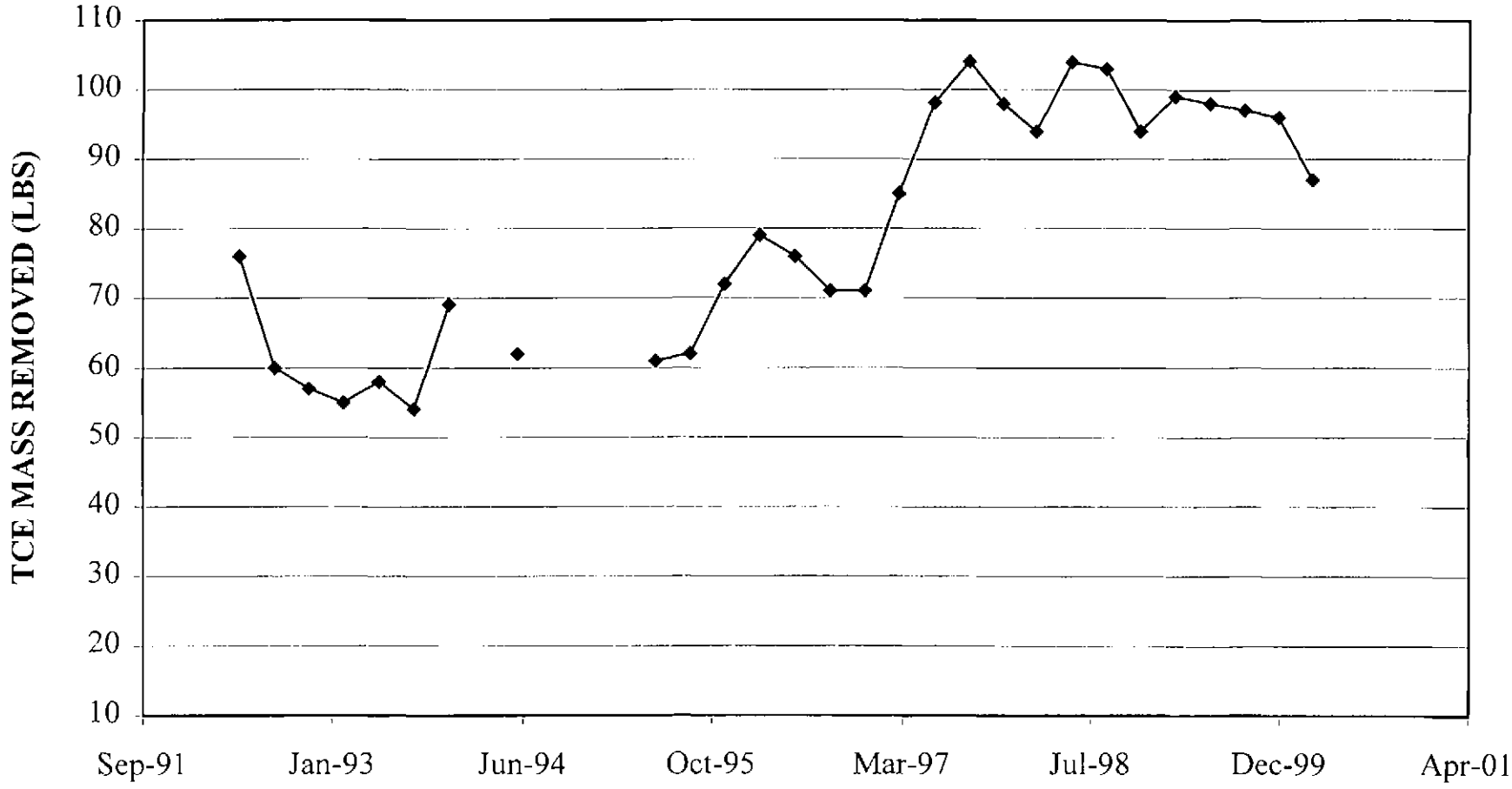
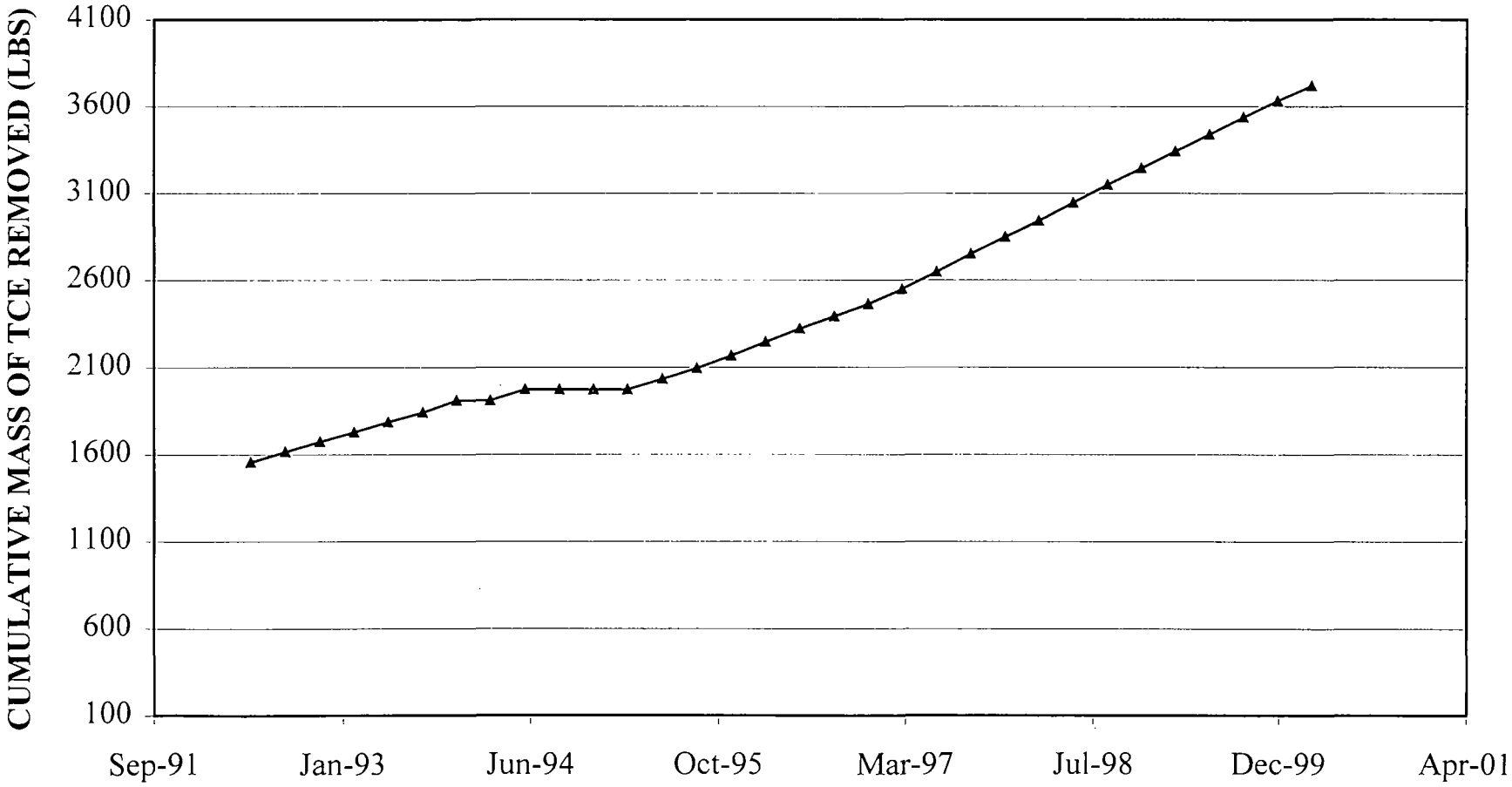


FIGURE 4-8
WATER PLANT #2 CUMULATIVE MASS REMOVAL
PER QUARTER SINCE 1992



Results of hydraulic modeling presented in 1994 were that MW-60 and MW-62 are adequate for monitoring containment because they are located properly downgradient of Water Plant #2 to detect any bypass contaminants, and because any bypass contaminants should have had adequate time to travel from the source area to the monitoring wells.[2] Moreover, the modeling indicated that no additional groundwater extraction was required at Water Plant #2 to effect containment of the plume.

This modeling was repeated during 1996 and 1997, using data obtained during a maintenance shutdown period at Water Plant #2. Groundwater conditions were evaluated under static and pumping conditions. The 1997 verification modeling confirmed the placement of MW-60 and MW-62 as sufficient to detect loss of containment, and also confirmed the adequacy of the Water Plant #2 pumping in containing all contaminated groundwater. The conclusions included the following:

- The static potentiometric surface between the facility and Water Plant #2 indicated a uniform hydraulic gradient between the area where the Jackson/Upper Claiborne unit is absent and MW-60/MW-62.

- The composite capture zone from the east and west wells includes the area of known contamination beneath the Carrier facility.

- With increased water demands from the Town of Collierville, pumping rates are expected to increase, thus causing the composite capture zone to increase in breadth.

[2] Both modeling efforts were performed to assess containment, particularly along the western edge of the site. Both the 1994 and 1996 efforts demonstrated that adequate containment is provided by the west well, ensuring that no TCE-contaminated groundwater bypasses the Water Plant #2 containment system.

- Monitoring wells MW-60 and MW-62 are located downgradient of the Town wells to intercept any contamination flowing along the western edge of the capture zone or moving under the production wells.

Since 1997, there have been no changes in operations at Water Plant #2 or in compliance monitoring data to suggest non-containment.

4.5.2 Water Plant #2 Production Rates

The Collierville wells have maintained production at approximately 1 MGD, with little downtime. Figures 4-9 through 4-12 show daily pumping rates for the period August 1997 through May 2000. These data, obtained from Town of Collierville maintenance records, are included as Appendix C. Tables 4-9 through 4-12 present monthly flow rate data for Water Plant #2. These data indicate that since August 1997, 74% of all operational days have exhibited flows greater than 1 MGD. The distribution of flow rates is shown in Table 4-13.

Table 4-9
Monthly Production Data for 1997 (in gallons)

Month	Total Water Treated (gallons per month)	Average Water Treated (gpd)	Maximum Water Treated (gpd)	Minimum Water Treated (gpd)
August	35,092,000	1,127,000	1,327,000	625,000
September	34,600,000	1,153,000	1,299,000	1,020,000
October	32,871,000	1,060,000	1,221,000	559,000
November	22,164,000	963,000	1,850,000	42,000
December	30,204,000	975,000	1,084,000	928,000
Averages for 1997		**1,055600**	**1,356,200**	**634,800**

FIGURE 4-9
1997 WATER PLANT #2 DAILY PRODUCTION RATES

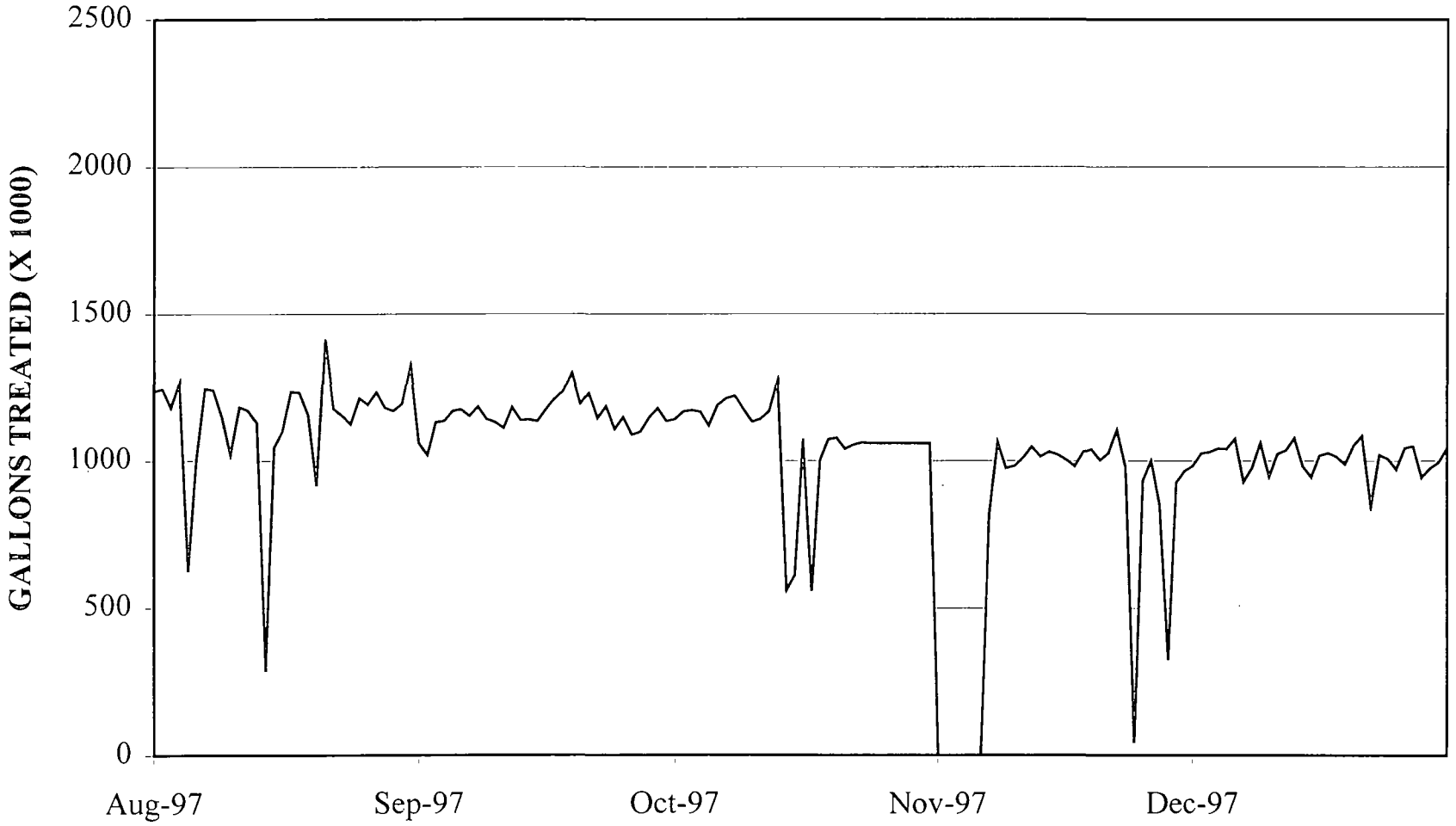


FIGURE 4-10
1998 WATER PLANT #2 PRODUCTION RATES

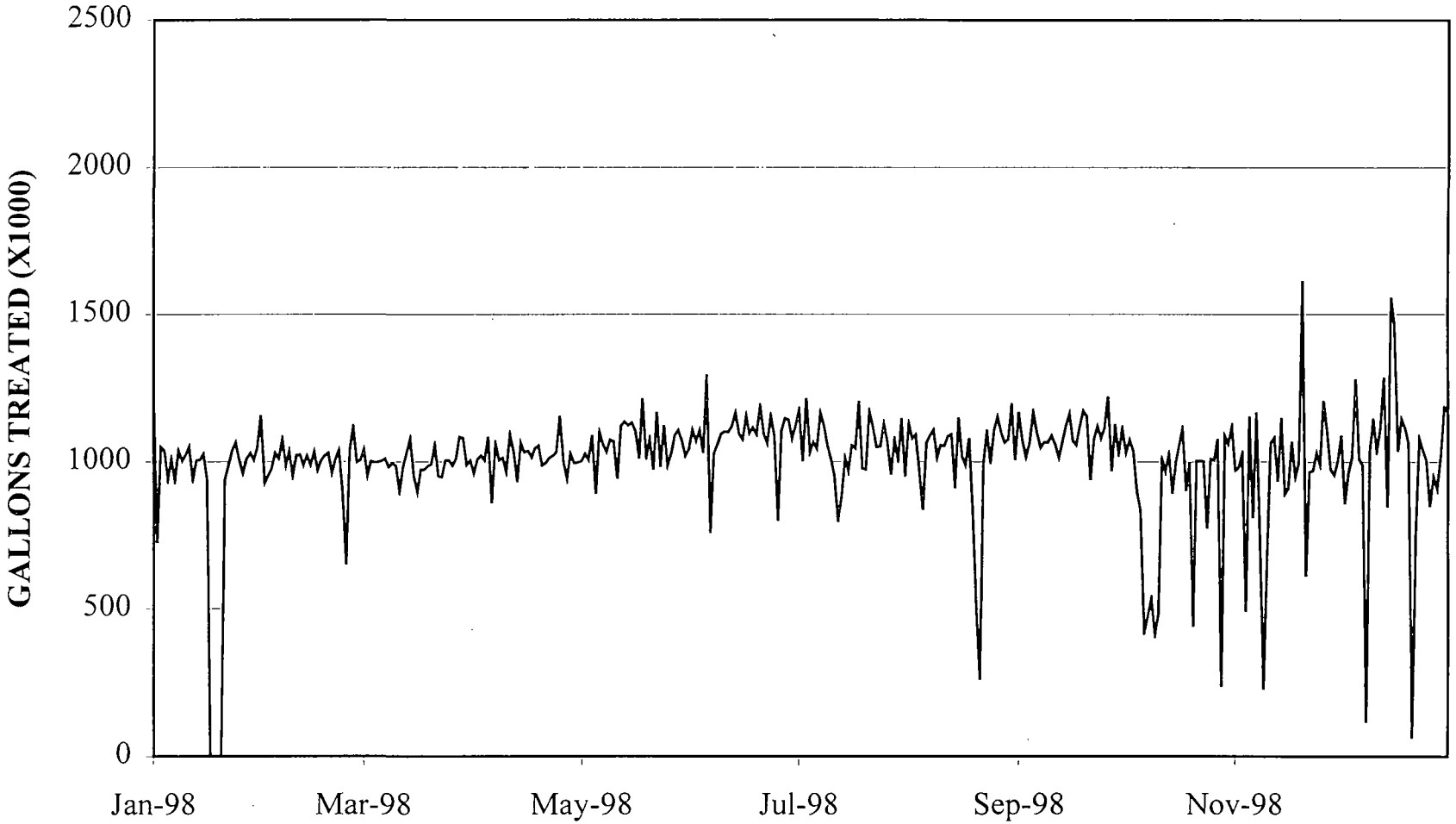


FIGURE 4-11
1999 WATER PLANT #2 DAILY PRODUCTION RATES

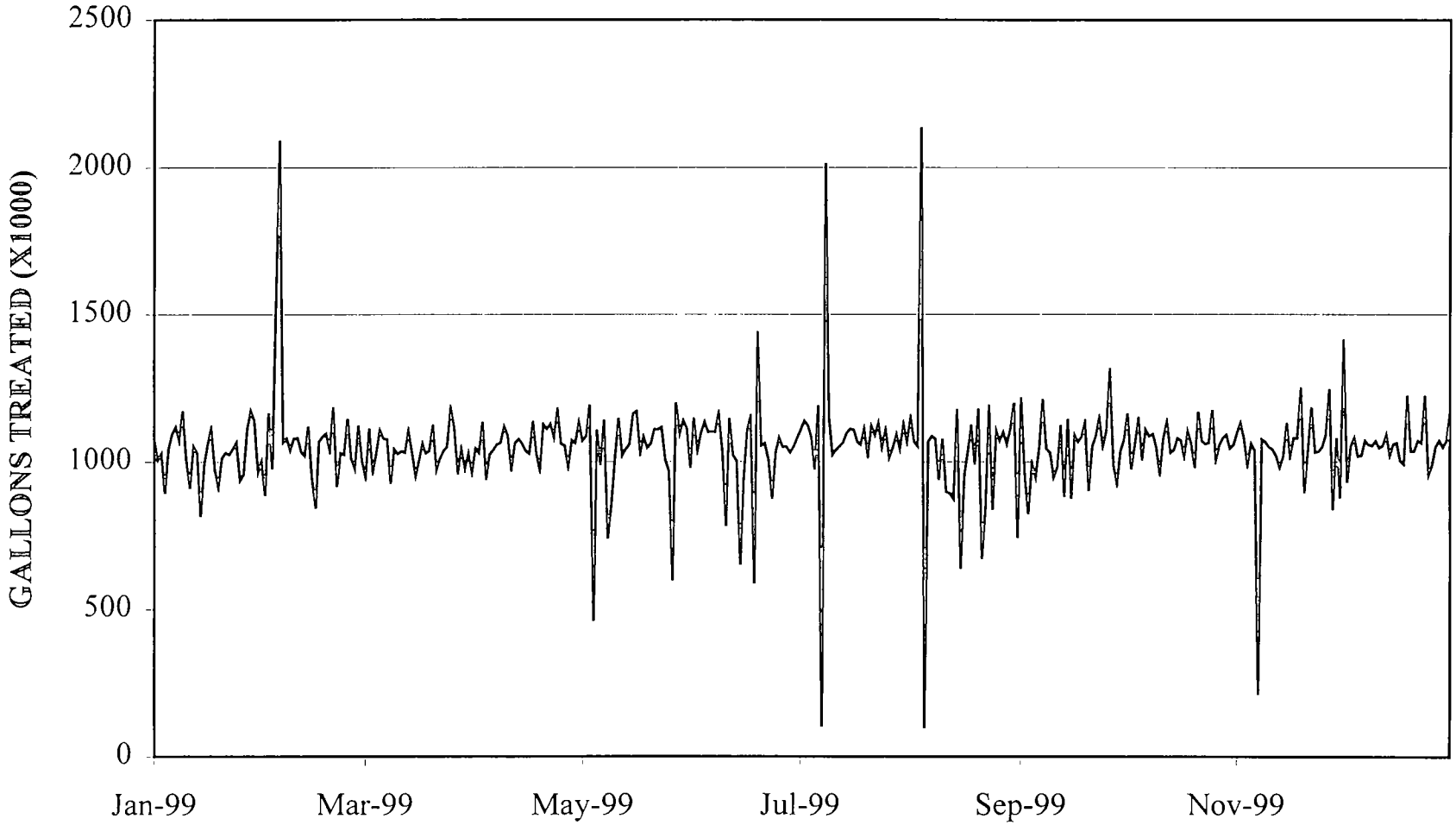


FIGURE 4-12
2000 WATER PLANT #2 DAILY PRODUCTION RATES

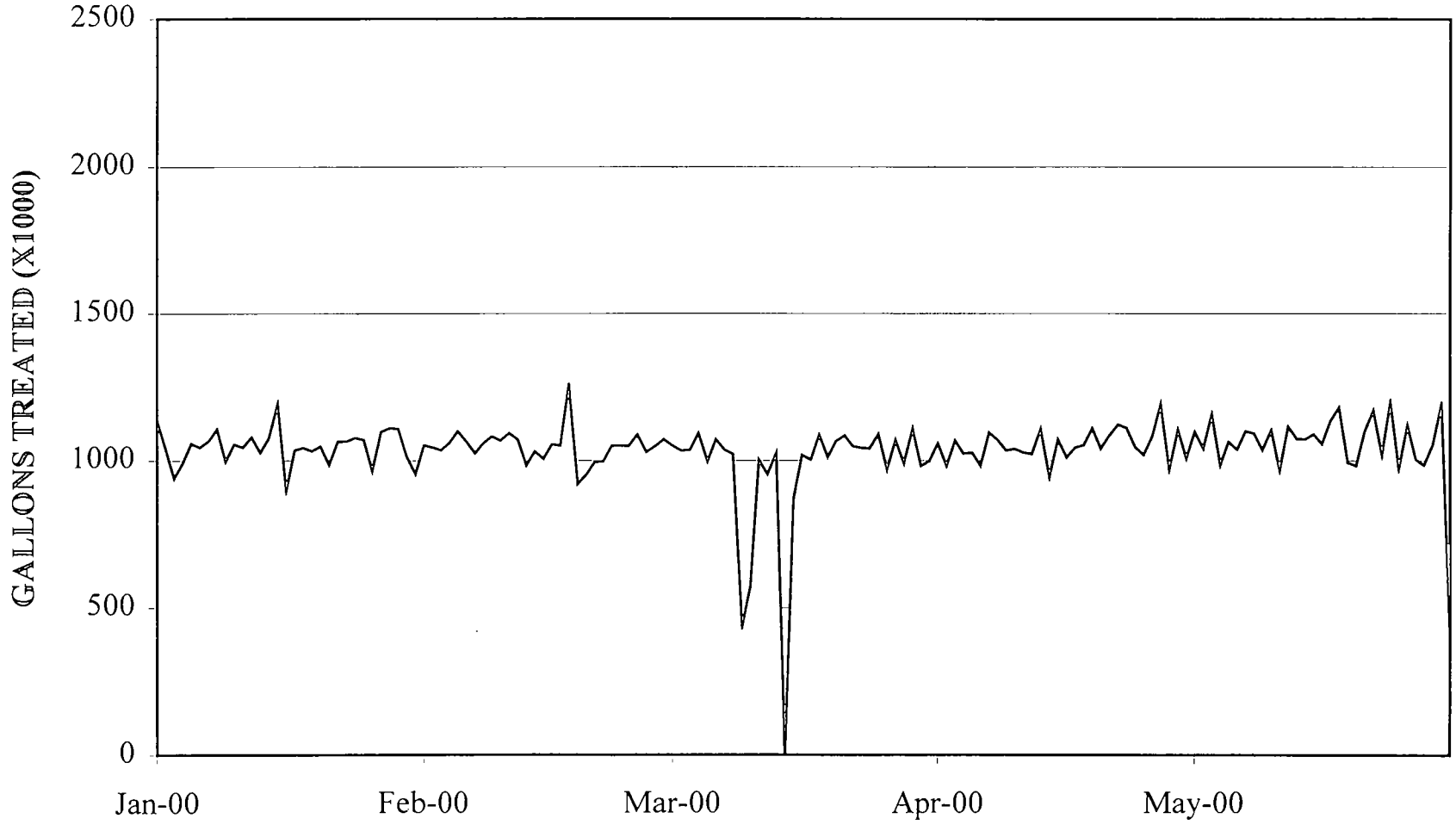


Table 4-10
Monthly Production Data for 1998

Month	Total Water Treated (gallons per month)	Average Water Treated (gpd)	Maximum Water Treated (gpd)	Minimum Water Treated (gpd)
January	27,258,000	879,000	1,235,000	0
February	27,772,000	992,000	1,120,000	650,000
March	30,842,000	995,000	1,084,000	898,000
April	30,452,000	1,015,000	1,156,000	859,000
May	32,817,000	1,059,000	1,215,000	891,000
June	32,638,000	1,088,000	1,296,000	758,000
July	32,480,000	1,048,000	1,217,000	798,000
August	31,204,000	1,007,000	1,198,000	260,000
September	32,641,000	1,088,000	1,221,000	938,000
October	26,984,000	870,000	1,120,000	236,000
November	28,724,000	957,000	1,615,000	227,000
December	32,170,000	1,038,000	1,558,000	63,000
Averages for 1998		**1,003,000**	**1,252,916**	**548,166**

Table 4-11
Monthly Production Data for 1999

Month	Total Water Treated (gallons per month)	Average Water Treated (gpd)	Maximum Water Treated (gpd)	Minimum Water Treated (gpd)
January	31,813,000	1,026,000	1,173,000	815,000
February	29,113,000	1,078,000	2,092,000	842,000
March	32,050,000	1,034,000	1,183,000	926,000
April	31,904,000	1,063,500	1,179,000	940,000
May	31,917,000	1,029,600	1,201,000	461,000
June	31,123,000	1,037,400	1,442,000	587,000
July	33,523,000	1,081,400	2,016,000	102,000
August	31,443,000	1,014,300	2,137,000	97,000
September	31,284,000	1,042,800	1,318,000	824,000
October	33,129,000	1,068,700	1,176,000	957,000
November	30,803,000	1,026,800	1,252,000	212,000
December	33,111,000	1,068,100	1,416,000	931,000
Averages for 1999		**1,047,550**	**1,465,416**	**641,166**

Total 4-12
Monthly Production Data for 2000

Month	Total Water Treated (gallons per month)	Average Water Treated (gpd)	Maximum Water Treated (gpd)	Minimum Water Treated (gpd)
January	32,410,000	1,045,500	1,193,000	897,000
February	30,379,000	1,047,600	1,259,000	920,000
March	29,794,000	961,100	1,108,000	0
April	31,543,000	1,051,400	1,191,000	945,000
May	32,606,000	1,051,800	1,200,000	416,000
Averages for 2000		**1,031,480**	**1,190,200**	**635,600**

Table 4-13
Flow Rate Records, August 1997 through May 2000

Flow Range	# Days in Range	% Operational Time in Range
< 0.8 MGD	50	5%
0.8-0.899 MGD	37	4%
0.9-0.999 MGD	174	17%
1.0-1.099 MGD	511	50%
1.1-1.199 MGD	210	20%
>1.2 MGD	46	4%
Total Days Operational Since August 1997	**1,028**	**100%**

Since 1994, Water Plant #2 wells have been shut down once, from July 24th to August 15, 1996, for maintenance; the total shut-down period was approximately 22 days. Typically, production is never halted more than 1 day at any one time, and the downtime is usually less than a full day due to the Town's water demands

4.5.3 Groundwater Monitoring Program/Effectiveness Monitoring

Groundwater samples have been collected from MW-60 and MW-62 every quarter since their completion. Results of sampling indicate no traces of TCE in either well. The absence of contamination at MW-60 and 62 indicate that capture is maintained at the current pumping rate, shared by the two production wells.

The Water Plant #2 treatment system continues to effectively treat groundwater from the production wells. TCE concentrations in both municipal wells have increased since quarterly monitoring began in 1995, an indication that the containment system is actively drawing the contaminant plume. Peak concentrations were quantified onSite during the pre-RI and RI actions (1988 through 1992). Travel times for TCE in groundwater are expected to be variable given aquifer heterogeneities, but are estimated to be in the range of 10 to 15 years.[3] Therefore, current concentration increases at Water Plant #2 are consistent with shallow groundwater (peak) concentrations below the MPA in the late 1980s and early 1990s.

Source area actions were begun at the MPA in 1995. Groundwater monitoring, reinitiated at MW-31 at the same time, indicated significant decreases in groundwater concentrations since the RI (completed in 1992). Therefore, it is reasonable to expect that concentrations will rise and peak at Water Plant #2 sometime during the next five to ten years, and then start to decline as cleaner groundwater (resulting from source control actions at the MPA) reaches the municipal well field. Mass removal rates at Water Plant #2, therefore, are expected to increase as the main body of the plume beneath the CAC plant is pulled toward Water Plant #2 over the next several years.

It is important to note, however, that heterogeneities in the Memphis Sand aquifer may draw out the peak, and concentrations may not approach MCLs for a long period of time. TCE is expected to remain as residual contamination in the shallower, finer grained portions of the aquifer. These finer grained sediments are likely to be less transmissive than the main Memphis Sand aquifer, and therefore will likely yield less water to the groundwater extraction system than the main producing zone. Once peak concentrations diminish, therefore, it is

[3] Travel times to Water Plant #2 modeled using advective groundwater transport were in the 15-year range; however, contaminants were first detected at Water Plant #2 six to seven years after the first spill. Changes in grain size within the Memphis Sand aquifer are expected to contribute to this variability. It is expected, therefore, that actual transport times are variable, in the 10 to 15 year range.

likely that contamination will diffuse at low levels into the higher transmissivity sands for a long period of time.

4.5.4 Water Plant #2 Performance/Conclusions

The municipal wells are providing adequate containment for the TCE plume, as evidenced by the increasing contaminant concentrations in Water Plant #2 raw water, and the absence of TCE in downgradient monitoring points. Modeling performed in 1994 and 1996 reinforced this conclusion. The increased water demand in the Town of Collierville, as evidenced by the increased daily and peak flow rates, suggests that the composite capture zone developed by the municipal wells will only grow larger.

5.0 INTERVIEWS/DOCUMENT REVIEW/ARAR REVIEW

In accordance with the Draft Five Year Review Guidance, the following activities were performed:

- Interviews of personnel involved in the Carrier project were conducted during June and July 2000.

- Document reviews were performed to acquire background information.

- ARARs were reviewed to determine if any changes had occurred since 1992.

5.1 Interviews

Five interviews were conducted during the five-year review:

- The Town of Collierville's Public Utilities Director
- The Town of Collierville's Planning and Development Department
- TDEC's Division of Superfund Project Manager
- USEPA Region IV's Remedial Project Manager (RPM)
- Carrier's Collierville Plant Manager

5.1.1 Town of Collierville's Utilities Director

Mr. Tim Overly, the Town of Collierville's Public Utilities Director, was interviewed by telephone on June 13, 2000. The Town of Collierville is responsible for ongoing operation and maintenance at Water Plant #2, and Mr. Overly was interviewed to identify any questions or concerns which may have arisen since system startup.

The overriding concern identified during the interview was that the Town has experienced turnover at both the administrative and maintenance levels. Personnel were not familiar with

the air stripper design, maintenance requirements at Water Plant #2, or the division of maintenance responsibilities. Mr. Overly indicated that more communication between Carrier, EnSafe, and the Town would be helpful in resolving this issue.

Over the long term, Mr. Overly expressed concerns regarding the Town's need to expand the capacity of Water Plant #2. He was aware of the Town's agreement to extract an average of 1 MGD from Water Plant #2, and stated that he may actually need to increase the volume of water extracted at this location to meet increasing usage demands. He indicated that the Town's ability to increase capacity at this location may be limited by the size of the air stripper; more information regarding the air stripper would help him evaluate future options.

Mr. Overly was not aware of any community concerns regarding the water treatment system at Water Plant #2, and indicated that there had been no inquiry at his office regarding the Site since 1997, when he was first employed by the Town.

Mr. Overly provided daily well production records for 1997 through May 2000. These are enclosed as Appendix C.

5.1.2 Town of Collierville's Planning and Development Department

On June 14, 2000 Mr. Jim Atkinson, with the Town of Collierville's Planning and Development department, was contacted by telephone to determine current and future land use plans for the Byhalia Road area near the Carrier facility.

Mr. Atkinson indicated that the current zoning for the property is GI, general industrial; the future land use map (e.g., long-range planning) indicated that use in the Byhalia Road area would remain general industrial or general commercial.

Mr. Atkinson provided a map showing zoning in the area. This map has been digitized and is shown as Figure 5-1.

5.1.3 USEPA Region IV RPM

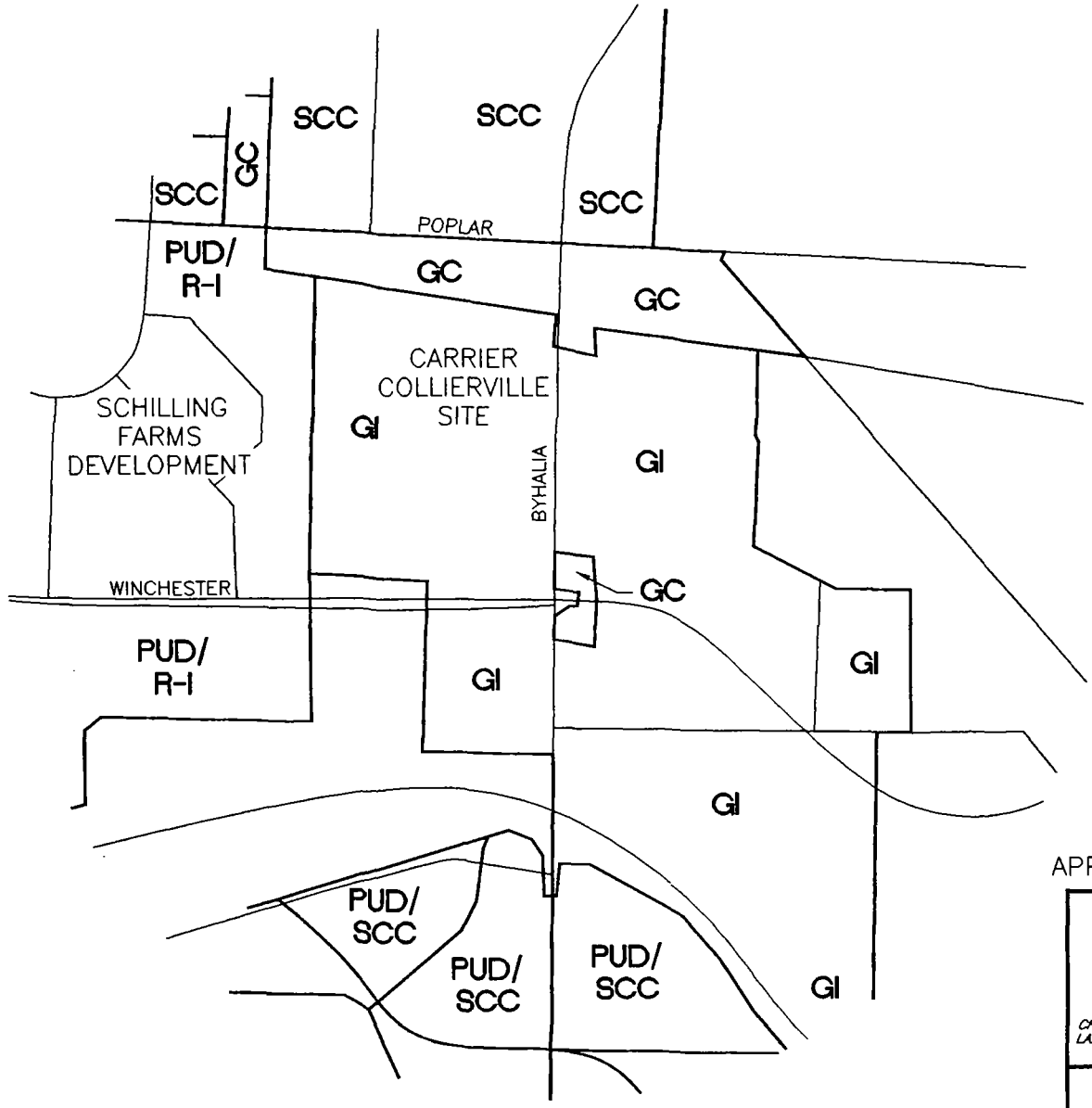
Ms. Beth Brown-Walden, USEPA's RPM for the CAC Site, was interviewed by telephone on June 23, 2000. Ms. Walden was interviewed to identify any USEPA concerns about the Site, as well as to determine if USEPA had been notified of any community concerns.

Ms. Brown-Walden was pleased with remedial operations at the Site, including reporting. She is unaware of any community issues regarding the Site, and has not been contacted by anyone in the community during her involvement with the project.

Ms. Brown-Walden indicated that the only issue she wanted to raise during the five-year review process was USEPA's interest in optimizing remediation performance, particularly with respect to groundwater contained by Water Plant #2.

5.1.4 TDEC Division of Superfund Project Manager

Mr. Jordan English, TDEC Division of Superfund, was interviewed on June 12th by telephone. Mr. English is manager of the Memphis Superfund office, and is responsible for monitoring progress at the Carrier Site.



LEGEND

GI – GENERAL INDUSTRIAL
GC – GENERAL COMMERCIAL
SCC – SHOPPING CENTER COMMERCIAL
PUD – PLANNED UNIT DEVELOPMENT
R-I – LOW DENSITY RESIDENTIAL

2300 0 2300

APPROX. SCALE FEET

SOURCE: OBTAINED FROM TOWN OF COLLIERVILLE

ENSAFE

(800) 588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC CINCINNATI,OH DALLAS,TX JACKSON,TN KNOXVILLE,TN
LANCASTER,PA NASHVILLE,TN NORFOLK,VA PADUCAH,KY PENSACOLA,FL
LITTLE ROCK,AR JACKSON,MS CLEVELAND,OH

FIGURE 5-1
LAND USE/ZONING NEAR
CARRIER COLLIERVILLE SITE
COLLIERVILLE, TENNESSEE

DWG DATE: 07/17/00 | DWG NAME: 3133G012

During the interview, Mr. English indicated that he is pleased with progress at the Carrier Site, and in fact uses the Site as an example when discussing Superfund issues with PRPs at other sites. He is satisfied with the level of reporting currently performed, and over the past five years has not fielded any concerns or complaints from area residents.

Two specific issues were identified by Mr. English:

- During first quarter 2000 sampling, elevated levels of lead and zinc were quantified in compliance monitoring well MW-31. Mr. English is concerned that this indicates a lead and zinc problem onSite. We discussed several responses, including evaluating low flow purging options, field-filtering samples, and evaluating historical data to determine any connection with water level and turbidity fluctuations.

- How timely is monitoring data collected at Water Plant #2, and how responsive is the current monitoring plan in evaluating a potential exceedance at the air stripper's effluent? Mr. English is concerned that the current monitoring program may not be effective at protecting the nearest residences/businesses in the event of non-compliance.

These two issues were subsequently discussed with Ms. Brown-Walden. She concurs with the approaches discussed with Mr. English regarding further assessment at MW-31. However, she does not believe there is any reason for concern regarding the monitoring frequency at Water Plant #2. Ms. Brown-Walden indicated that the protectiveness of the monitoring system was evaluated before it was implemented, and the system was approved as adequate.[4] Changes

[4] The monitoring program in-place at the Site was developed using the data quality objective (DQO) process, in which it was determined that quarterly sampling was more than adequate to detect trends in extracted groundwater. Treatment effectiveness does not deteriorate sharply, except in the case of catastrophic failures (e.g., blower failure) which are monitored by the process control system. Catastrophic failures immediately trigger system shutdown and prevent distribution of untreated groundwater.

within the Memphis Sand aquifer are not expected to be sudden; rather, data can be used predict trends over the long term.[5]

5.1.5 Carrier's Collierville Plant Manager

Mr. Frank Sizemore, plant manager at Carrier's Collierville facility, was contacted on July 17, 2000, and interviewed by telephone. Mr. Sizemore indicated that he has been at the plant for three years, and has not received any complaints about the remediation systems onSite during that time. He stated that he has no overriding concerns regarding operation of the systems; in fact, various facility workers have inquired when the systems will be shut down.

His role in the remediation process consists of managing any hazardous material generated from the NRS or MPA areas including (but not limited to) spent activated carbon, water treatment and disposal, and soil residuals. Mr. Sizemore indicated that since he arrived at the plant, groundwater from the MPA has been treated and discharged using the facility's pretreatment system in compliance with its Town of Collierville sewer use permit. Small quantities of VOCs are permitted in the wastewater discharge in this permit.

In addition, Mr. Sizemore and his staff provide daily oversight for the remediation systems, and contact EnSafe for O&M services in the event of system shutdown.

Mr. Sizemore identified two changes in plant permitting which have occurred during the last five years. The first, which has already been discussed, is that all air discharges are currently permitted under the Title V process; the facility received its Title V permit in June 1998. Under the Title V program, all emissions sources at the facility have been identified under a single permit, replacing older, point-source permits. Mr. Sizemore indicated that the Title V

[5] Once water is discharged from the air stripper, it passes through the Town of Collierville's aerator to a chlorination system and finally the storage tank. Thus, additional aeration capacity is available in the Town's treatment system which is not included in the actual remedial design. It is therefore highly unlikely that small exceedances of the MCL will occur at the tap of an end user following distribution through the Town's water supply system.

permit may not be renewed upon its expiration in June 2003, given the facility's goal of reducing volatile emissions such that it is no longer considered a major source.

The second change in permitting was that the facility's NPDES permit expired in 1999. This permit was not renewed as Carrier identified no current discharges to the Nonconnah Creek, and had no future plans to discharge under the permit.

Mr. Sizemore identified two areas in which reporting could be improved:

- Under the Title V program, he is required to report air discharges twice a year; he has requested more frequent documentation of emissions rates from the NRS and MPA, so that he can report contributions from the remediation systems in a more timely manner.

- He provides environmental compliance training services annually to Carrier employees, and he has requested that a presentation on the CERCLA program and the Site's remediation status be included in his annual training.

Other than these two issues, Mr. Sizemore indicated that he was satisfied with the remediation systems and the reporting structure currently used.

5.2 Document Review

The following documents generated since the 1992 ROD was issued were reviewed for Site history and remediation data:

- *Carrier Air Conditioning Superfund Site Record of Decision* (USEPA, September 9, 1992)

- *East Well Aquifer Pumping Test Report, Collierville Municipal Well Field* (EnSafe, December 14, 1992)
- *Carrier Collierville Site Remedial Design Work Plan* (EnSafe, April 11, 1994)
- *Prefinal/Final Design Soil Vapor Extraction, Carrier Collierville Site Main Plant Area* (EnSafe, July 29, 1994)
- *Groundwater Remedy Design* (EnSafe, August 25, 1994)
- *Final Design Soil Vapor Extraction, Carrier Collierville Site Main Plant Area* (EnSafe, September 22, 1994)
- *Technical Memorandum, Site Downgradient Monitoring Well Data Quality Assessment* (EnSafe, October 18, 1994)
- *Operation and Maintenance Plan Soil Vapor Extraction, Carrier Collierville Site Main Plant Area* (EnSafe, May 11, 1995)
- *Final Construction Inspection Report, Main Plant Area SVE* (EnSafe, June 13, 1995)
- *Preliminary Close Out Report* (USEPA Region 4, October 31, 1995)
-
- *Fourth-Quarter 1995 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, February 12, 1996)
- *First-Quarter 1996 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, April 29, 1996)

- *Second-Quarter 1996 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, August 26, 1996)

- *Third-Quarter 1996 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, October 31, 1996)

- *Technical Memorandum, North Remediation Site Confirmation Soil Borings* (EnSafe, January 20, 1997)

- *Fourth-Quarter 1996 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, January 27, 1997)

- *Memorandum, Carrier Collierville Verification Modeling* (EnSafe, March 12, 1997)

- *First-Quarter 1997 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, May 21, 1997)

- *Second-Quarter 1997 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, August 18, 1997)

- *Third-Quarter 1997 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, November 20, 1997)

- *Fourth-Quarter 1997 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, March 12, 1998)

- Correspondence from Craig Wise, EnSafe Inc., to Beth Brown, USEPA, April 17, 1998; Subject: Monitoring Well Closures

- *First-Quarter 1998 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, June 1, 1998)

- *1994-1995 Progress Reports, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, June 1, 1998)

- *Second-Quarter 1998 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, August 15, 1998)

- *Third-Quarter 1998 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, November 24, 1998)

- *Fourth-Quarter 1998 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, February 28, 1999) *First-Quarter 1996 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, April 29, 1996)

- *First-Quarter 1999 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, May 6, 1999)

- *Second-Quarter 1999 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, July 29, 1999)
- *Third-Quarter 1999 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, December 7, 1999)

- *Fourth-Quarter 1999 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, February 9, 2000)

- *First-Quarter 2000 Progress Report, Carrier Air Conditioning Collierville, Tennessee* (EnSafe, May 4, 2000)

These documents, in addition the final RI (EnSafe, March 27, 1992) and FS (EnSafe, March 31, 1992) were the primary sources for data evaluated in this report.

5.3 ARAR Review

ARARs identified in the ROD were reviewed to determine if changes made since 1992 (if any) call into question the protectiveness of the remedy. The ROD identifies the following regulations as ARARs at the CAC Site:

- Safe Drinking Water Act (SDWA), 40 CFR 141.50, 141.63, 141.80, and 143.3
- Clean Water Act (CWA), 40 CFR Parts 122, 125, 129, 133, 136, 230, 403.5,
- Clean Air Act (CAA) 40 CFR Parts 50, 60, 61
- Tennessee Water Quality Control Act (69-3-101)
- RCRA 40 CFR Parts 260 through 270
- Fish and Wildlife Coordination Act, 16 USC 661 et seq.
- OSHA, 29 CFR 1910
- EPA Groundwater Protection Strategy (USEPA 1984)
- Town of Collierville Municipal Code of Ordinances 10-230
- Shelby County Well Construction Codes, Sections 4 and 5
- Executive Order 11990 Wetlands Protection Policy
- Executive Order 11988 Floodplain Management Policy

SDWA

Promulgated, chemical-specific standards used to develop groundwater RAOs were examined to determine the impact of changes to SDWA. None of the MCLs identified in SDWA have

changed since 1992; therefore, the ARARs used to develop RAOs still meet the protectiveness criterion.

CWA

CWA discharges are managed under Carrier's sewer use agreement with the Town of Collierville's Publicly Owned Treatment Works (POTW). All discharges to the POTW are made in compliance with the sewer use agreement and therefore are in compliance with CWA. Standards for discharge to waters of the state (e.g., NPDES effluent limitations), dredge and fill activities, etc. are not applicable to remedial actions as implemented onSite.

CAA

In 1996, all air permits at the CAC plant were consolidated under the Title V program, as required by 40 CFR 70. The remediation systems at the Site are all identified in the facility's Title V permit as insignificant sources for VOCs, and typically emit less than 1 lb/day TCE. Therefore, changes to the CAA do not impact the protectiveness of this remedy.

RCRA

Carrier's waste management and disposal practices associated with the remediation systems have been in accordance with RCRA; changes to RCRA have no impact on the protectiveness of the remediation systems.

OSHA

All personnel working with the SVE systems are required to have OSHA training. Changes to OSHA have been integrated, where applicable, to affected Site employees and contractors. These changes do not affect the protectiveness of the remediation system.

EPA Groundwater Protection Strategy

USEPA's groundwater protection strategy has evolved significantly since 1984, as technical information regarding fate and transport properties of chlorinated solvents has improved.

However, the mass reduction and groundwater containment strategy applied at the CAC Site is consistent with the state-of-the-art. Cleanup data demonstrate this strategy is effective.

The following ARARs and TBCs identified in the ROD have no impact on the protectiveness of the Site remedy as implemented: Tennessee Water Quality Control Act, Fish and Wildlife Coordination Act, Town of Collierville Municipal Code of Ordinances, Shelby County Well Construction Codes, Executive Order 11990 (Wetlands Protection Policy), and Executive Order 11988 (Floodplain Management Policy).

6.0 ASSESSMENT

This section presents the results of the five-year review process, particularly with respect to three questions:

- Have conditions external to the remedy changed since the remedy was selected?
- Has the remedy been implemented in accordance with decision documents?
- Has any risk information changed since the remedy was selected?

6.1 Conditions External to the Remedy

The primary factors which are key to ROD implementation yet external to the remedy are changes in land use, exposure pathways, and Site conditions.

Land Use

Land use at the Site has been industrial since Carrier began operations. All surrounding land has been zoned by the Town of Collierville as general industrial or general commercial. Future land use in this area is expected to remain industrial.

Pathways

Exposure pathways at the Site are the same as those identified in the initial RI/FS process: dermal contact and ingestion of surface soil, and domestic use of groundwater. However, domestic consumption of TCE-contaminated groundwater has been eliminated as a pathway through treatment at Water Plant #2. These pathways are not expected to change in the future.

Site Conditions

Some development has occurred adjacent to the Carrier Site due to roadway improvements on Byhalia Road, and construction of Winchester Road along the southern perimeter of the

property. However, physical conditions on the property — and most importantly in the impacted areas — remain the same.

Site hydraulic concerns were evaluated in 1994 and again in 1996/1997. Conclusions regarding groundwater hydrogeology and the subsequent effectiveness of Water Plant #2 as a containment system are consistent with previous data. No changes are anticipated.

6.2 Remedy Implementation and System Operations

Remedy implementation and system operations evaluated during this five-year review were deemed to be in accordance with the ROD and on-track for meeting Site remedial goals.

Site Controls

Site controls are adequate. Fencing and limited access to remediation areas (the most highly contaminated areas onSite) prevent unauthorized contact with contaminated media. Zoning restrictions in the Town of Collierville indicate that future land use will be consistent with ROD cleanup standards.

Remedy Performance

As discussed in previous sections, treatment systems onSite are functioning as designed. Since system modifications were made in 1996, mass removal at the NRS area have been decreasing steadily. Mass removal rates at the MPA have also been tailing off since 1996. Over 14,000 lbs TCE have been removed from the CAC Site since system installation. Moreover, sampling performed during 1995/1996 indicated that only one small area at NRS exceeded the TCE soil cleanup criterion. Soil addressed by the MPA system has not been sampled to date.

Decreases in TCE concentrations in MW-31 since the RI indicate that mass contributions to the Memphis Sand from shallow groundwater have been significantly reduced, by at least one order-of-magnitude, since the RI.

The treatment system at Water Plant #2 is functioning as designed; TCE is being removed to concentrations below the MCL by the air stripper system. Data show mass removal rates are increasing, due to both the increasing contaminant concentrations and the increasing flow rates quantified at Water Plant #2. The municipal wells are providing complete containment for the TCE plume, as evidenced by the absence of TCE in downgradient monitoring points.

Adequacy of System O&M

The five-year review indicated that O&M for the NRS and MPA are adequate at the Site. O&M requirements at Water Plant #2 need to be discussed with the Town of Collierville to ensure responsibilities are clearly defined.

Optimization — SVE Systems

System optimization at the NRS and MPA have been an integral part of operations, and documented by the system modifications made since startup. At the NRS, sampling proposed for late 2000 will provide information as to whether the 0.533 mg/kg goal has been achieved given operational changes since 1996, the last sampling event. If the RAO has been achieved, remedial actions in the NRS will be terminated.

Sampling conducted in the MPA area during late 2000 will be used to target vapor extraction efforts on recalcitrant zones, including valving off less-contaminated areas and enhancing recovery through shallow-zone venting. Optimization based on current soil data is expected to enhance mass recovery in this area.

Optimization — Water Plant #2 and Containment System

The hydraulics of the containment system at Water Plant #2 have been evaluated twice since the installation of the treatment system in 1990. Data indicate that containment is achieved under the operating conditions that have been in place since the early 1990s. Mass removal rates are increasing due to increasing contaminant concentrations in raw water. These increasing concentrations are likely indicative of peak contamination that has migrated from the source area since the late 1980s and early 1990s, when shallow groundwater TCE concentrations were at the highest levels.

Peak concentrations are anticipated at the Water Plant #2 wellheads for several years, given initial concentrations near the source area. However, given that source area actions were initiated during 1995, and source area groundwater concentrations had already started to decline during 1994/1995, it is reasonable to expect that concentrations will rise and peak at Water Plant #2 sometime during the next five to ten years, and then start to decline as cleaner groundwater (resulting from source control actions at the MPA) reaches the municipal well field.

Once peak concentrations attenuate, however, groundwater conditions are expected to be diffusion limited (i.e., limited by mass transfer from the aquifer matrix into groundwater). Residual mass in groundwater is expected to be concentrated in finer-grained, less transmissive sediments at the top of the Memphis Sand aquifer. Mass transfer rates, therefore, will vary with aquifer heterogeneities, and TCE flushing from beneath the former source areas will require a long period of time.

Current production data indicate that Water Plant #2 is operating at or near capacity, with average pumping rates of 1.1 MGD and a maximum design extraction rate of 1.4 MGD. If the Town increases production capacity significantly, the containment system's total mass removal

at Water Plant #2 will increase. Increasing mass removal by installation of another well at Water Plant #2, for example, may shorten overall travel times from the source area to the Town wells; the actual travel times will depend on the well location. Over the long term, however, once concentrations drop and contaminant transport is limited by diffusion, additional pumping will have little or no effect on mass removal.

Optimization of the groundwater remedy, therefore, is best accomplished by completing the source control action at the MPA, and eliminating future contributions to Memphis Sand groundwater.

Early Indicators of Potential Remedy Failure

No early indicators of potential remedy failure (e.g., equipment breakdowns) or changes in the scope of operations were identified.

O&M Costs

O&M costs have been low, and are expected to remain low. Costs are comparable to other sites using SVE and air stripping as remedial technologies.

7.0 DEFICIENCIES AND RECOMMENDATIONS

The following issues were identified during the five-year review and require attention. None affect protectiveness at the current time.

7.1 North Remediation System

Mass removal rates at the NRS area have decreased significantly since system startup: approximately 500 lbs of TCE have been removed since 1995, compared with over 11,000 pounds of TCE from 1989 through 1995. Although removal rates have increased during the past year due to the addition of a positive displacement blower, the previous confirmation sampling event in 1996 indicated that the majority of soil samples from the NRS area met the ROD cleanup goal of 0.533 mg/kg TCE. Carrier believes it is appropriate to sample soil concentrations in the NRS area to determine if operational enhancements made since 1996 have achieved the ROD goal.

Three maintenance items were noted during the system inspection:

- A hole in the fence and an insecure lock require repair and/or replacement.
- Sample ports at the shallow and deep manifold lines require replacement.
- If the air strippers are required for treatment of water at the NRS, the packing material should be inspected thoroughly and cleaned, if necessary, to remove any fouling/deposits.

7.2 Main Plant Area

USEPA and TDEC have indicated concern over elevated lead and zinc concentrations in MW-31. Both agencies, however, are amenable to a data review process before determining additional actions or changes to the sampling protocol at this location. Issues to be evaluated include:

- Sampling protocol and well stabilization parameters
- Contaminant trends versus water levels
- Inorganic trends at other monitoring locations

Mass removal rates at the MPA system have decreased significantly since system startup, and have begun to approach asymptotic levels multiple times. System enhancements or intermittent operation improved removal rates each time. The system is currently operating intermittently: it is shut down during wet, rainy periods and turned on during dry conditions to enhance mass recovery under diffusion-limited conditions. Carrier believes it is now appropriate to sample soil concentrations in the MPA area to determine if they meet the ROD goal of 0.533 mg/kg.

Two maintenance issues were noted at the MPA:

- Sludge has accumulated at the base of the moisture separator and should be removed and disposed of accordingly.

- The dilution air valve filter will require replacement following the scheduled change-out of carbon, which should occur during July.

In addition, given current removal rates from the MPA, it is possible that off-gas treatment using carbon adsorption is no longer required. Once soil data are evaluated, and system optimization is performed (if necessary), operations should be reviewed to determine if carbon treatment is still necessary.

7.3 Water Plant #2

Interviews with the Town of Collierville's Director of Public Utilities indicated a breakdown in communications between Carrier and the Town, particularly with respect to each party's

responsibilities regarding maintenance. Further coordination is required between these parties to ensure continued operation of Water Plant #2 in the most efficient manner.

The June 2000 system inspection indicated some algae fouling on air stripper packing material. To prevent any degradation in treatment capacity, packing material should be inspected and cleaned, if necessary. Additionally, the pressure drop across the columns and other performance indicators should be monitored on a regular basis by the Town of Collierville's maintenance department for gradual changes in performance.

7.4 Recommendations for the CAC Site

Table 7-1 summarizes recommendations and required actions identified during this five-year review process.

7.5 Next Review

The next policy review for the CAC Site will be required in 2005, five years from the completion date (e.g., signature date) of this five-year review report.

Table 7-1
Recommendations and Required Actions

Recommendations	Party Responsible	Oversight Agency	Milestone Date	Currently Affects Protectiveness
NRS System				
Collect soil borings to evaluate system effectiveness and determine if shutdown is viable	Carrier	USEPA/ TDEC	Sampling by October 31, 2000; Report by December 31, 2000	No
Repair fencing and locks	Carrier	USEPA/ TDEC	August 31, 2000	No
Replace sample ports at shallow and deep manifold lines	Carrier	USEPA/ TDEC	During next maintenance activity	No
Clean air stripper packing material	Carrier	USEPA/ TDEC	If the water portion of the treatment system is turned on	No
MPA System				

Table 7-1
Recommendations and Required Actions

Recommendations	Party Responsible	Oversight Agency	Milestone Date	Currently Affects Protectiveness
NRS System				
Evaluation of inorganics concentrations at MW-31, with recommendations for sampling protocol	Carrier	USEPA/ TDEC	August 31st, or before 3rd Quarter Sampling Event	No
Collect soil borings to determine system effectiveness and determine if shutdown is viable	Carrier	USEPA/ TDEC	Sampling by October 31, 2000; Report by December 31, 2000	No
Sludge removal from moisture separator	Carrier	USEPA/ TDEC	August 31, 2000	No
Replacement of dilution air valve filter	Carrier	USEPA/ TDEC	August 31, 2000	No
Evaluate need for carbon treatment of off-gas	Carrier	USEPA/ TDEC	December 31, 2000	No
Water Plant #2				
Coordinate meeting with Town of Collierville to discuss Water Plant #2	Carrier	USEPA/ TDEC	Meeting by August 31, 2000	No
Inspect air stripper packing material at Water Plant #2 and re-establish operations monitoring system for Town employees	Carrier	USEPA/ TDEC	Meeting by August 31, 2000	No

8.0 PROTECTIVENESS STATEMENT

The remedies implemented at the MPA, NRS, and Water Plant #2 at the Carrier facility are protective of human health and the environment. Results of the five-year review indicate that:

- Mass removal at the two SVE treatment areas is ongoing, and significant mass reduction has occurred since the systems were installed.

- Concentrations in MW-31 are decreasing, indicating the MPA system is effective at mass removal and that mass contributions to the Memphis Sand aquifer are decreasing accordingly.

- TCE concentrations at Water Plant #2 are increasing, indicating that the wells are drawing in contaminants formerly beneath the Main Plant.

- Groundwater extraction rates are being maintained at levels sufficient to contain the TCE plume. Moreover, the Town of has indicated that increased demand requires additional pumping from Water Plant #2, as evidenced by higher peak flows (5% of all daily flows are greater than 1.2 MGD).

Conditions at the Site are not expected to change in the near future, given the area's land use (industrial/commercial) and zoning controls currently in place. Access controls and surface conditions (e.g., pavement in the MPA area) are adequate to prevent exposure.

Appendix A

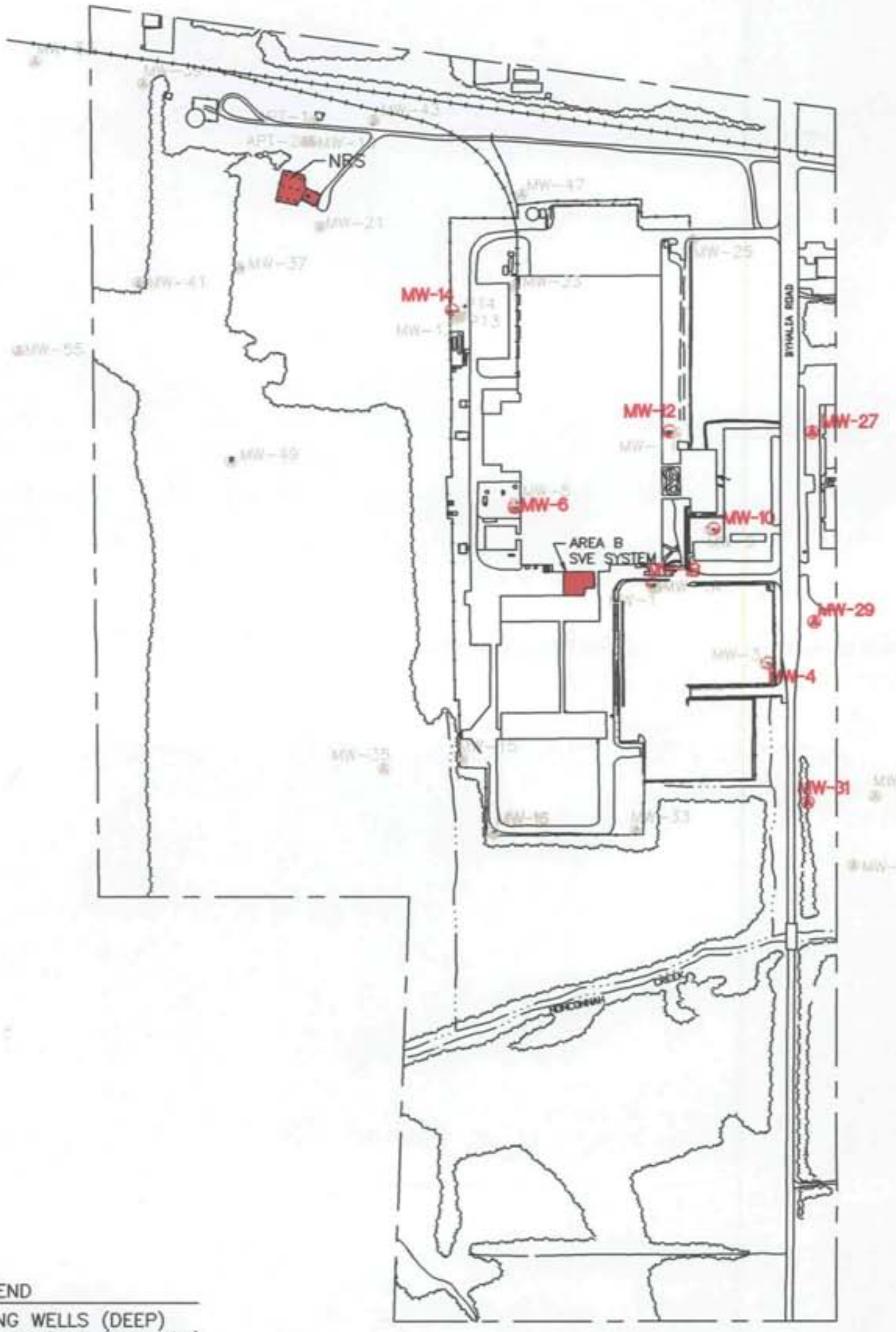
Abandoned Well Information

Table 2-1
Monitoring Wells Abandoned during 1997 and 1998

Well	Location	Well	Location
APT-1	Onsite	MW-35	Onsite
APT-2	Onsite	MW-37	Onsite
PZ-1	Onsite	MW-43	Onsite
PZ-2	Onsite	MW-47	Onsite
PZ-3	Onsite	MW-49	Onsite
PZ-4	Onsite	Pilot Test "Area A" SVE Wells (8)	Onsite
MW-1	Onsite	Pilot Test "Area C" SVE Wells (10)	Onsite
MW-1A	Onsite	MW-57	Burch Property
MW-3	Onsite	MW-58	Burch Property
MW-5	Onsite	MW-39	Schilling Farm
MW-9	Onsite	MW-41	Schilling Farm
MW-11	Onsite	MW-51	Schilling Farm
MW-13	Onsite	MW-53	Schilling Farm
MW-15	Onsite	MW-55	Schilling Farm
MW-16	Onsite	MW-59	Offsite – East
MW-21	Onsite	MW-61	Offsite – East
MW-23	Onsite	CMW-001	City of Collierville Property
MW-25	Onsite	CMW-002	City of Collierville Property
MW-33	Onsite	CMW-003	City of Collierville Property

Table 2-2
Monitoring Wells Remaining at Carrier Site

Well	Location	Well	Location
MW-1B	Onsite	MW-27	Offsite – East
MW-4	Onsite	MW-29	Offsite – East
MW-6	Onsite	MW-31	Offsite – East
MW-10	Onsite	MW-60	Offsite – North
MW-12	Onsite	MW-62	Offsite – North
MW-14	Onsite	NRS (9 SVE wells)	Onsite
MW-27	Onsite	MPA (7 SVE wells)	Onsite



LEGEND

- ● – MONITORING WELLS (DEEP)
- ● – MONITORING WELLS (SHALLOW)
- MW-62 – MONITORING WELL NUMBER

NOTES:
WELLS/REMEDIATION WELLS SHOWN IN RED ARE ACTIVE. ALL OTHER WELLS (GRAY) ARE ABANDONED.

400 0 400

SCALE FEET

ENSAFE

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LANCASTER,PA NASHVILLE,TN NORFOLK,VA PADUCAH,KY PENSACOLA,FL
RALEIGH,NC COLOGNE, GERMANY

ACTIVE MONITORING AND REMEDIAL WELLS
CARRIER CORP., COLLIERVILLE

DWG DATE: 07/31/00 | DWG NAME: 2106B002

Appendix B

Review of Human Health Baseline Risk Assessment

Appendix B

Review of Human Health Baseline Risk Assessment

In accordance with the five-year review guidance, the original Human Health Baseline Risk Assessment (BRA) prepared for the Carrier Collierville Site was reviewed to evaluate basic assumptions regarding risk to human health and determine if any assumptions have changed. Current USEPA Region IV guidance was considered during this evaluation. The remedial investigation assumed no risks due to ecological considerations, as the Site is an operating industrial facility.

Because the major site chemical of concern (COC) was trichloroethene (TCE), this was used as a screening-level indicator to assess changes in risk guidance. Because current and projected future use of the site is industrial, the review focuses on this exposure scenario.

Intake Parameters

Several intake parameters used to calculate chronic daily intakes (CDIs) have changed since the initial BRA.

For the surface area (SA) of skin exposed to contaminated soil, the original report used a value of 2,300 cm^2 for the adult worker. Current guidance bases the SA on the 90^{th} percentile areas of the head, hands, and forearms of an adult male, obtained from the U.S. EPA Exposure Factors Handbook, and assumes the individual is clothed with shoes, long pants, and short sleeves. Thus, a SA of 4,100 cm^2 is currently used to assess site worker dermal exposure. The increase in SA would increase the CDI.

For exposure duration (ED), the original report used an ED of 20 years. U.S. EPA Region IV guidance recommends an ED of 25 years. As a result, the CDI would be expected to increase due to the increased ED.

For the soil-to-skin adherence factor (AF), the original report used a value of 2 mg/cm^2. This is an overly conservative value: recent Region IV guidance recommends 1 mg/cm^2 for evaluation of reasonable maximum exposure (RME) intake calculations. Further adjustment of the AF is possible, but was not considered here. U.S. EPA (1992), *Dermal Exposure Assessment: Principles and Applications – Interim Report*, ORD, EPA/600/8.91/011B, recommends an AF of 0.2 mg/cm^2 as a reasonable central estimate. Reductions in the AF directly reduce dermal risk.

Alternative Exposure Scenarios

While future residential land use is an unlikely scenario at the Carrier Collierville site, it is possible that other exposure scenarios typical of an industrial facility would be considered under new guidance. For example, a construction or utility worker scenario might be considered if subsurface work were required in contaminated areas. This evaluation did not assess alternative, short-term exposure scenarios.

Inhalation

The inhalation pathway was not considered during the initial 1992 risk assessment given the widespread occurrence of pavement across the site. Foundations and asphalt/concrete are assumed to be barrier layers preventing exposure. Inhalation risks were not estimated for this site given that the contaminated area is located in the central, active portion of the manufacturing facility and that soil is not expected to be exposed. Under current guidance, it is likely that exposures due to inhalation would only be considered when the concrete is removed (e.g., during a short term maintenance/utility repair event).

Toxicity Factors

The ingestion carcinogenic toxicity factor (SF) for TCE did not change from the value used in the original report; i.e., SF = 1.1E-02 $(mg/kg\text{-}day)^{-1}$. Therefore, no changes would be expected due to the ingestion SF. The SF used for dermal contact is not clear from the original report. For purposes of this review, a default dermal SF of 7.33E-02 $(mg/kg\text{-}day)^{-1}$ was calculated by dividing the oral (ingestion) SF by an absorption factor.

Noncarcinogenic toxicity factors (reference doses, RfDs) were not available for TCE when the original report was written. The current oral RfD was obtained from the U.S. EPA, Region III Risk-Based Concentration Table and the default dermal RfD was obtained by multiplying the oral RfD by an absorption factor.

Exposure Point Concentration

For the exposure point concentration (EPC) term, the original report used a soil concentration of 35 mg/kg, which was the mean concentration of surface soil samples from 0- to 5-feet below ground surface. Region IV guidance requires the use of the 95% UCL or the maximum detected concentration if the 95% UCL exceeds the maximum detected concentration. It can reasonably be expected that the 95% UCL would be much higher than the value of 35 mg/kg used in the original report, thus increasing the total risk posed to site workers.

To evaluate the maximum risk posed to site workers, it was assumed that the concentration term would be equal to the maximum detected concentration of TCE in surface soil of 250 mg/kg.

Lead Evaluation

It is important to note that the lead analysis performed during the BRA compared site concentrations assuming a hazard index (HI). However, current methodology evaluates the 95% UCL (or maximum) lead concentrations using screening values (400 mg/kg for residential scenarios, 900 mg/kg for industrial scenarios). Lead can therefore be eliminated from the COC list as its maximum concentration is less than 400 mg/kg; no additional assessment would be required under current guidance.

TCE Risk Summary

To evaluate the effect of changes in intake parameters and toxicity values, the same EPC used in the original report, 35 mg/kg, was used to calculate the CDI. The calculated CDI was then used in conjunction with current TCE toxicity values to estimate risk. Input parameters are shown in Table 1, at the end of this appendix.

The estimated incremental lifetime cancer risk (ILCR) to the site worker due to oral and dermal exposures from TCE exposure increased from an ILCR of 1.0E-07 in the original report to an ILCR of 4.7E-07 using recent guidance and toxicity values. These values are well within USEPA allowable risk range of 1E-06 to 1E-04.

As noted above, noncarcinogenic risk due to TCE was not considered during the original BRA. Using currently available RfDs for TCE results in an estimated noncarcinogenic risk of 0.02, below the USEPA's generally acceptable risk level of 0.1 for the noncarcinogenic risk contribution of a single chemical.

If the EPC used for risk estimates was increased to 250 mg/kg, the maximum detection onsite, noncarcinogenic risk to the site worker (sum of ingestion and dermal contact pathways) would increase from 0.023 to 0.131, and carcinogenic risk would increase from an ILCR of 4E-07 to an ILCR of 3E-06.

Risk and hazard estimates for the 35 mg/kg and 250 mg/kg scenarios are summarized in Table 2, at the end of this appendix.

Summary of Findings

Due to advancements in risk assessment methodology since the BRA was developed, several factors used in assessing risks due to TCE have been changed, including:

- Three intake parameters used to calculate the CDI for the dermal contact exposure pathway were altered from values used in the original report. Two of these, SA and ED, were adjusted upwards resulting in higher CDIs. The other, AF, was adjusted downwards, resulting in a lower CDI. Carcinogenic risk and noncancer toxicity, therefore, would likely increase overall due to the more conservative assumptions now used.
- Oral and dermal RfDs for calculating noncarcinogenic risk from TCE exposure were not available at the time of the original report and are now available. HI contributions would therefore increase if the BRA was performed today.

- The method used for calculating the concentration term in the original report is not consistent with current Region IV guidance. The acceptable method is to use either the maximum detected concentration or 95% UCL. In either case, the new concentration term would be much higher than the value used for TCE in the original report. Again, the site risk posed by TCE would likely increase.

If a new BRA were performed, the overall effect of using current USEPA Region IV guidance is that both carcinogenic and noncarcinogenic risk estimates would be increased. While TCE was used as an example for the above assessment, this logic can be extended to other site COCs: risks contributed by DCE, PCE, etc. will also change. It is expected that the oral and dermal site risk under an industrial scenario would be increased by roughly one order of magnitude, still within the range of 1E-06 to 1E-04, the allowable risk range established by USEPA. However, given that 85% of the risk is contributed by the dermal pathway, it is possible that the increases may be limited given that the adherence factor (AF) may be decreased if site-specific considerations are evaluated.

The inhalation pathway, which was not included in the 1992 BRA as impacted areas were beneath asphalt and concrete, may be evaluated under new risk assessment guidelines for specific exposure scenarios (e.g., short term maintenance or utility worker exposures). It is likely that the consideration of the inhalation pathway would increase overall site risks; however, this five-year review analysis of risk parameters did not calculate the actual increases.

TABLE 1
PATHWAY PARAMETERS USED TO ESTIMATE CDI FOR SOIL INGESTION AND DERMAL CONTACT
COLLIERVILLE, TENNESSEE

	Site Worker	Units
Ingestion Rate Soil (IRsoil)	50 (a)	mg/day
Fraction Ingested (FI)	1 (b)	unitless
Absorption Factor (ABS)	0.01 (b)	unitless
Exposure Frequency (EF)	250 (b)	events/year
Exposure Duration (ED)	25 (b)	years
Skin Surface Area Available for Contact (SA)	4100 (c)	cm^2/event
Soil to Skin Adherence Factor (AF)	1 (d)	mg/cm^2
Conversion Factor	1.00E-06	kg/mg
Body Weight (BW)	70 (e)	kg
Averaging Time (AT)		
Noncancer	9,125 (f)	days
Cancer	25,550 (g)	days

(a) Based on USEPA's central estimate of adult soil ingestion in industrial settings of 50 mg/day (USEPA 1997).

(b) Recommended by U.S. EPA Region IV. Supplemental Guidance to RAGS: Region IV Bulletin. Human Health Risk Assessment.

(c) Accounts for head, hands, and forearms at 90th percentile values for adult from Table 4B.1, Exposure Factors Handbook; assumes individual is clothed with shoes, long pants, and short sleeves; rounded up from 4,090 cm2.

(d) This value considered appropriate for evaluation of reasonable maximum exposure (RME) intake assumptions according to U.S. EPA Region IV guidance.

(e) USEPA (1989) Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A).

(f) Calculated as the product of exposure duration (years) x 365 days/year.

(g) Calculated as the product of 70 years (assumed lifetime) x 365 days per year.

TABLE 2
RISK SUMMARY

Medium	Exposure Pathway		EPC = 35 mg/kg Future Site Worker HQ	EPC = 35 mg/kg Future Site Worker ILCR	EPC = 250 mg/kg Future Site Worker HQ	EPC = 250 mg/kg Future Site Worker ILCR
Surface Soil	Ingestion	**VOCs**				
		TCE	0.003	7E-08	0.020	5E-07
	Dermal	**VOCs**				
		TCE	0.02	4E-07	0.11	3E-06
Surface Soil Pathway Sum			**0.37**	**5E-06**	**0.13**	**3E-06**

ILCR indicates incremental excess lifetime cancer risk.
HQ indicates hazard quotient

Appendix C

Town of Collierville, TN
Water Treatment Plant # 2
Monthly Operation Reports

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 0000126
NAME OF WATER TREATMENT PLANT #2 COUNTY Shelby
MONTH OF August 19 97

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS OR GALLONS USED	FREE RESIDUAL MG/L DIST. SYSTEM	POUNDS OR GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1237		18	1.0	70	1.02	1.0	18	24	5.6	8.4			8	D							
2	1245		18	1.0	71	1.03	1.0	18	24	5.6	8.4			8	D							
3	1181		16	1.0	67	1.02	1.0	18	24	5.6	8.4			9	D							
4	1267		18	1.0	73	1.04	1.0	18	24	5.6	8.5			9	D							
5	625		9	1.0	37	1.06	1.0	18	24	5.6	8.4			9	D							
6	1007		14	0.9	58	1.04	1.0	18	24	5.6	8.3			8	D							
7	1247		17	0.9	71	1.03	1.0	18	25	5.6	8.4			9	D							
8	1241		17	1.0	70	1.02	1.0	18	25	5.6	8.4			8	D							
9	1150		16	1.0	65	1.08	1.0	18	25	5.6	8.4			8	D							
10	1028		14	0.9	58	1.03	1.0	18	25	5.6	8.3			8	D							
11	1183		17	1.1	65	0.99	1.0	18	24	5.6	8.3			8	D							
12	1172		16	1.0	66	1.02	1.0	18	24	5.6	8.4			9	D							
13	1130		16	1.0	65	1.04	1.0	18	24	5.6	8.3			9	D							
	284		4	1.1	17	1.08	1.0	18	25	5.6	8.3			8	D							
	1046		15	1.0	58	1.0	1.0	18	24	5.6	8.3			8	D							
16	1102		16	1.0	69	1.03	1.0	18	24	5.6	8.4			9	D							
17	1295		17	1.0	70	1.02	1.0	18	24	5.6	8.3			8	D							
18	1233		18	1.1	71	1.04	1.0	18	24	5.6	8.3			9	D							
19	1158		16	1.0	65	1.01	1.0	18	25	5.6	8.4			9	D							
20	915		12	0.9	53	1.04	1.0	18	25	5.6	8.4			8	D							
21	1414		21	1.0	80	1.02	1.0	18	24	5.6	8.4			8	D							
22	1197		16	1.0	67	1.03	1.0	18	24	5.6	8.5			8	D							
23	1154		16	1.0	66	1.03	1.0	18	24	5.6	8.4			9	D							
24	1125		16	1.1	67	1.07	1.0	18	25	5.6	8.3			8	D							
25	1213		17	1.0	68	1.0	1.0	18	24	5.6	8.3			8	D							
26	1191		17	1.0	67	1.01	1.0	18	25	5.6	8.4			9	D							
27	1234		17	1.0	70	1.02	1.0	18	24	5.6	8.4			8	D							
28	1181		17	1.0	68	1.03	1.0	18	24	5.6	8.4			9	D							
29	1170		16	1.0	68	1.05	1.0	18	24	5.6	8.4			9	D							
30	1194		16	1.0	68	1.02	1.0	18	25	5.6	8.4			8	D							
31	1327		20	1.0	75	1.02	1.0	18	25	5.6	8.3			8	D							
TOTAL	35,092		493																			
AVE.	1,127		16	1.0		1.04	1.0	18	24	5.6	8.4			9	D							
MAX	1327		20	1.1		1.08	1.0	18	25	5.6	8.5			9	D							
MIN.	625		9	0.9		0.99	1.0	18	24	5.6	8.3			8	D							

REMARKS 9.16

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices, and other activities for the reporting period specified herein.

Certified Operator James T. Matthews
Certificate Number 000575

This form must be received by the appropriate field office by the 10th of the following

CN-0707

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 0000126

NAME OF WATER TREATMENT PLANT #2 COUNTY Shelby

MONTH OF Sept 19 97

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS OR [illegible] USED	FREE RESIDUAL MG/L DIST. SYSTEM	[illegible] GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1061	1	15	1.4	60	1.05	1.0	18	24	5.6	8.4			9	0							
2	1020		15	1.4	60	1.05	1.0	18	24	5.6	8.4			9	0							
3	1131		17	1.3	63	1.0	1.0	18	24	5.6	8.5			8	0							
4	1136		17	1.4	68	1.0	1.0	18	24	5.6	8.5			8	0							
5	1170		16	1.4	63	1.0	1.0	18	25	5.6	8.6			8	0							
6	1175		17	1.3	64	1.08	1.1	18	24	5.6	8.4			9	0							
7	1153		17	1.3	63	1.0	1.0	18	24	5.6	8.4			8	0							
8	1185		16	1.4	62	1.0	1.0	18	25	5.6	8.4			9	0							
9	1143		16	1.4	62	0.97	1.0	18	24	5.6	8.4			8	0							
10	1132		17	1.4	63	1.0	1.0	18	24	5.6	8.4			8	0							
11	1113		16	1.3	63	1.0	1.0	18	24	5.6	8.4			8	0							
12	1183		18	1.3	64	1.0	1.0	18	25	5.6	8.4			8	0							
	1139		17	1.4	62	0.97	1.0	18	25	5.6	8.4			9	0							
	1141		17	1.4	63	1.0	1.0	18	24	5.6	8.3			8	0							
15	1135		16	1.2	63	1.0	1.0	18	24	5.6	8.4			9	0							
16	1175		16	1.3	64	1.0	1.0	18	25	5.6	8.4			8	0							
17	1210		18	1.3	67	1.0	0.95	18	25	5.6	8.4			8	0							
18	1237		18	1.3	68	0.98	0.95	18	24	5.6	8.5			8	0							
19	1299		18	1.4	69	1.0	1.0	18	24	5.6	8.4			8	0							
20	1195		17	1.4	68	1.0	1.0	18	24	5.6	8.4			9	0							
21	1231		17	1.4	69	1.0	1.0	18	24	5.6	8.4			8	0							
22	1145		17	1.4	67	1.0	1.0	18	24	5.6	8.4			8	0							
23	1186		16	1.3	67	1.0	1.0	18	25	5.6	8.4			9	0							
24	1108		16	1.3	63	0.99	1.0	18	25	5.6	8.5			9	0							
25	1148		16	1.4	63	1.0	1.0	18	24	5.6	8.5			8	0							
26	1089		15	1.4	61	1.0	1.0	18	24	5.6	8.5			8	0							
27	1099		15	1.3	61	1.0	0.95	18	24	5.6	8.4			9	0							
28	1147		16	1.3	63	1.0	1.0	18	24	5.6	8.4			9	0							
29	1179		17	1.3	62	1.0	1.0	18	25	5.6	8.4			8	0							
30	1135		16	1.4	62	1.0	1.0	18	25	5.6	8.4			8	0							
31																						
TOTAL	34600		579																			
AVE	1153		17	1.3		1.0	1.0	18	24		8.4			8	0							
MAX	1299		18	1.4		1.08	1.0	18	25		8.5			9	0							
MIN	1020		15	1.2		0.97	0.95	18	24		8.3			8	0							

REMARKS _____

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices and other activities for the reporting period specified herein.

Certified Operator [signature]

Certificate Number 00575

CN-0707

This form must be received by the appropriate field office by the 10th of the following

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 0000126

NAME OF WATER TREATMENT PLANT WATER PLANT # 2 COUNTY Shelby

MONTH OF Octobee 1997

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS [redacted] USED	FREE RESIDUAL MG/L DIST. SYSTEM	[redacted] GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1142		12	1.1	65	1.02	1.0	19	25	5.6	8.4			8	0							
2	1168		11	1.0	67	1.03	1.0	20	27	5.6	8.4			9	0							
3	1173		12	1.1	64	0.98	1.0	20	27	5.6	8.5			9	0							
4	1167		12	1.1	66	1.02	0.95	19	25	5.7	8.5			8	0							
5	1120		12	1.1	66	1.06	1.0	19	25	5.7	8.4			8	0							
6	1190		13	1.1	65	0.98	1.0	19	26	5.7	8.4			9	0							
7	1213		13	1.2	67	0.99	1.0	20	26	5.6	8.3			9	0							
8	1221		13	1.1	67	0.99	0.9	20	27	5.6	8.3			8	0							
9	1176		12	1.1	66	1.01	1.0	20	27	5.6	8.3			8	0							
10	1133		12	1.0	65	1.03	1.0	19	26	5.7	8.4			8	0							
11	1143		12	1.0	66	1.04	0.9	19	26	5.6	8.4			9	0							
12	1168		11	1.0	66	1.02	0.8	19	26	5.6	8.4			9	0							
13	1278		13	1.1	67	0.94	1.0	19	27	5.7	8.4			8	0							
	559		7	1.1	33	1.06	1.0	20	25	5.7	8.4			9	0							
15	611		7	1.1	34	1.0	1.0	19	25	5.6	8.4			8	0							
16	1075		11	1.0	64	1.07	1.0	19	26	5.7	8.5			8	0							
17	557		7	1.2	34	1.10	1.0	20	26	5.7	8.4			8	0							
18	1001		11	1.1	65	1.17	1.0	19	27	5.6	8.4			9	0							
19	1073		11	1.1	64	1.07	0.95	19	26	5.6	8.3			8	0							
20	1078		12	1.2	65	1.08	1.0	20	26	5.6	8.3			8	0							
21	1040		12	1.1	60	1.03	1.0	20	26	5.6	8.4			9	0							
22	1054		12	1.1	66	1.13	1.1	19	26	5.6	8.4			9	0							
23	1062		12	1.2	65	1.1	1.0	19	25	5.7	8.4			8	0							
24	1060		12	1.0	67	1.13	1.1	20	26	5.7	8.3			9	0							
25	1060		13	1.0	65	1.1	1.0	19	27	5.6	8.4			8	0							
26	1060		12	1.1	65	1.1	0.9	20	26	5.6	8.4			8	0							
27	1060		12	1.3	67		0.9	19	26	5.6	8.4			8	0							
28	1060		12	1.1	66	1.13	1.0	19	26	5.7	8.4			9	0							
29	1060		11	1.1	65	1.1	1.0	20	25	5.6	8.4			9	0							
30	1060		12	1.1	67	1.13	0.9	19	25	5.6	8.3			9	0							
31	1060		12	1.0	67	1.13	0.95	19	26	5.6	8.4			8	0							
TOTAL	32871																					
AVE	1060		10	1.1		1.03	1.0	19	26	5.6	8.4			8	0							
MAX	1221		13	1.2		1.13	1.1	20	27	5.7	8.5			9	0							
MIN	559		7	1.0		0.98	0.9	19	25	5.6	8.3			8	0							

REMARKS Master Meter Malfunction
Used Avg 23-31
Plant Down For Repairs 11-2-97

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices and other activities for the reporting period specified herein.

Certified Operator James L Mathis

Certificate Number 000575

CN-0707

This form must be received by the appropriate field office by the 10th of the following

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 000126

NAME OF WATER TREATMENT PLANT Water Plant #2 COUNTY Shelby

MONTH OF November 19 97

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS [redacted] USED	FREE RESIDUAL MG/L DIST. SYSTEM	[redacted] GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1																						
2																						
3																						
4																						
5																						
6																						
7	817		12	1.2	45	0.99	0.9	18	26	5.6	8.4			9	0							
8	1069		15	1.3	60	1.02	1.0		25		8.4				0							
9	975		15	1.4	55	1.02	1.0		25		8.3				0							
10	982		15	1.4	55	1.0	0.9	18	26	5.6	8.4			9	0							
11	1009		15	1.3	54	0.96	0.95		26		8.5				0							
12	1048		16	1.3	59	1.01	1.0		23		8.4				0							
13	1015		15	1.3	57	1.01	1.0		25		8.4				0							
	1031		15	1.4	55	0.96	0.95	18	25	5.6	8.4			8	0							
15	1021		15	1.4	58	1.02	1.0		25		8.3				0							
16	1003		16	1.4	57	1.02	1.0		26		8.4				0							
17	981		14	1.4	54	0.99	1.0	18	25	5.7	8.4			9	0							
18	1030		14	1.3	59	1.03	1.0		26		8.4				0							
19	1039		14	1.3	59	1.02	1.0		26		8.4				0							
20	1002		14	1.3	58	1.03	1.0	18	24	5.7	8.3			8	0							
21	1026		14	1.4	59	1.01	0.9		24		8.4				0							
22	1104		15	1.3	60	0.98	0.9		25		8.4				0							
23	978		13	1.3	53	0.98	0.9	18	25	5.7	8.4			8	0							
24	42		2	1.3	2	0.85	1.0		24		8.5				0							
25	932		13	1.2	52	1.0	1.0		25		8.4				0							
26	1001		14	1.3	50	0.9	1.0	18	24	5.6	8.4			9	0							
27	849		12	1.2	47	0.99	1.0		25		8.4				0							
28	324		5	1.3	19	1.05	1.0		25		8.4				0							
29	926		13	1.3	53	1.03	1.0	18	25	5.6	8.3			8	0							
30	965		13	1.3	52	0.96	1.0		23		8.3				0							
31																						
TOTAL	22164																					
AVE	963		12	1.3		1.01	0.95	18	25	5.6	8.4			8	0							
MAX	1850		15	1.4		1.03	1.0	18	26	5.6	8.5			9	0							
MIN	42		2	1.2		0.85	0.9	18	24	5.6	8.3			8	0							

REMARKS Plant Off For Repair of Lime Feed Equip & Replace Master Meter Nov 1 thru 6

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices and other activities for the reporting period specified herein

Certified Operator James F Martin

Certificate Number 000575

CN-0707

This form must be received by the appropriate field office by the 10th of the followin

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 0000126

NAME OF WATER TREATMENT PLANT WATER PLANT #2 COUNTY Shelby

MONTH OF December 1997

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS USED	FREE RESIDUAL MG/L DIST. SYSTEM	GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	982		10	1.1	552	1.01	1.0	18	25	5.8	8.3			8	0							
2	1025		11	1.1	57.4	1.0	1.0		24		8.2				0							
3	1030		11	1.2	59.1	1.03	1.0		25		8.3				0							
4	1042		11	1.1	58.7	1.01	1.0	18	27	5.7	8.3			9	0							
5	1040		11	1.1	58.1	1.01	1.0		27		8.4				0							
6	1075		11	1.0	61.0	1.02	1.0		26		8.4				0							
7	928		10	1.1	53.0	1.03	0.9	18	25	5.8	8.3			9	0							
8	976		11	1.0	55.3	1.02	0.9		25		8.3				0							
9	1061		12	1.1	60.1	1.02	1.0		24		8.3				0							
10	946		11	1.2	54.4	1.04	1.0	18	22	5.8	8.2			8	0							
11	1023		11	1.0	58.6	1.03	1.0		24		8.3				0							
12	1036		11	1.0	59.1	1.03	1.0		24		8.3				0							
13	1077		12	1.1	61.2	1.02	1.0	18	24	5.8	8.3			8	0							
	980		10	1.1	56.1	1.03	0.9		24		8.3				0							
..	944		10	1.1	54.6	1.04	0.8		23		8.3				0							
16	1018		11	1.1	58.1	1.03	1.0	18	23	5.8	8.3			8	0							
17	1026		11	1.1	59.0	1.04	1.0		25		8.4				0							
18	1014		11	1.1	57.9	1.03	1.0		23		8.3				0							
19	988		11	1.1	56.8	1.03	1.0	18	23	5.8	8.3			9	0							
20	1051		11	1.1	59.7	1.02	1.0		21		8.2				0							
21	1084		11	1.1	63.2	1.05	1.0		23		8.3				0							
22	842		9	1.1	48.5	1.04	0.9	19	23	5.8	8.3			9	0							
23	1020		11	1.1	59.1	1.04	0.8		24		8.2				0							
24	1007		11	1.1	57.2	1.02	1.0		22		8.2				0							
25	970		10	1.0	55.1	1.02	1.0	18	23	5.7	8.3			8	0							
26	1043		11	1.1	59.3	1.02	1.0		24		8.2				0							
27	1050		11	1.1	60.4	1.04	1.0		23		8.3				0							
28	943		10	1.0	55.1	1.05	1.0	18	23	5.8	8.3			9	0							
29	974		10	1.0	56.2	1.04	1.0		23		8.3				0							
30	993		11	1.0	57.6	1.04	1.0		22		8.2				0							
31	1043		12	1.1	59.7	1.03	1.0	19	25	5.8	8.4			9	0							
TOTAL	30204																					
AVE	975		11	1.1		1.03	1.0	18	23		8.3			8	0							
MAX	1084		12	1.2		1.05	1.0	19	25		8.4			9	0							
MIN	928		9	1.0		1.01	0.8	18	21		8.2			8	0							

IKS

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices and other activities for the reporting period specified herein.

Certified Operator James L. Wilson

Certificate Number 000575

CN-0707

This form must be received by the appropriate field office by the 10th of the following

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY Town of Collierville PWSID 0000126

NAME OF WATER TREATMENT PLANT WATER PLANT #2 COUNTY Shelby

MONTH OF JANUARY 19 98

DATE	WATER TREATED GALLONS X1000	FINISHED TURBIDITY NTU	CHLORINE		FLUORIDE			ALKALINITY MG/L		pH		HARDNESS MG/L		FREE CO_2		IRON MG/L			MANGANESE MG/L			CORROSION CONTROL
			POUNDS USED	FREE RESIDUAL MG/L DIST. SYSTEM	GALLONS USED	CALCULATED DOSAGE MG/L	DISTRIBUTION SYSTEM MG/L	TOTAL RAW	TOTAL FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED	DIST. SYSTEM	RAW	FINISHED	DIST. SYSTEM	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1235		14	1.4	94	1.2	1.2	19	20	5.8	7.2			8	0							
2	724		14	1.3	70	1.7	1.2	19	19	5.8	7.0			8	0							
3	1050		17	1.2	125	2.1	1.1	19	20	5.8	7.2			8	0							
4	1027		7	1.1	60	1.0	1.2	18	21	5.8	7.2			8	0							
5	937		12	.9	83	1.6	1.2	19	21	5.8	7.2			9	0							
6	1009		10	.9	90	1.6	1.3	19	23	5.8	8.2			8	0							
7	935		15	1.2	90	1.6	1.2	19	21	5.8	8.0			8	0							
8	1037		19	1.6	89	1.5	1.1	19	20	5.8	7.8			8	0							
9	1003		19	1.5	81	1.5	1.2	19	20	5.8	7.8			8	0							
10	1023		14	.5	87	1.5	1.2	20	25	5.8	7.8			9	0							
11	1031		8	.3	89	1.6	1.1	19	25	5.8	8.0			8	0							
12	939		2	.5	85	1.3	1.2	19	26	5.8	8.4			8	0							
13	1025		14	1.0	75	1.6	1.1	19	31	5.8	8.0			9	0							
	1007		13	1.0	92	1.4	1.2	19	24	5.8	8.2			8	0							
15	1027		15	1.0	83	1.0	1.4	20	39	5.8	8.4			9	0							
16	939		9	1.1	56	1.0	1.7	19	21	5.8	8.4			8	0							
17	0		6	1.0	1.5	0	1.4	19	28	5.8	8.2			8	0							
18	0		1	.9	0	0	1.4	19	26	5.8	8.6			8	0							
19	0		1	.7	0	0	1.4	19	25	5.8	8.4			8	0							
20	0		1	.6	0	0	1.3	19	29	5.8	8.4			8	0							
21	938		15	2.0	93	1.3	1.2	19	28	5.8	8.4			8	0							
22	987		15	1.7	91	1.5	1.1	18	25	5.8	8.2			8	0							
23	1038		18	1.5	83	1.5	1.3	19	26	5.8	8.4			8	0							
24	1066		13	1.0	90	1.5	1.1	19	25	5.8	7.8			8	0							
25	1035		11	1.0	88	1.5	1.1	18	27	5.8	8.0			8	0							
26	962		10	1.0	92	1.5	1.1	19	27	5.8	8.2			8	0							
27	1010		8	.9	84	1.5	1.3	19	29	5.8	7.8			8	0							
28	1029		10	1.1	87	1.5	1.3	19	25	5.8	8.0			8	0							
29	1006		11	1.0	83	1.5	1.3	19	29	5.8	8.0			8	0							
30	1047		11	1.0	76	1.3	0.9	19	31	5.7	8.3			8	0							
31	1159		17	1.4	112	1.7	1.1	19	25	5.8	8.0			8	0							
TOTAL	16133 27,258																					
AVE	520 879		1.3			1.1		19	25	5.8	7.9			8	0							
MAX	1235 PO		2.0			2.1		19	39	5.8	8.4			8	0							
MIN	0 1/9/98		0.6			1.0		19	19	5.8	7.0			8	0							

REMARKS _____

I certify that the data provided actually represents the water quality and quantity, treatment, operational practices and other activities for the reporting period specified herein.

Certified Operator James F. Mathis

Certificate Number 000525

CN-0707

This form must be received by the appropriate field office by the 10th of the following

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: February 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	927	9.0	1.5	81.7	1.59	1.00	-----	23	-----	8.4	-----	0
02	952	12.0	1.6	90.3	1.71	0.50	19	25	5.8	8.4	9	0
03	976	15.0	1.9	9.4	0.17	1.00	-----	24	-----	7.8	-----	0
04	1029	13.0	1.6	87.7	1.53	1.10	20	25	5.7	7.8	8	0
05	1010	16.0	1.6	96.5	1.72	0.90	-----	25	-----	8.2	-----	0
06	1077	18.0	1.5	81.3	1.36	0.70	19	26	5.8	8.2	8	0
07	987	5.0	0.6	89.2	1.63	1.10	-----	29	-----	8.2	-----	0
08	1036	9.0	0.7	81.7	1.42	1.10	-----	31	-----	8.0	-----	0
09	951	24.0	1.8	81.0	1.53	1.20	18	31	5.8	8.0	9	0
10	1022	17.0	1.8	90.9	1.60	1.10	-----	27	-----	8.0	-----	0
11	1024	15.0	1.0	87.5	1.54	1.00	19	28	5.8	8.0	8	0
12	988	5.0	0.7	88.9	1.62	1.10	-----	28	-----	8.2	-----	0
13	1021	16.0	1.1	78.2	1.38	1.10	19	28	5.7	8.0	8	0
14	989	12.0	0.8	40.2	0.73	1.20	-----	31	-----	8.0	-----	0
15	1034	12.0	0.7	130.5	2.27	1.20	-----	26	-----	8.2	-----	0
16	971	10.0	1.7	82.7	1.53	1.20	20	24	5.8	8.0	9	0
17	1004	34.0	1.3	86.0	1.54	1.30	-----	30	-----	8.0	-----	0
18	1021	14.0	1.3	88.2	1.55	1.00	19	30	5.8	8.0	8	0
19	1030	17.0	1.3	86.3	1.51	1.20	-----	26	-----	8.0	-----	-----
20	962	12.0	1.3	1.6	0.03	1.00	19	27	5.7	8.0	8	0
21	1008	17.0	1.3	79.0	1.41	1.10	-----	26	-----	8.0	-----	-----
22	1039	16.0	1.2	87.6	1.52	1.00	-----	18	-----	7.2	-----	-----
23	903	16.0	1.2	82.4	1.64	1.00	18	26	5.7	7.8	9	0
24	650	11.0	1.3	49.6	1.37	1.00	-----	23	-----	7.8	-----	-----
25	1038	13.0	0.9	83.8	1.45	1.10	19	20	5.8	7.2	8	0
26	1120	10.0	0.4	92.8	1.49	1.10	-----	21	-----	7.6	-----	-----
27	998	19.0	1.2	79.9	1.44	1.10	19	28	5.8	8.4	9	9
28	1005	15.0	1.2	93.8	1.68	1.20	-----	29	-----	8.4	-----	-----
TOTAL	27772	402.0	34.3	2208.7	39.98	29.60	228	741	69.2	223.8	101	9
AVERAGE	992	14.4	1.2	78.9	1.43	1.06	19	26	5.8	8.0	8	0
MAXIMUM	1120	34.0	1.9	130.5	2.27	1.30	20	31	5.8	8.4	9	9
MINIMUM	650	5.0	0.4	1.6	0.03	0.50	18	18	5.7	7.2	8	0

REMARKS:

James L Mitchell
CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 000575

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: March 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	1041	18.0	1.0	88.5	1.53	1.20	-----	30	-----	8.4	-----	0
02	952	15.0	1.4	83.7	1.58	1.10	18	24	5.6	8.0	8	0
03	1002	18.0	1.4	80.2	1.44	1.20	-----	21	-----	7.6	-----	0
04	997	18.0	1.3	86.7	1.57	1.10	19	17	5.7	7.2	9	0
05	999	15.0	1.3	86.2	1.55	1.00	-----	29	-----	8.0	-----	0
06	1002	17.0	1.2	87.4	1.57	1.10	18	31	5.6	8.2	9	0
07	1009	15.0	0.9	81.1	1.45	1.10	-----	25	-----	8.0	-----	0
08	982	5.0	0.9	82.9	1.52	1.10	-----	24	-----	7.8	-----	0
09	995	16.0	1.4	83.2	1.51	1.10	19	27	5.6	8.0	8	0
10	986	16.0	1.3	84.4	1.54	1.10	-----	23	-----	8.0	-----	0
11	898	14.0	1.3	62.3	1.25	1.10	18	24	5.6	8.0	9	0
12	982	22.0	1.3	104.0	1.91	1.20	-----	23	-----	8.0	-----	0
13	1030	18.0	1.4	78.5	1.37	1.10	20	27	5.7	8.0	9	0
14	1078	22.0	1.2	85.5	1.43	1.20	-----	29	-----	8.2	-----	0
15	950	12.0	1.2	84.4	1.60	1.20	-----	28	-----	8.2	-----	0
16	898	13.0	1.1	75.8	1.52	1.10	19	27	5.7	8.2	9	6
17	974	16.0	1.3	81.4	1.50	1.20	-----	27	-----	8.4	-----	0
18	973	12.0	1.3	85.4	1.58	1.20	18	30	5.6	8.2	8	0
19	985	16.0	0.9	81.0	1.48	1.10	-----	25	-----	8.2	-----	0
20	991	16.0	1.0	83.4	1.51	1.30	19	25	5.6	8.2	9	0
21	1058	19.0	1.1	91.0	1.55	1.10	-----	25	-----	8.2	-----	0
22	950	15.0	0.6	80.5	1.53	1.10	-----	24	-----	7.8	-----	0
23	947	11.0	0.6	80.1	1.52	1.00	19	25	5.6	8.0	9	0
24	1004	19.0	1.8	84.6	1.52	1.10	-----	27	-----	8.4	-----	0
25	1005	21.0	1.5	86.7	1.55	1.10	18	25	5.6	8.0	8	0
26	986	21.0	1.5	83.2	1.52	1.20	-----	22	-----	7.8	-----	0
27	1010	18.0	1.3	86.5	1.54	1.10	20	21	5.7	8.0	9	0
28	1084	16.0	1.1	88.7	1.47	1.10	-----	24	-----	8.2	-----	0
29	1081	12.0	1.1	92.6	1.54	1.20	-----	27	-----	8.6	-----	0
30	989	8.0	0.5	84.6	1.54	1.20	18	27	5.6	8.2	8	0
31	1004	11.0	0.7	85.5	1.53	1.20	-----	24	-----	8.0	-----	0
TOTAL	30842	485.0	35.6	2610.0	47.22	35.20	243	787	73.2	250.0	112	6
AVERAGE	995	15.6	1.1	84.2	1.52	1.14	19	25	5.6	8.1	9	0
MAXIMUM	1084	22.0	1.8	104.0	1.91	1.30	20	31	5.7	8.6	9	6
MINIMUM	898	5.0	0.5	62.3	1.25	1.00	18	17	5.6	7.2	8	0

REMARKS:

James Z. McAdam
CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 000575

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: April 1998

	WATER	--- CHLORINE ---		---- FLUORIDE ----			-- ALKALINITY --		---- pH ----		---- CO2 ----	
	TREATED		MG/L		MG/L	MG/L	MG/L		SU			
	GALLONS	POUNDS	FREE	GALS	CALC'D	DIST	TOTAL				FREE	
DATE	x1000	USED	RESIDUAL	USED	DOSAGE	SYSTEM	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
01	961	9.0	0.7	83.1	1.56	1.20	18	26	6.3	8.0	52	0
02	1008	11.0	0.8	85.9	1.53	1.30	17	26	6.3	7.6	54	0
03	1021	11.0	0.7	88.5	1.56	1.20	19	27	6.3	7.6	55	0
04	1004	18.0	1.8	82.2	1.47	1.30	19	40	6.3	7.8	53	0
05	1085	21.0	1.7	93.9	1.56	1.20	19	29	6.3	7.8	53	0
06	859	18.0	1.6	70.8	1.48	1.30	19	28	6.3	8.0	53	0
07	1064	23.0	1.7	88.4	1.50	1.20	21	41	6.3	8.0	52	0
08	1005	24.0	1.7	85.1	1.52	1.30	20	45	6.3	8.0	68	0
09	1013	20.0	1.6	87.6	1.56	1.20	19	38	4.6	8.0	54	0
10	964	20.0	1.7	80.5	1.50	1.30	24	37	4.8	8.8	59	0
11	1095	20.0	1.1	91.9	1.51	1.30	21	34	4.8	8.8	43	0
12	1035	19.0	0.5	91.0	1.58	1.20	23	35	4.7	8.6	44	0
13	932	8.0	0.7	80.1	1.55	1.20	16	31	4.7	8.8	54	0
14	1064	21.0	0.8	90.1	1.52	1.20	20	36	4.5	8.4	56	0
15	1032	11.0	1.8	83.6	1.46	1.20	19	28	6.1	8.6	59	0
16	1037	25.0	1.9	91.5	1.59	1.30	18	39	6.6	8.9	57	0
17	1014	21.0	1.8	84.4	1.50	1.40	20	27	6.2	8.1	58	0
18	1046	18.0	1.4	90.6	1.56	1.20	19	29	6.1	8.0	58	0
19	1054	20.0	1.9	91.7	1.57	1.20	19	28	6.3	8.0	57	0
20	987	14.0	1.7	90.1	1.64	1.20	19	35	4.6	8.1	50	0
21	994	10.0	1.4	73.4	1.33	1.20	20	27	6.3	8.0	58	0
22	1012	16.0	1.2	86.8	1.54	1.20	19	28	6.2	8.0	58	0
23	1020	20.0	1.4	84.8	1.50	1.10	21	28	6.5	8.1	61	0
24	1032	21.0	1.4	90.6	1.58	1.20	19	30	6.3	8.5	60	0
25	1156	22.0	1.4	92.9	1.45	1.20	20	30	6.3	8.2	46	0
26	999	21.0	1.2	88.7	1.60	1.10	20	33	6.4	8.2	47	0
27	941	15.0	0.9	78.8	1.51	1.20	20	29	6.4	8.2	60	0
28	1027	17.0	1.3	88.0	1.54	1.10	22	33	6.5	8.0	63	0
29	994	16.0	1.4	83.5	1.51	1.10	19	27	6.3	8.0	61	0
30	997	15.0	1.4	86.1	1.55	1.20	21	26	6.3	8.0	60	0
TOTAL	30452	525.0	40.5	2584.6	45.83	36.50	590	950	177.9	245.1	1663	0
AVERAGE	1015	17.5	1.3	86.2	1.53	1.22	20	32	5.9	8.2	55	0
MAXIMUM	1156	25.0	1.9	93.9	1.64	1.40	24	45	6.6	8.9	68	0
MINIMUM	859	8.0	0.5	70.8	1.33	1.10	16	26	4.5	7.6	43	0

REMARKS:

CERTIFIED OPERATOR:

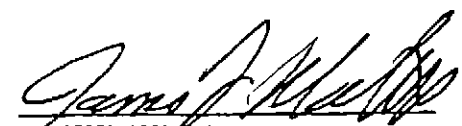
CERTIFICATE NUMBER: 000575

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: May 1998

	WATER TREATED GALLONS	--- CHLORINE ---		---- FLUORIDE ----			-- ALKALINITY --		---- pH ----		---- CO2 ----	
			MG/L		MG/L	MG/L	MG/L		SU			
DATE	x1000	POUNDS USED	FREE RESIDUAL	GALS USED	CALC'D DOSAGE	DIST SYSTEM	TOTAL RAW	FINISHED	RAW	FINISHED	FREE RAW	FINISHED
01	1001	17.0	1.2	79.8	1.43	1.20	20	26	4.7	8.1	58	0
02	1027	19.0	1.5	92.5	1.62	1.20	21	25	6.6	8.0	60	0
03	1006	21.0	1.4	85.4	1.53	1.20	20	28	6.6	8.0	57	0
04	1090	12.0	1.0	91.6	1.51	1.20	19	26	6.2	8.3	59	0
05	891	8.0	1.3	73.8	1.49	1.10	18	25	6.4	7.0	60	0
06	1101	23.0	1.3	94.8	1.55	1.30	20	27	6.5	7.2	60	0
07	1059	13.0	0.6	99.0	1.68	1.20	20	22	6.5	7.0	65	0
08	1033	12.0	1.2	76.8	1.34	1.30	21	24	6.3	7.0	64	0
09	1074	18.0	1.1	102.8	1.72	1.10	20	25	6.3	6.8	60	0
10	1069	14.0	1.1	82.8	1.39	1.10	21	24	6.3	6.8	61	0
11	942	15.0	1.2	77.8	1.49	1.20	20	22	6.3	6.7	60	0
12	1122	20.0	1.0	94.8	1.52	1.20	20	21	6.4	6.7	67	0
13	1136	27.0	1.1	93.7	1.48	1.20	20	21	6.4	6.9	64	0
14	1123	17.0	1.1	87.5	1.40	1.30	20	22	6.3	7.5	60	0
15	1132	17.0	1.1	94.2	1.50	1.20	21	21	6.4	7.6	65	0
16	1104	18.0	1.5	96.6	1.58	1.20	20	21	6.3	7.4	64	0
17	1010	18.0	1.9	87.7	1.56	1.30	20	22	6.4	7.4	60	0
18	1215	22.0	1.8	101.8	1.51	1.30	21	25	6.3	7.6	61	0
19	1014	18.0	1.5	87.8	1.56	1.20	19	24	6.4	7.5	56	0
20	1078	20.0	1.8	98.3	1.64	1.20	20	23	6.4	7.3	60	0
21	972	20.0	1.7	89.4	1.66	1.30	20	23	6.2	8.8	60	0
22	1169	19.0	1.8	94.0	1.45	1.40	19	31	6.5	8.5	59	0
23	982	17.0	1.7	86.5	1.59	1.30	19	36	6.3	8.4	60	0
24	1124	18.0	1.4	94.9	1.52	1.30	19	39	6.0	8.3	60	0
25	987	27.0	1.4	92.3	1.68	1.20	20	36	5.0	8.0	59	0
26	1027	13.0	1.4	77.8	1.36	1.30	19	36	4.7	8.0	58	0
27	1089	11.0	1.3	94.3	1.56	1.30	18	27	4.3	8.0	58	0
28	1107	13.0	1.1	95.6	1.55	0.70	19	29	4.3	8.0	57	0
29	1072	8.0	0.6	86.9	1.46	1.40	21	31	4.4	8.2	65	0
30	1020	9.0	0.8	87.2	1.54	1.30	21	33	4.3	8.2	64	0
31	1041	7.0	0.8	89.3	1.54	1.30	20	32	4.4	8.2	64	0
TOTAL	32617	511.0	39.6	2787.7	47.42	38.00	616	829	182.4	237.4	1885	0
AVERAGE	1059	16.5	1.3	89.9	1.53	1.23	20	27	5.9	7.7	61	0
MAXIMUM	1215	27.0	1.9	102.8	1.72	1.40	21	39	6.6	8.8	67	0
MINIMUM	891	7.0	0.6	73.8	1.34	0.70	18	21	4.3	6.7	56	0

REMARKS:


CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 00576

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF WATER SUPPLY

Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126

NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY

MONTH OF: June 1998

	WATER	--- CHLORINE ---		---- FLUORIDE ----			-- ALKALINITY --		---- pH ----		---- CO2 ----	
	TREATED		MG/L		MG/L	MG/L	MG/L		SU			
	GALLONS	POUNDS	FREE	GALS	CALC'D	DIST	TOTAL				FREE	
DATE	x1000	USED	RESIDUAL	USED	DOSAGE	SYSTEM	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
01	1108	22.0	1.2	83.5	1.36	1.10	19	32	4.4	8.1	58	0
02	1070	35.0	1.4	83.1	1.40	1.20	20	31	4.4	8.0	61	0
03	1106	8.0	1.0	84.6	1.38	1.10	20	30	4.4	8.4	66	0
04	1030	21.0	1.5	81.2	1.42	1.10	21	30	4.5	8.2	60	0
05	1296	20.0	1.2	94.2	1.31	1.20	20	34	4.5	8.2	60	0
06	758	15.0	1.1	62.2	1.48	1.30	20	33	4.4	8.0	60	0
07	1026	27.0	2.0	77.2	1.35	1.20	19	30	4.4	8.2	59	0
08	1057	21.0	0.9	84.1	1.43	1.10	19	31	4.6	8.2	59	0
09	1094	26.0	2.2	81.3	1.34	1.20	20	31	4.5	8.1	62	0
10	1102	22.0	1.7	82.4	1.35	1.20	23	30	4.5	8.1	63	0
11	1100	23.0	1.5	86.2	1.41	1.20	22	33	4.6	8.1	61	0
12	1119	22.0	1.6	87.6	1.41	1.10	21	32	4.4	8.1	60	0
13	1164	24.0	1.4	84.7	1.31	1.30	21	33	4.4	8.1	60	0
14	1094	15.0	0.6	84.4	1.39	1.10	20	32	4.5	8.0	61	0
15	1075	14.0	1.4	81.5	1.36	1.10	21	30	4.6	8.1	60	0
16	1157	18.0	1.8	82.0	1.28	1.10	20	31	4.6	8.1	60	0
17	1096	15.0	1.4	85.5	1.40	1.10	20	35	4.5	8.1	64	0
18	1115	15.0	1.5	86.2	1.39	1.10	20	34	4.5	8.1	62	0
19	1093	12.0	1.5	80.8	1.33	1.20	21	30	4.5	8.2	62	0
20	1190	16.0	1.4	90.2	1.36	1.20	21	30	4.5	8.2	60	0
21	1094	14.0	1.2	84.2	1.39	1.20	22	31	4.5	8.2	59	0
22	1062	14.0	1.1	79.1	1.34	1.10	23	31	4.5	8.2	57	0
23	1155	15.0	1.1	87.7	1.37	1.20	22	30	4.6	8.2	58	0
24	1085	5.0	0.1	69.4	1.15	0.90	19	22	4.6	7.6	58	0
25	799	26.0	1.7	73.8	1.66	1.20	19	22	4.5	7.6	57	0
26	1106	16.0	1.6	84.0	1.37	1.10	20	29	4.5	7.9	57	0
27	1147	17.0	1.6	86.5	1.36	1.10	20	29	4.6	7.7	58	0
28	1143	17.0	1.4	83.5	1.31	1.10	19	25	4.6	7.4	57	0
29	1078	15.0	1.4	81.7	1.36	1.10	19	21	4.5	7.2	57	0
30	1119	27.0	1.3	82.9	1.33	1.20	20	20	4.6	7.0	63	0
TOTAL	32638	557.0	40.6	2475.7	41.10	34.40	611	892	135.2	239.6	1799	0
AVERAGE	1088	18.6	1.4	82.5	1.37	1.15	20	30	4.5	8.0	60	0
MAXIMUM	1296	35.0	2.2	94.2	1.66	1.30	23	35	4.6	8.4	66	0
MINIMUM	758	5.0	0.1	62.2	1.15	0.90	19	20	4.4	7.0	57	0

REMARKS:

James F. Whitt

CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 415-80-019

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: July 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	1175	6.0	1.4	90.2	1.38	1.10	19	24	4.6	7.0	61	0
02	1002	17.0	1.5	74.9	1.35	1.20	18	23	4.5	7.1	60	0
03	1217	17.0	1.5	92.6	1.37	1.20	19	22	4.6	7.0	61	0
04	1032	14.0	1.3	82.7	1.44	1.30	18	23	4.7	7.0	61	0
05	1066	14.0	0.7	86.5	1.46	1.20	19	22	4.7	6.9	60	0
06	1044	14.0	0.7	85.9	1.48	1.20	19	22	4.8	7.0	61	0
07	1166	10.0	1.1	77.4	1.19	1.20	19	23	4.7	7.0	60	0
08	1121	14.0	1.2	92.9	1.49	1.20	19	24	4.6	7.2	61	0
09	1054	12.0	1.2	70.5	1.20	1.20	20	24	4.7	8.2	60	0
10	1010	13.0	1.2	86.3	1.54	1.20	20	23	4.7	8.1	60	0
11	953	11.0	1.2	52.1	0.98	1.10	21	24	4.7	8.1	60	0
12	798	5.0	0.8	80.2	1.81	1.20	22	26	4.8	8.0	61	0
13	882	7.0	0.9	77.9	1.59	1.20	27	28	4.7	8.0	64	0
14	1013	9.0	1.1	93.3	1.66	1.10	25	27	4.8	8.0	63	0
15	967	8.0	1.2	61.5	1.14	1.20	26	30	4.7	8.2	64	0
16	1055	11.0	1.2	85.0	1.45	0.90	23	30	4.8	8.0	63	0
17	1046	13.0	1.1	78.3	1.35	1.10	22	27	4.7	8.1	61	0
18	1205	20.0	1.1	94.3	1.41	1.10	24	28	4.7	8.0	62	0
19	977	8.0	1.0	65.9	1.21	1.20	23	27	4.8	8.0	64	0
20	973	18.0	0.6	80.1	1.48	1.20	22	29	4.7	8.1	66	0
21	1172	13.0	1.3	87.7	1.35	1.20	23	28	4.7	8.0	65	0
22	1118	16.0	1.1	85.2	1.37	1.20	22	28	4.7	8.0	64	0
23	1050	15.0	1.2	83.8	1.44	1.20	21	28	4.6	7.9	64	0
24	1052	15.0	1.2	79.6	1.36	1.20	21	29	4.6	8.0	65	0
25	1129	16.0	1.2	87.5	1.40	1.10	20	28	4.6	8.0	65	0
26	1068	16.0	1.2	83.3	1.40	1.20	21	29	4.6	7.9	64	0
27	958	10.0	1.2	74.3	1.40	1.20	20	29	4.6	7.8	64	0
28	1076	16.0	1.2	78.4	1.31	1.20	20	29	4.7	7.8	65	0
29	1004	11.0	1.0	79.0	1.42	1.10	19	30	4.7	7.8	65	0
30	1147	11.0	1.0	95.1	1.49	1.20	20	30	4.6	7.9	64	0
31	950	11.0	1.0	63.9	1.21	1.20	19	30	4.6	7.9	64	0
TOTAL	32480	391.0	34.2	2506.3	43.14	36.30	651	824	145.0	240.0	1942	0
AVERAGE	1048	12.6	1.1	80.8	1.39	1.17	21	27	4.7	7.7	63	0
MAXIMUM	1217	20.0	1.5	95.1	1.81	1.30	27	30	4.8	8.2	66	0
MINIMUM	798	5.0	0.6	52.1	0.98	0.90	18	22	4.5	6.9	60	0

REMARKS:

CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 415-80-019.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: August 1998

	WATER TREATED GALLONS	--- CHLORINE ---		---- FLUORIDE ----			-- ALKALINITY -- MG/L TOTAL		---- pH ---- SU		---- CO2 ---- FREE	
DATE	x1000	POUNDS USED	MG/L FREE RESIDUAL	GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
01	1132	14.0	0.9	88.8	1.41	1.20	22	29	4.5	8.0	69	0
02	1079	9.0	0.8	83.7	1.40	1.30	24	27	4.4	7.8	70	0
03	1092	12.0	0.8	83.0	1.37	0.70	25	25	4.4	6.8	70	0
04	970	10.0	1.0	73.0	1.35	1.10	20	30	4.6	6.8	65	0
05	837	9.0	1.1	65.1	1.40	1.20	22	30	4.6	7.4	62	0
06	1064	13.0	1.3	92.5	1.56	1.10	24	31	4.5	7.6	60	0
07	1089	12.0	0.9	73.2	1.21	1.20	23	28	4.6	8.0	61	0
08	1109	11.0	1.0	75.8	1.23	1.20	22	30	4.6	8.1	60	0
09	1014	12.0	1.0	84.5	1.50	1.30	22	29	4.7	8.0	60	0
10	1056	11.0	1.0	84.5	1.44	1.30	22	30	4.6	8.0	65	0
11	1054	12.0	0.9	78.6	1.34	1.00	23	34	4.6	8.2	69	0
12	1087	6.0	0.4	83.8	1.39	1.20	23	34	4.7	8.1	68	0
13	1094	12.0	0.9	68.4	1.13	1.00	22	33	4.7	8.0	68	0
14	910	8.0	0.8	71.3	1.41	1.20	22	35	4.6	8.0	69	0
15	1150	23.0	1.0	91.9	1.44	1.20	22	34	4.6	8.0	68	0
16	1017	11.0	1.0	82.5	1.46	1.10	23	33	4.6	8.0	69	0
17	989	2.0	0.9	75.5	1.37	1.00	23	31	4.6	8.0	68	0
18	1080	26.0	0.5	84.5	1.41	1.10	22	38	4.5	8.3	68	0
19	825	0.0	0.8	38.7	0.84	0.70	21	48	4.5	8.1	69	0
20	499	5.0	0.8	27.9	1.01	1.00	20	45	4.6	8.0	68	0
21	260	8.0	0.8	11.1	0.77	0.70	20	40	4.6	8.0	69	0
22	990	16.0	1.0	69.7	1.27	1.10	21	38	4.6	8.0	68	0
23	1106	25.0	1.0	98.2	1.60	1.10	23	36	4.5	7.9	67	0
24	996	19.0	1.5	66.0	1.19	1.10	24	34	4.5	7.8	67	0
25	1108	15.0	1.5	84.7	1.38	1.00	23	34	4.6	8.3	65	0
26	1152	18.0	1.5	84.8	1.33	0.90	21	31	4.6	7.8	66	0
27	1099	18.0	1.5	84.1	1.38	1.20	20	31	4.5	7.9	65	0
28	1065	16.0	0.9	83.7	1.41	1.20	22	33	4.7	7.8	65	0
29	1076	19.0	1.0	84.6	1.42	1.20	22	32	4.7	8.0	65	0
30	1198	19.0	1.0	90.8	1.36	1.20	21	30	4.6	8.0	65	0
31	1007	11.0	0.7	77.0	1.38	1.10	22	31	4.6	8.0	65	0
TOTAL	31204	402.0	30.0	2341.9	41.15	33.90	686	1024	142.0	244.7	2053	0
AVERAGE	1007	13.0	1.0	75.5	1.33	1.09	22	33	4.6	7.9	66	0
MAXIMUM	1198	26.0	1.5	98.2	1.60	1.30	25	48	4.7	8.3	70	0
MINIMUM	260	0.0	0.4	11.1	0.77	0.70	20	25	4.4	6.8	60	0

REMARKS:

CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 415-80-01

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: September 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	1168	17.0	1.4	90.5	1.39	1.10	22	32	4.6	7.8	65	0
02	1074	17.0	1.4	78.0	1.31	1.10	21	31	4.5	8.0	63	0
03	1017	20.0	1.4	80.3	1.42	1.20	21	31	4.6	8.0	63	0
04	1062	14.0	0.9	75.9	1.29	1.00	20	29	4.6	8.1	64	0
05	1169	14.0	0.9	81.4	1.25	1.00	21	29	4.5	8.0	64	0
06	1098	13.0	0.8	71.2	1.17	1.00	19	28	4.5	8.0	63	0
07	1049	8.0	0.7	72.6	1.25	1.00	20	29	4.6	7.9	65	0
08	1066	12.0	1.0	67.7	1.14	1.00	20	30	4.5	7.8	65	0
09	1066	10.0	0.1	74.1	1.25	0.90	19	28	4.5	7.8	64	0
10	1088	9.0	0.7	71.5	1.18	1.00	20	35	4.5	8.0	63	0
11	1058	13.0	1.2	72.7	1.24	1.00	24	30	4.7	8.0	65	0
12	1013	28.0	1.4	55.4	0.98	0.90	24	30	4.6	8.0	64	0
13	1070	3.0	0.6	73.8	1.24	1.00	23	29	4.6	8.0	64	0
14	1124	17.0	1.2	64.0	1.02	1.00	20	28	4.6	8.0	66	0
15	1163	17.0	0.9	76.0	1.18	1.00	22	27	4.7	7.9	65	0
16	1071	14.0	0.9	67.7	1.14	1.00	21	30	4.6	7.6	66	0
17	1056	14.0	1.1	76.1	1.30	1.00	20	34	4.6	7.8	64	0
18	1118	14.0	1.1	73.4	1.18	1.00	19	28	4.5	7.8	64	0
19	1173	15.0	1.1	75.4	1.16	1.00	20	27	4.5	7.7	67	0
20	1155	15.0	1.1	73.6	1.15	1.00	21	25	4.6	7.6	69	0
21	938	12.0	1.1	66.9	1.28	1.00	20	26	4.6	7.4	70	0
22	1077	16.0	0.9	74.2	1.24	1.00	23	28	4.5	7.6	69	0
23	1120	15.0	1.1	70.9	1.14	1.10	22	29	4.6	7.2	65	0
24	1080	15.0	1.0	72.3	1.21	1.10	21	27	4.6	7.4	66	0
25	1114	13.0	0.9	72.8	1.18	1.00	22	25	4.5	7.6	67	0
26	1221	12.0	0.9	83.9	1.24	1.00	21	29	4.6	7.7	68	0
27	968	12.0	0.9	65.3	1.21	1.00	22	28	4.5	7.8	66	0
28	1128	15.0	1.0	76.0	1.21	1.00	23	29	4.5	7.8	65	0
29	1025	15.0	0.9	68.1	1.20	1.00	21	28	4.5	8.2	61	0
30	1112	14.0	1.4	75.6	1.22	1.10	22	29	4.6	8.1	63	0
TOTAL	32641	423.0	29.9	2197.3	36.37	30.50	634	868	136.9	234.6	1953	0
AVERAGE	1088	14.1	1.0	73.2	1.21	1.02	21	29	4.6	7.8	65	0
MAXIMUM	1221	28.0	1.4	90.5	1.42	1.20	24	35	4.7	8.2	70	0
MINIMUM	938	3.0	0.1	55.4	0.98	0.90	19	25	4.5	7.2	61	0

REMARKS:

CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 415-80-0190

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: October 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	1032	12.0	1.2	69.9	1.22	1.00	21	30	4.6	7.9	61	0
02	1074	19.0	1.3	43.2	0.72	0.80	24	41	4.7	8.5	65	0
03	1037	3.0	1.1	75.3	1.31	1.10	22	40	4.6	7.9	64	0
04	898	10.0	1.1	64.4	1.29	1.10	23	40	4.7	7.9	65	0
05	835	11.0	1.1	29.5	0.64	1.05	22	38	4.6	8.7	62	0
06	419	-----	1.2	16.4	0.70	1.00	23	42	4.6	8.8	63	0
07	475	3.0	1.0	17.2	0.65	0.80	21	38	4.5	8.7	61	0
08	536	5.0	1.1	10.7	0.36	0.80	23	41	4.7	7.9	63	0
09	409	4.0	1.1	26.0	1.14	1.10	-----	-----	-----	7.8	-----	-----
10	483	4.0	0.9	20.1	0.75	0.80	24	35	5.6	8.0	64	0
11	1009	8.0	1.0	78.2	1.40	0.80	24	33	5.8	8.0	63	0
12	965	10.0	1.5	65.8	1.23	0.90	25	30	5.8	8.5	64	0
13	1028	9.0	1.5	55.1	0.96	0.90	25	31	5.7	8.5	64	0
14	893	11.0	1.3	81.3	1.64	1.60	20	29	5.7	7.9	62	0
15	999	11.0	1.1	82.0	1.48	1.50	23	35	5.6	8.5	60	0
16	1059	11.0	1.2	61.1	1.04	1.00	26	30	5.8	8.5	52	0
17	1116	13.0	1.3	87.5	1.41	1.10	25	31	5.7	8.1	55	0
18	901	11.0	1.3	61.1	1.22	1.00	24	33	5.6	8.2	54	0
19	998	12.0	1.2	60.5	1.09	1.00	25	36	5.6	8.4	54	0
20	440	7.0	1.3	26.3	1.08	1.00	22	33	5.7	8.6	52	0
21	1003	13.0	1.2	58.2	1.04	1.10	26	31	5.6	8.3	59	0
22	1003	33.0	1.2	77.4	1.39	1.10	25	31	5.6	7.8	56	0
23	1002	-----	1.1	69.9	1.26	1.00	23	35	5.6	7.1	54	0
24	775	10.0	1.7	40.1	0.93	1.00	21	29	5.6	8.6	60	0
25	1009	5.0	1.1	70.6	1.26	1.00	24	36	5.7	7.9	58	0
26	1005	9.0	1.3	64.1	1.15	1.20	26	30	5.8	7.7	56	0
27	1078	11.0	1.2	78.9	1.32	1.20	23	28	6.0	7.7	56	0
28	236	9.0	1.8	25.4	1.94	1.80	23	33	6.0	8.7	53	0
29	1087	10.0	1.2	74.7	1.24	1.30	22	29	5.7	8.2	55	0
30	1060	12.0	1.3	58.7	1.00	1.00	23	28	5.7	8.5	54	0
31	1120	13.0	1.4	85.7	1.38	1.20	23	27	5.6	8.2	55	0
TOTAL	26984	299.0	38.4	1735.3	35.22	33.25	701	1003	162.5	254.0	1764	0
AVERAGE	870	10.3	1.2	56.0	1.14	1.07	23	33	5.4	8.2	59	0
MAXIMUM	1120	33.0	1.8	87.5	1.94	1.80	26	42	6.0	8.8	65	0
MINIMUM	236	3.0	0.9	10.7	0.36	0.80	20	27	4.5	7.1	52	0

REMARKS:

CERTIFIED OPERATOR:

CERTIFICATE NUMBER: 4/5-80061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: November 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	970	11.0	1.1	60.0	1.11	1.00	24	30	5.8	8.0	54	0
02	980	12.0	1.2	78.9	1.45	1.20	25	34	5.7	8.2	52	0
03	1028	10.0	1.3	59.2	1.04	1.00	23	30	5.7	8.3	50	0
04	492	9.0	1.9	41.4	1.51	1.90	25	35	5.6	8.4	51	0
05	1154	12.0	0.9	92.0	1.44	1.40	25	34	5.7	8.3	55	0
06	810	9.0	0.9	58.2	1.29	1.40	26	32	5.7	8.0	63	0
07	1168	11.0	1.2	82.9	1.28	1.40	26	34	5.6	8.0	60	0
08	746	11.0	1.2	46.1	1.11	1.20	25	33	5.6	8.1	57	0
09	227	2.0	1.0	29.1	2.31	1.50	24	31	5.7	8.5	59	0
10	695	6.0	1.0	56.0	1.45	1.50	23	30	5.6	8.5	58	0
11	1065	9.0	1.0	76.1	1.29	1.10	22	28	5.6	8.5	56	0
12	1082	10.0	1.0	77.2	1.28	1.10	21	26	5.7	8.6	58	0
13	933	9.0	1.0	68.2	1.32	1.00	20	26	6.0	8.7	60	0
14	1149	8.0	1.0	55.7	0.87	1.00	21	27	6.0	8.5	59	0
15	890	10.0	1.1	71.9	1.45	1.40	20	26	5.8	8.6	61	0
16	908	8.0	1.0	69.4	1.38	1.10	20	27	5.6	8.5	63	0
17	1069	10.0	1.1	70.9	1.19	1.20	23	28	5.7	8.8	57	0
18	947	9.0	1.0	46.9	0.89	0.70	24	31	5.8	8.5	53	0
19	995	7.0	0.5	77.8	1.41	1.10	22	29	5.5	8.2	54	0
20	1615	14.0	1.0	75.4	0.84	0.90	20	27	5.7	7.9	58	0
21	612	3.0	1.0	84.1	2.47	1.80	21	25	5.6	7.8	57	0
22	965	9.0	1.2	67.6	1.26	1.10	22	23	5.7	8.0	56	0
23	969	11.0	1.4	57.8	1.07	0.80	23	24	5.7	8.0	55	0
24	1029	12.0	1.2	75.7	1.32	0.80	19	24	5.8	7.7	55	0
25	990	14.0	1.2	71.1	1.29	0.80	23	25	5.7	7.7	60	0
26	1207	10.0	1.1	110.4	1.65	1.00	21	24	5.8	7.9	57	0
27	1100	11.0	1.0	89.4	1.46	1.00	20	25	5.7	7.8	56	0
28	974	11.0	1.0	103.5	1.91	1.40	21	24	5.7	7.7	55	0
29	955	11.0	1.0	96.3	1.82	1.30	20	25	5.8	7.6	57	0
30	1000	11.0	1.1	101.6	1.83	1.20	21	25	5.8	8.4	61	0
TOTAL	28724	290.0	32.5	2150.8	42.00	35.30	670	842	171.4	245.7	1707	0
AVERAGE	957	9.7	1.1	71.7	1.40	1.18	22	28	5.7	8.2	57	0
MAXIMUM	1615	14.0	1.9	110.4	2.47	1.90	26	35	6.0	8.8	63	0
MINIMUM	227	2.0	0.5	29.1	0.84	0.70	19	23	5.5	7.6	50	0

REMARKS:

CERTIFIED OPERATOR: James D. Wilson

CERTIFICATE NUMBER: 415-80-0190

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: December 1998

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	1090	10.0	1.1	106.2	1.75	1.40	21	24	5.7	8.4	60	0
02	857	10.0	1.2	53.7	1.13	0.80	21	31	5.7	8.5	55	0
03	961	12.0	1.1	116.5	2.18	1.60	21	26	5.8	8.0	65	0
04	1016	10.0	1.0	124.7	2.21	1.60	21	26	5.7	8.6	64	0
05	1281	12.0	1.0	124.5	1.75	1.50	20	25	5.7	8.0	63	0
06	1008	6.0	1.0	110.2	1.97	1.60	20	25	5.8	7.9	64	0
07	988	11.0	1.1	91.4	1.67	1.30	20	26	5.7	7.7	65	0
08	1115	10.0	1.1	94.9	1.53	1.20	21	26	5.7	7.9	63	0
09	1031	9.0	1.1	95.7	1.67	1.20	20	25	5.8	8.4	59	0
10	1144	11.0	1.1	93.5	1.47	1.20	19	26	6.0	8.5	70	0
11	1035	9.0	1.1	84.4	1.47	1.00	19	24	5.7	8.7	65	0
12	1114	11.0	1.1	82.1	1.33	1.00	20	25	5.8	8.6	65	0
13	1286	13.0	1.1	103.6	1.45	0.90	21	25	5.7	8.5	64	0
14	847	7.0	1.2	36.5	0.78	0.80	22	26	5.7	8.6	67	0
15	1558	11.0	1.0	79.4	0.92	1.10	22	29	6.0	8.6	63	0
16	1463	10.0	1.0	81.6	1.00	1.10	20	26	5.9	8.5	64	0
17	1037	11.0	1.0	77.2	1.34	1.00	24	27	5.8	7.7	60	0
18	1145	10.0	1.0	78.0	1.23	1.10	21	25	6.1	7.5	64	0
19	1115	11.0	1.1	86.3	1.39	1.20	20	27	6.0	7.8	62	0
20	1062	6.0	1.0	75.8	1.28	1.00	21	29	5.9	8.0	63	0
21	63	6.0	1.2	42.9	12.26	0.50	22	33	5.8	9.2	60	0
22	748	8.0	1.2	79.8	1.92	1.30	20	31	5.9	7.7	62	0
23	1080	11.0	1.3	79.2	1.32	1.10	21	30	5.8	8.0	60	0
24	1039	13.0	1.3	85.4	1.48	1.20	20	31	5.8	8.0	64	0
25	1006	8.0	1.1	61.1	1.09	1.10	22	32	5.7	8.1	63	0
26	848	13.0	1.3	61.1	1.30	1.20	20	29	5.6	8.0	66	0
27	947	12.0	1.3	79.8	1.52	1.30	23	30	5.6	8.1	67	0
28	909	12.0	1.3	70.6	1.40	1.00	25	30	5.6	8.3	70	0
29	1021	13.0	1.3	76.7	1.35	1.10	25	29	5.7	8.6	60	0
30	1185	5.0	0.7	82.7	1.26	1.10	23	26	5.7	8.5	60	0
31	1171	7.0	0.9	82.9	1.27	1.10	20	26	5.9	8.9	61	0
TOTAL	32170	308.0	34.1	2598.4	55.68	35.60	655	850	179.3	255.8	1958	0
AVERAGE	1038	9.9	1.1	83.8	1.80	1.15	21	27	5.8	8.3	63	0
MAXIMUM	1558	13.0	1.3	124.7	12.26	1.60	25	33	6.1	9.2	70	0
MINIMUM	63	5.0	0.7	36.5	0.78	0.50	19	24	5.6	7.5	55	0

REMARKS: 18 BAGS OF LIME USED.
17 BAGS OF FLUORIDE USED.

Timothy P. Overly
CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: January 1999

	WATER TREATED	--- CHLORINE ---		---- FLUORIDE ----			-- ALKALINITY --		---- pH ----		---- CO2 ----	
	GALLONS		MG/L		MG/L	MG/L	MG/L		SU			
DATE	x1000	POUNDS USED	FREE RESIDUAL	GALS USED	CALC'D DOSAGE	DIST SYSTEM	TOTAL RAW	FINISHED	RAW	FINISHED	FREE RAW	FINISHED
01	1073	6.0	0.8	82.8	1.39	1.30	20	27	5.8	8.2	61	0
02	1006	9.0	1.0	77.1	1.38	1.20	22	26	5.7	8.3	62	0
03	1027	5.0	0.8	59.7	1.05	1.00	22	25	5.7	8.4	59	0
04	893	4.0	0.8	83.7	1.69	1.10	24	26	5.8	8.8	60	0
05	1043	7.0	0.7	72.3	1.25	1.10	23	27	5.7	8.5	61	0
06	1094	9.0	0.8	77.8	1.28	1.00	20	23	5.7	8.1	60	0
07	1118	8.0	0.9	89.0	1.43	1.10	21	26	5.7	8.0	63	0
08	1071	13.0	1.2	99.2	1.67	1.40	20	24	5.8	8.0	62	0
09	1173	13.0	1.2	93.5	1.43	1.20	20	25	5.7	8.1	61	0
10	1006	7.0	1.1	79.7	1.43	1.20	21	23	5.8	8.0	60	0
11	913	7.0	1.0	57.4	1.13	1.00	20	24	5.8	8.0	62	0
12	1052	12.0	1.1	81.8	1.40	1.20	21	24	5.8	8.1	57	0
13	1031	13.0	1.1	84.8	1.48	1.20	20	24	5.7	8.1	63	0
14	815	9.0	0.9	131.5	2.90	1.40	20	25	5.7	8.1	60	0
15	990	9.0	0.9	24.3	0.44	1.20	20	25	5.7	8.0	59	0
16	1059	6.0	0.8	72.6	1.23	1.20	20	24	5.8	8.0	62	0
17	1113	14.0	1.0	70.7	1.14	1.10	21	25	5.7	8.0	61	0
18	974	8.0	0.8	42.4	0.78	0.80	20	26	5.8	8.1	63	0
19	913	14.0	0.6	64.9	1.28	1.10	20	26	5.8	8.0	63	0
20	1012	14.0	1.4	68.4	1.22	1.10	21	28	5.7	8.0	63	0
21	1030	11.0	1.3	64.4	1.13	1.00	20	27	5.8	8.3	64	0
22	1023	10.0	1.3	55.3	0.97	0.90	23	28	5.7	8.4	60	0
23	1043	12.0	1.3	71.4	1.23	1.10	21	27	5.8	8.4	61	0
24	1065	10.0	1.3	70.7	1.19	1.00	22	26	5.8	8.2	60	0
25	936	11.0	1.3	46.7	0.90	0.90	20	27	5.7	8.0	62	0
26	956	10.0	1.0	65.6	1.24	1.00	21	26	5.9	8.1	61	0
27	1110	13.0	1.1	84.8	1.38	1.00	20	26	5.8	8.0	65	0
28	1172	14.0	1.1	61.9	0.95	0.90	21	27	5.8	8.3	63	0
29	1140	8.0	0.9	75.6	1.19	1.00	20	23	5.7	8.5	62	0
30	963	6.0	0.9	54.4	1.02	0.90	20	25	5.8	8.3	63	0
31	999	7.0	0.9	72.3	1.30	1.10	21	26	5.7	8.2	61	0
TOTAL	31813	299.0	31.0	2236.7	39.50	33.70	645	791	178.4	253.5	1904	0
AVERAGE	1026	9.6	1.0	72.2	1.27	1.09	21	26	5.8	8.2	61	0
MAXIMUM	1173	14.0	1.4	131.5	2.90	1.40	24	28	5.9	8.8	65	0
MINIMUM	815	4.0	0.6	24.3	0.44	0.80	20	23	5.7	8.0	57	0

REMARKS: TEN BAGS OF LIME USED.
THIRTEEN BAGS OF FLUORIDE USED.

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 COUNTY: SHELBY
MONTH OF: February 1999

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	886	8.0	0.9	53.5	1.09	1.00	20	24	5.7	8.3	60	0
02	1165	6.0	0.8	71.3	1.10	1.00	21	27	5.8	8.0	62	0
03	977	13.0	1.2	63.4	1.17	1.10	27	30	5.7	7.9	65	0
04	---	---	---	---	---	---	---	---	---	---	---	---
05	2092	20.0	1.3	129.9	1.12	1.00	22	26	5.7	8.4	63	0
06	1066	11.0	1.1	72.5	1.22	1.20	21	26	5.7	8.2	64	0
07	1079	12.0	1.2	72.3	1.21	1.20	23	27	5.6	8.0	64	0
08	1039	10.0	1.1	63.0	1.09	1.10	25	27	5.6	7.9	65	0
09	1079	11.0	1.1	71.3	1.19	1.00	24	23	5.7	8.3	63	0
10	1080	12.0	1.1	66.8	1.11	1.00	25	25	5.7	8.0	64	0
11	1033	12.0	1.1	63.2	1.10	1.00	17	20	5.8	8.2	65	0
12	1020	10.0	1.1	54.7	0.97	1.00	16	18	5.8	7.4	63	0
13	1120	11.0	1.1	75.4	1.21	1.10	16	19	5.7	7.6	62	0
14	942	12.0	1.1	50.4	0.96	1.00	17	20	5.7	7.5	61	0
15	842	7.0	1.1	63.7	1.36	1.10	17	20	5.6	7.3	63	0
16	1068	5.0	0.8	74.0	1.25	1.00	17	19	5.7	7.3	63	0
17	1084	7.0	0.9	58.2	0.97	1.00	16	18	5.7	7.4	62	0
18	1095	10.0	1.1	72.1	1.19	1.00	16	17	5.7	7.4	64	0
19	1038	12.0	1.1	72.4	1.26	1.00	17	19	5.8	7.3	63	0
20	1185	12.0	1.1	74.8	1.14	1.00	16	18	5.7	7.4	62	0
21	916	11.0	1.1	55.0	1.08	1.00	17	20	5.7	7.4	60	0
22	1029	10.0	1.1	67.1	1.17	1.00	18	19	5.6	7.2	61	0
23	1023	11.0	1.2	64.4	1.13	1.00	17	19	5.6	7.3	60	0
24	1145	12.0	1.0	71.7	1.13	1.00	18	18	5.7	7.2	61	0
25	1009	13.0	1.1	68.5	1.22	1.00	16	19	5.6	7.3	62	0
26	976	9.0	1.0	59.4	1.10	1.00	18	21	5.6	7.3	63	0
27	1123	8.0	1.0	71.7	1.15	1.10	17	20	5.7	7.4	61	0
28	1002	7.0	1.0	63.0	1.13	1.10	16	21	5.7	7.4	62	0
TOTAL	29113	282.0	29.0	1843.7	30.81	28.00	510	560	153.6	206.3	1688	0
AVERAGE	1078	10.4	1.1	68.3	1.14	1.04	19	21	5.7	7.6	63	0
MAXIMUM	2092	20.0	1.3	129.9	1.36	1.20	27	30	5.8	8.4	65	0
MINIMUM	842	5.0	0.8	50.4	0.96	1.00	16	17	5.6	7.2	60	0

REMARKS: 02/05/99 IS A TWO DAY TOTAL.
10 BAGS OF LIME USED.
9 BAGS OF FLUORIDE USED.

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
Monthly Operation Report

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE — PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 — COUNTY: SHELBY
MONTH OF: March 1999

DATE	WATER TREATED GALLONS x1000	--- CHLORINE --- POUNDS USED	MG/L FREE RESIDUAL	---- FLUORIDE ---- GALS USED	MG/L CALC'D DOSAGE	MG/L DIST SYSTEM	-- ALKALINITY -- MG/L TOTAL RAW	FINISHED	---- pH ---- SU RAW	FINISHED	---- CO2 ---- FREE RAW	FINISHED
01	946	8.0	1.1	59.0	1.12	1.00	17	21	5.6	7.4	60	0
02	1113	11.0	1.1	72.0	1.16	1.00	19	22	5.6	7.4	61	0
03	962	8.0	1.0	63.7	1.19	1.00	18	24	5.7	9.0	60	0
04	1031	8.0	1.1	65.3	1.14	1.00	19	23	5.7	7.5	62	0
05	1106	10.0	1.1	68.3	1.11	1.00	19	21	5.8	7.4	60	0
06	1078	11.0	1.2	64.5	1.08	1.00	18	22	5.7	7.4	60	0
07	1076	7.0	1.0	67.5	1.13	1.00	17	21	5.7	7.3	61	0
08	926	8.0	0.9	59.6	1.16	0.90	18	20	5.6	7.3	60	0
09	1042	8.0	0.9	68.9	1.19	1.00	19	24	5.6	8.5	62	0
10	1026	10.0	1.3	59.9	1.05	1.00	18	24	5.7	8.5	60	0
11	1036	12.0	1.3	68.3	1.19	1.00	19	20	5.7	7.5	58	0
12	1030	25.0	1.4	63.9	1.12	1.00	18	21	5.8	7.4	59	0
13	1105	4.0	1.1	72.9	1.19	1.00	19	20	5.7	7.4	60	0
14	1032	14.0	1.2	64.6	1.13	1.00	18	22	5.7	7.3	59	0
15	950	11.0	1.2	73.4	1.39	0.90	17	20	5.6	7.2	62	0
16	1004	11.0	0.7	45.5	0.82	0.80	18	20	5.7	7.3	60	0
17	1061	13.0	1.2	68.4	1.16	1.00	18	22	5.7	7.3	64	0
18	1028	11.0	1.3	63.8	1.12	1.00	17	20	5.6	7.3	63	0
19	1036	21.0	1.3	67.7	1.18	1.00	19	22	5.7	7.5	64	0
20	1122	3.0	1.1	68.4	1.10	1.00	18	22	5.8	7.4	63	0
21	973	10.0	1.3	59.5	1.10	1.00	17	21	5.7	7.4	63	0
22	1011	11.0	1.2	68.5	1.22	1.00	18	24	5.7	8.4	62	0
23	1036	14.0	1.2	67.9	1.18	1.00	19	22	5.8	8.0	63	0
24	1051	15.0	1.1	63.9	1.09	1.00	17	25	5.8	8.4	58	0
25	1183	10.0	0.8	76.7	1.17	1.00	19	25	5.7	8.5	63	0
26	1115	9.0	1.0	68.0	1.10	1.00	19	24	5.8	8.4	60	0
27	961	9.0	1.2	64.2	1.20	1.10	18	23	5.7	8.4	59	0
28	1044	10.0	1.2	64.7	1.12	1.00	17	24	5.6	8.3	61	0
29	976	10.0	1.3	63.8	1.18	1.00	18	24	5.6	8.3	60	0
30	1028	8.0	1.1	60.1	1.05	1.00	17	23	5.7	8.3	59	0
31	962	11.0	1.1	63.2	1.18	1.10	17	22	5.8	8.3	59	0
TOTAL	32050	331.0	35.0	2026.1	35.30	30.80	559	688	176.6	242.0	1885	0
AVERAGE	1034	10.7	1.1	65.4	1.14	0.99	18	22	5.7	7.8	61	0
MAXIMUM	1183	25.0	1.4	76.7	1.39	1.10	19	25	5.8	9.0	64	0
MINIMUM	926	3.0	0.7	45.5	0.82	0.80	17	20	5.6	7.2	58	0

REMARKS: 13 BAGS OF LIME USED.
14 BAGS OF FLUORIE USED.

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE — PWSID: 0000126
NAME OF WATER TREATMENT PLANT: WATER PLANT #2 — COUNTY SHELBY

MONTH OF: APRIL, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1045	10	1.13	68.4	1.18	1.00	18	24	5.7	8.2	60	0
2	1029	10	1.23	63.5	1.11	1.00	17	22	5.6	8.5	63	0
3	1135	11	1.25	72.5	1.15	1.00	18	21	5.6	8.1	62	0
4	940	6	0.80	55.7	1.07	1.00	18	20	5.7	8.1	62	0
5	1024	8	0.84	67.0	1.18	1.00	17	20	5.7	8.0	63	0
6	1039	10	1.21	63.8	1.10	1.00	19	23	5.6	8.2	61	0
7	1058	10	1.10	67.1	1.14	1.00	18	23	5.7	8.4	60	0
8	1064	12	1.16	77.9	1.32	1.00	19	23	5.7	8.3	62	0
9	1119	11	1.09	61.8	0.99	0.90	20	23	5.6	8.4	64	0
10	1088	12	1.09	66.9	1.11	1.00	19	24	5.7	8.4	63	0
11	973	10	0.99	63.2	1.17	1.00	19	24	5.7	8.5	62	0
12	1063	5	0.90	66.1	1.12	1.00	18	25	5.7	8.6	63	0
13	1077	7	0.77	66.6	1.11	1.00	18	21	5.6	8.1	61	0
14	1060	9	1.10	62.9	1.07	1.00	19	22	5.6	8.0	62	0
15	1037	8	1.00	63.6	1.10	1.00	18	23	5.6	8.0	62	0
16	1027	8	1.00	66.2	1.16	1.10	18	22	5.7	8.0	60	0
17	1135	9	1.00	71.0	1.12	1.10	17	23	5.7	8.0	62	0
18	1030	9	1.00	63.2	1.10	1.00	17	23	5.6	8.1	64	0
19	970	9	1.00	63.4	1.18	1.00	16	24	5.7	8.0	67	0
20	1127	11	1.13	72.2	1.15	1.00	17	24	5.6	7.8	64	0
21	1111	12	1.20	63.6	1.03	1.00	16	23	5.7	8.5	65	0
22	1128	6	0.90	71.4	1.14	1.00	18	22	5.7	8.2	62	0
23	1082	8	1.02	67.4	1.12	1.00	18	20	5.6	8.0	60	0
24	1179	8	1.00	79.3	1.21	1.10	17	22	5.6	8.0	60	0
25	1060	9	1.00	66.6	1.13	1.00	17	21	5.7	8.0	61	0
26	1055	9	0.96	67.9	1.16	0.90	18	24	5.6	7.9	62	0
27	979	10	1.08	54.6	1.00	1.00	17	23	5.6	8.0	60	0
28	1073	8	1.02	66.2	1.11	1.00	18	25	5.6	7.7	61	0
29	1063	10	1.08	64.3	1.09	1.00	18	22	5.7	7.8	64	0
30	1134	11	1.02	64.5	1.02	1.00	17	24	5.7	8.0	63	0
31												
TOTAL	31904	276	31.07	1988.8	33.64	30.1	534	680	169.6	243.8	1865	0
AVG	1063.5	9.20	1.04	66.3	1.12	1.00	17.8	22.7	5.65	8.13	62.2	0
MAX	1179	12	1.25	79.3	1.32	1.1	20	25	5.7	8.6	67	0
MIN	940	5	0.77	54.6	0.99	0.9	16	20	5.6	7.7	60	0

Tim Overly

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: MAY, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1071	11	1.00	62.5	1.05	1.00	17	22	5.7	8.0	63	0
2	1086	10	1.00	63.0	1.04	1.00	18	23	5.6	7.9	64	0
3	1193	10	1.00	55.0	0.83	0.90	18	22	5.6	7.7	65	0
4	461	7	1.20	34.4	1.34	0.90	16	21	5.7	8.1	63	0
5	1108	10	1.00	63.2	1.03	1.00	17	21	5.7	8.2	64	0
6	989	10	0.90	69.5	1.26	1.00	18	21	5.8	8.3	63	0
7	1142	12	0.70	56.5	0.89	0.80	18	19	5.7	8.0	61	0
8	739	13	0.80	42.2	1.03	1.00	16	21	5.6	7.9	61	0
9	856	4	0.70	60.4	1.27	0.80	15	22	5.6	7.7	62	0
10	1014	2	0.70	49.0	0.86	1.00	15	23	5.7	8.5	61	0
11	1148	7	0.80	63.4	0.99	1.00	17	21	5.7	8.5	61	0
12	1021	6	0.70	62.9	1.11	1.10	16	22	5.6	8.3	60	0
13	1042	8	0.90	67.2	1.16	1.10	18	24	5.5	8.0	64	0
14	1058	9	1.00	67.3	1.14	1.00	17	23	5.6	8.0	63	0
15	1162	10	1.00	71.5	1.10	1.00	18	24	5.7	8.0	62	0
16	1172	12	1.00	67.7	1.04	0.90	16	22	5.6	7.8	62	0
17	1029	11	1.00	63.6	1.11	1.00	17	21	5.7	8.0	63	0
18	1084	11	1.00	71.4	1.18	1.00	18	23	5.7	7.6	61	0
19	1047	11	1.00	70.0	1.20	1.10	17	22	5.7	8.0	63	0
20	1061	12	1.10	76.9	1.30	1.00	16	21	5.6	7.9	62	0
21	1110	14	1.10	61.6	1.00	1.00	18	22	5.6	8.0	64	0
22	1109	17	1.10	71.4	1.16	1.00	16	24	5.5	8.1	60	0
23	1117	17	1.00	67.7	0.99	1.00	19	22	5.7	8.3	64	0
24	1005	11	0.30	65.3	1.17	1.00	19	20	5.7	8.3	62	0
25	968	17	1.30	54.6	1.01	1.40				8.3		0
26	598	2	1.20	50.2	1.51	1.00				8.1		0
27	1201	14	1.20	71.1	1.06	1.00		22	5.5	7.7		0
28	1095	14	1.10	67.0	1.10	1.10	16	20	5.6	7.8	64	0
29	1140	16	1.20	71.5	1.13	1.00	17	21	5.6	7.9	63	0
30	1113	14	1.10	72.0	1.16	1.00	17	20	5.7	8.0	64	0
31	978	10	1.00	58.7	1.08	1.00	18	21	5.6	8.1	62	0
TOTAL	31917	332	30.1	1948.7	34.3	31.1	478	630	163.6	249	1751	0
AVG	1029.6	10.71	0.97	62.9	1.11	1.00	17.1	21.7	5.64	8.03	62.5	0
MAX	1201	17	1.3	76.9	1.51	1.4	19	24	5.8	8.5	65	0
MIN	461	2	0.3	34.4	0.83	0.8	15	19	5.5	7.6	60	0

Tim Overly

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: JUNE+AH113, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1148	11	0.90	67.5	1.06	1.10	-	33	-	8.2	-	0
2	1035	23	0.80	67.6	1.18	1.00	-	21	-	8.1	-	0
3	1097	10	1.30	67.4	1.11	1.00	19	22	5.6	8.0	63	0
4	1135	4	1.00	63.7	1.04	1.00	-	22	-	8.0	-	0
5	1100	14	1.40	82.1	1.34	1.10	-	21	-	7.9	-	0
6	1101	14	1.50	57.4	0.94	1.10	-	20	-	8.0	-	0
7	1100	18	1.50	71.1	1.16	1.00	-	22	-	7.0	-	0
8	1166	16	1.40	82.0	1.26	1.10	-	31	-	8.1	-	0
9	1037	28	1.00	53.3	0.92	1.10	17	19	5.7	6.7	50	0
10	782	8	1.80	54.5	1.25	1.10	-	20	-	6.8	-	0
11	1147	20	1.50	54.2	0.85	0.80	-	17	-	7.2	-	0
12	1022	6	1.30	62.6	1.10	1.00	-	21	-	7.8	-	0
13	1003	26	1.30	67.2	1.21	1.00	-	21	-	6.0	-	0
14	650	6	1.50	33.5	0.92	1.30	-	23	-	8.2	-	0
15	944	18	1.40	11.2	0.21	1.20	-	21	-	7.9	-	0
16	1106	23	0.90	132.9	2.16	1.00	-	25	-	8.2	-	0
17	1153	20	2.00	56.8	0.88	1.30	-	22	-	7.7	-	0
18	587	8	1.80	62.7	1.92	1.00	-	24	-	8.1	-	0
19	1442	10	1.00	63.0	0.79	1.00	-	24	-	8.0	-	0
20	1054	11	1.10	70.1	1.20	1.00	-	23	-	8.0	-	0
21	1062	14	1.50	63.1	1.07	1.10	-	24	-	7.8	-	0
22	1006	17	2.10	64.9	1.16	1.30	-	21	-	7.7	-	0
23	873	14	1.60	59.4	1.22	1.00	-	18	-	7.7	-	0
24	1031	4	1.40	57.5	1.00	1.00	-	23	-	8.7	-	0
25	1081	22	0.80	59.2	0.98	1.00	17	20	5.8	8.6	47	0
26	1050	4	0.50	67.1	1.15	1.00	-	21	-	8.5	-	0
27	1051	8	1.20	63.8	1.09	1.00	-	26	-	8.0	-	0
28	1031	13	1.40	63.9	1.11	1.00	-	22	-	7.9	-	0
29	1050	17	1.20	63.2	1.08	0.90	-	17	-	7.9	-	0
30	1079	16	1.40	63.4	1.05	1.00	-	19	-	8.1	-	0
31												
TOTAL	31123	423	39.5	1906.3	33.41	31.5	53	663	17.1	234.8	160	0
AVG	1037.4	14.10	1.32	63.5	1.11	1.05	17.7	22.1	5.70	7.83	53.3	0
MAX	1442	28	2.1	132.9	2.16	1.3	19	33	5.8	8.7	63	0
MIN	587	4	0.5	11.2	0.21	0.8	17	17	5.6	6	47	0

Tim Overly

CERTIFIED OPERATOR: TIM OVERLY

CERTIFICATE NUMBER: 587-90-0460

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: JULY, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1107	16	1.30	67.0	1.08	1.00		19		7.9		0
2	1138	16	1.40	66.3	1.04	0.90	18	20	5.6	8.0	60	0
3	1123	16	1.40	60.4	0.96	0.90		20		8.0		0
4	1083	12	1.40	67.6	1.12	1.00		23		8.0		0
5	974	14	1.40	63.1	1.16	1.00		20		8.0		0
6	1190	15	0.70	68.8	1.04	0.90		22		7.9		0
7	102	17	0.90	63.2	1.12	1.00		45		8.6		0
8	2016	6	0.80	63.7	0.56	1.00	28	21		8.7	60	0
9	1153	14	0.80	67.7	1.09	1.00		20	5.8	8.5		0
10	1023	6	1.00	66.8	1.12	1.00		20		8.1		0
11	1039	2	0.40	62.7	1.09	1.00		22		8.9		0
12	1053	7	1.00	58.9	1.00	1.00		24		8.4		0
13	1065	11	1.70	67.6	1.14	1.10		20		7.6		0
14	1097	16	1.30	69.0	1.13	1.00		21		7.5		0
15	1111	14	1.50	59.0	0.95	0.90	17	19		7.6	47	0
16	1108	14	1.50	52.9	0.85	0.90		20	5.9	8.0		0
17	1068	18	1.50	63.1	1.06	1.00		21		7.8		0
18	1057	14	1.20	58.9	1.00	1.00		20		8.0		0
19	1111	16	1.60	59.1	0.96	0.90		24		8.0		0
20	1020	16	1.40	55.0	0.97	1.00		19		8.2		0
21	1120	16	1.30	63.2	1.01	0.90		20		7.8		0
22	1089	10	0.60	63.4	1.04	0.90	14	20	5.6	8.5	41	0
23	1130	12	1.00	59.3	0.94	1.00		19		7.8		0
24	1048	14	0.90	59.6	1.02	0.90		21		8.4		0
25	1107	7	1.00	63.4	1.03	0.80		19		8.3		0
26	1014	14	1.20	58.7	1.04	0.70		18		7.7		0
27	1048	19	1.20	64.4	1.10	1.00		19		8.1		0
28	1092	16	1.00	53.3	0.87	1.00	16	18	5.8	7.9	47	0
29	1043	12	1.00	55.0	0.94	1.00		18		8.4		0
30	1127	10	1.00	63.2	1.00	1.00		18		8.3		0
31	1067	10	1.00	59.0	0.99	1.00		19		8.5		0
TOTAL	33523	400	35.4	1923.3	31.42	29.7	93	649	28.7	251.4	255	0
AVG	1081.4	12.90	1.14	62.0	1.01	0.96	18.6	20.9	5.74	8.11	51.0	0
MAX	2016	19	1.7	69	1.16	1.1	28	45	5.9	8.9	60	0
MIN	102	2	0.4	52.9	0.56	0.7	14	18	5.6	7.5	41	0

CERTIFIED OPERATOR: JAMES MATTHEWS

CERTIFICATE NUMBER: 411-31-0061

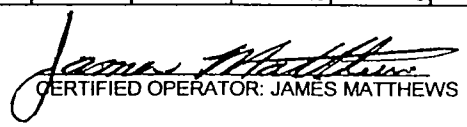
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: AUGUST, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1149	10	1.00	62.9	0.99	1.00	0	19	0.0	8.5	0	0
2	1067	12	1.40	62.8	1.06	1.00	0	18	0.0	8.0	0	0
3	1053	12	0.80	58.7	1.00	1.00	0	25	0.0	8.4	0	0
4	2137	32	0.80	58.9	0.33	1.10	0	18	0.0	8.4	0	0
5	97	16	1.30	59.2	1.01	1.10	19	21	5.7	8.2	53	0
6	1068	12	1.30	63.1	1.06	1.00	0	20	0.0	8.3	0	0
7	1086	14	1.30	59.4	0.98	1.10	0	21	0.0	8.0	0	0
8	1078	12	1.30	63.2	1.05	1.00	0	19	0.0	8.0	0	0
9	938	12	1.10	54.3	1.04	1.10	0	19	0.0	8.1	0	0
10	1078	14	1.10	62.8	1.04	1.00	0	18	0.0	8.1	0	0
11	899	10	1.10	47.5	0.95	1.00	0	18	0.0	8.3	0	0
12	893	6	1.00	49.6	1.00	1.10	0	19	0.0	8.3	0	0
13	874	12	0.90	50.3	1.03	1.00	20	17	5.6	8.3	51	0
14	1178	12	0.90	58.5	0.89	1.00	0	17	0.0	8.2	0	0
15	638	6	0.90	41.5	1.17	1.10	0	18	0.0	8.4	0	0
16	954	11	1.40	54.1	1.02	1.00	0	19	0.0	7.8	0	0
17	1029	19	1.30	59.1	1.03	1.00	0	19	0.0	7.7	0	0
18	1121	16	1.30	62.7	1.00	1.00	0	23	0.0	7.7	0	0
19	992	16	1.20	32.2	0.58	0.90	13	18	5.7	7.9	57	0
20	1180	10	1.20	54.5	0.83	0.90	0	22	0.0	7.9	0	0
21	671	6	1.00	37.3	1.00	0.90	0	21	0.0	8.1	0	0
22	844	9	1.00	41.6	0.89	1.00	0	17	0.0	7.8	0	0
23	1193	9	1.20	53.2	0.80	0.90	0	18	0.0	7.8	0	0
24	839	16	1.40	43.6	0.93	0.90	0	22	0.0	7.6	0	0
25	1105	16	1.30	54.3	0.88	0.90	0	21	0.0	7.7	0	0
26	1070	14	1.40	64.4	1.07	0.90	0	23	0.0	7.6	0	0
27	1099	18	1.30	50.1	0.82	1.00	18	18	5.7	7.8	53	0
28	1059	14	0.90	44.4	0.75	1.00	0	23	0.0	7.9	0	0
29	1111	6	1.00	49.9	0.80	0.90	0	20	0.0	8.0	0	0
30	1200	9	0.80	64.8	0.97	0.90	0	18	0.0	8.0	0	0
31	743	12	1.40	31.7	0.76	1.00	0	22	0.0	7.8	0	0
TOTAL	31443	393	35.3	1650.6	28.73	30.7	70	611	22.7	248.6	214	0
AVG	1014.3	12.68	1.14	53.2	0.93	0.99	2.3	19.7	0.73	8.02	6.9	0
MAX	2137	32	1.4	64.8	1.17	1.1	20	25	5.7	8.5	57	0
MIN	97	6	0.8	31.7	0.33	0.9	0	17	0	7.6	0	0



CERTIFIED OPERATOR: JAMES MATTHEWS

CERTIFICATE NUMBER: 411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: SEPTEMBER, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1218	14	1.50	58.5	0.86	1.00	0	18	0.0	7.7	0	0
2	957	18	1.50	46.9	0.95	1.00	19	21	5.6	7.6	52	0
3	824	12	1.50	52.4	1.14	1.00	0	16	0.0	7.9	0	0
4	993	16	1.30	50.2	0.90	0.90	0	17	0.0	7.8	0	0
5	947	11	1.40	36.6	0.69	0.90	0	17	0.0	7.7	0	0
6	1047	9	1.20	50.7	0.87	0.90	0	18	0.0	8.0	0	0
7	1213	20	1.50	54.4	0.80	0.90	0	23	0.0	7.9	0	0
8	1043	26	1.50	50.6	0.87	0.90	0	17	0.0	7.7	0	0
9	1031	26	1.00	54.2	0.94	0.90	12	20	5.7	8.3	67	0
10	947	20	1.00	64.1	1.21	0.90	0	19	0.0	7.7	0	0
11	979	2	1.00	36.2	0.66	0.90	0	17	0.0	8.0	0	0
12	1124	7	1.20	50.1	0.80	1.00	0	19	0.0	7.9	0	0
13	883	10	1.30	50.7	1.03	1.00	0	18	0.0	7.7	0	0
14	1145	17	1.00	54.0	0.84	1.00	0	21	0.0	7.7	0	0
15	876	10	0.70	50.5	1.03	1.00	0	20	0.0	8.2	0	0
16	1090	8	0.60	54.4	0.89	1.00	17	19	5.7	8.8	50	0
17	1067	2	1.40	64.6	1.08	1.00	0	22	0.0	8.1	0	0
18	1083	22	1.40	48.0	0.79	1.00	0	17	0.0	7.9	0	0
19	1132	10	1.20	60.7	0.97	1.00	0	19	0.0	8.1	0	0
20	902	9	1.30	48.9	0.97	0.90	0	17	0.0	7.9	0	0
21	1051	13	1.20	54.5	0.93	1.00	0	17	0.0	8.0	0	0
22	1085	10	1.10	49.7	0.82	1.10	0	18	0.0	8.0	0	0
23	1147	12	1.10	68.3	1.07	1.10	16	17	5.9	8.2	53	0
24	1053	12	1.10	44.0	0.75	1.00	0	17	0.0	8.0	0	0
25	1103	14	1.10	58.6	0.95	1.00	0	18	0.0	7.9	0	0
26	1318	14	1.10	62.7	0.85	0.90	0	17	0.0	8.0	0	0
27	987	12	1.20	49.8	0.91	1.00	0	17	0.0	7.9	0	0
28	927	20	0.60	54.7	1.06	1.00	0	19	0.0	8.4	0	0
29	1037	8	1.10	68.6	1.10	1.00	0	17	0.0	7.9	0	0
30	1075	10	1.00	34.9	0.58	1.00	19	21	5.7	8.0	52	0
31												
TOTAL	31284	394	35.1	1582.5	27.31	29.2	83	553	28.6	238.9	274	0
AVG	1042.8	13.13	1.17	52.8	0.91	0.97	2.8	18.4	0.95	7.96	9.1	0
MAX	1318	26	1.5	68.6	1.21	1.1	19	23	5.9	8.8	67	0
MIN	824	2	0.6	34.9	0.58	0.9	12	16	5.6	7.6	50	0

CERTIFIED OPERATOR:JAMES MATTHEWS

CERTIFICATE NUMBER: 411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: OCTOBER, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1164	10	0.90	57.9	0.94	1.00	0	18	0.0	8.0	0	0
2	977	10	1.10	68.2	1.25	1.00	0	17	0.0	8.0	0	0
3	1058	10	1.20	43.1	0.73	1.00	0	18	0.0	8.1	0	0
4	1148	10	1.00	54.5	0.85	1.00	0	18	0.0	8.0	0	0
5	1006	12	1.20	57.5	1.02	1.00	0	18	0.0	8.1	0	0
6	1109	10	1.10	63.4	1.02	1.10	0	19	0.0	8.0	0	0
7	1086	12	1.18	48.1	0.79	1.00	15	20	5.7	8.1	57	0
8	1094	12	1.20	55.0	0.90	0.90	0	20	0.0	8.2	0	0
9	1049	12	1.10	53.9	0.92	1.00	0	20	0.0	8.2	0	0
10	957	12	1.10	49.8	0.93	0.90	0	18	0.0	8.3	0	0
11	1078	5	0.90	57.7	0.96	0.90	0	20	0.0	8.9	0	0
12	1135	17	0.60	53.6	0.85	1.00	0	18	0.0	8.6	0	0
13	1031	8	1.04	54.3	0.94	0.90	0	21	0.0	8.2	0	0
14	1039	8	1.00	68.0	1.17	1.00	18	20	5.7	8.1	51	0
15	1080	18	0.60	51.4	0.85	1.00	0	19	0.0	8.6	0	0
16	1072	2	0.65	62.7	1.05	1.00	0	23	0.0	8.4	0	0
17	1020	2	0.60	57.9	1.02	1.00	0	18	0.0	8.3	0	0
18	1103	10	1.20	61.3	1.00	1.00	0	17	0.0	7.7	0	0
19	1063	12	1.23	57.9	0.98	1.00	0	18	0.0	7.8	0	0
20	982	10	1.01	55.8	1.02	1.20	0	31	0.0	7.7	0	0
21	1170	11	1.20	64.6	0.99	1.10	0	19	0.0	7.9	0	0
22	1070	17	1.54	68.8	1.15	1.10	15	19	5.7	7.8	60	0
23	1060	16	1.54	49.0	0.83	0.90	0	17	0.0	7.9	0	0
24	1064	12	1.10	62.1	1.05	1.10	0	19	0.0	8.0	0	0
25	1176	2	0.80	66.8	1.02	0.80	0	20	0.0	8.5	0	0
26	1006	16	1.27	55.1	0.98	0.90	0	19	0.0	7.8	0	0
27	1057	10	1.30	73.5	1.25	1.10	0	16	0.0	7.3	0	0
28	1082	12	1.21	75.9	1.26	1.1	16.0	17.0	5.7	7.2	56	0
29	1092	14	1.07	79.1	1.3	1.1	0.0	16.0	0	7.4	0	0
30	1045	12	1.13	67.4	1.16	1.1	0.0	16.0	0	7.3	0	0
31	1056	12	1.30	74.0	1.26	1.1	0.0	25.0	0	9.7	0	0
TOTAL	33129	336	33.37	1868	31.44	31.3	64	594	22.8	250.1	224	0
AVG	1068.7	10.84	1.08	60.3	1.01	1.01	2.1	19.2	0.74	8.07	7.2	0
MAX	1176	18	1.54	79.1	1.3	1.2	18	31	5.7	9.7	60	0
MIN	957	2	0.6	43.1	0.73	0.8	15	16	5.7	7.2	51	0

CERTIFIED OPERATOR:JAMES MATTHEWS

CERTIFICATE NUMBER:411-31-0061

CERTIFICATE NUMBI ER : 411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: NOVEMBER, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1098	14	1.30	62.9	1.03	0.90	0	16	0.0	7.4	0	0
2	1132	16	1.20	58.2	0.92	0.90	0	24	0.0	9.2	0	0
3	1080	14	1.20	70.5	1.17	1.00	0	18	0.0	7.6	0	0
4	991	18	1.20	70.9	1.28	1.10	16	18	5.8	7.4	52	0
5	1061	18	1.30	67.0	1.13	1.00	0	17	0.0	7.3	0	0
6	1038	2	0.50	70.9	1.22	1.10	0	18	0.0	7.2	0	0
7	212	3	0.60	26.6	2.25	1.00	0	17	0.0	7.4	0	0
8	1076	10	1.20	52.9	0.88	1.10	0	17	0.0	7.2	0	0
9	1068	12	1.30	71.1	1.19	1.00	0	20	0.0	8.2	0	0
10	1050	11	1.30	70.1	1.20	1.10	0	21	0.0	8.5	0	0
11	1042	12	1.10	62.6	1.08	1.10	15	17	5.8	7.7	60	0
12	1021	12	1.30	70.4	1.24	1.10	0	19	0.0	8.5	0	0
13	981	10	1.30	72.6	1.33	1.10	0	18	0.0	7.1	0	0
14	1017	10	1.30	52.5	0.93	1.00	0	17	0.0	7.1	0	0
15	1131	13	1.30	66.7	1.06	1.00	0	16	0.0	7.2	0	0
16	1019	17	1.30	62.8	1.10	1.10	0	21	0.0	8.9	0	0
17	1080	14	1.30	70.3	1.17	1.10	0	18	0.0	7.5	0	0
18	1080	24	0.50	63.0	1.05	1.10	15	19	5.8	7.6	58	0
19	1252	10	1.30	67.0	0.96	1.10	0	17	0.0	7.1	0	0
20	896	14	1.30	77.5	1.55	1.00	0	18	0.0	7.1	0	0
21	1039	10	1.30	52.5	0.90	1.00	0	15	0.0	7.2	0	0
22	1185	13	1.30	71.0	1.08	1.00	0	17	0.0	7.4	0	0
23	1032	15	1.30	63.0	1.09	1.20	0	17	0.0	7.2	0	0
24	1035	14	1.30	58.4	1.01	1.00	0	17	0.0	7.5	0	0
25	1051	11	1.40	61.9	1.06	1.00	0	16	0.0	7.3	0	0
26	1091	19	1.40	58.9	0.97	1.00	16	18	5.8	7.2	54	0
27	1247	12	1.30	58.2	0.84	1.00	0	20	0.0	7.2	0	0
28	839	12	1.30	55.1	1.18	1.1	0.0	21.0	0	7.3	0	0
29	1081	14	1.30	62.4	1.04	1.0	0.0	16.0	0	7.2	0	0
30	878	6	0.60	61.9	1.27	0.9	0.0	17.0	0	7.3	0	0
31												
TOTAL	30803	380	35.6	1889.8	34.18	31.1	62	540	23.2	226	224	0
AVG	1026.8	12.67	1.19	63.0	1.14	1.04	2.1	18.0	0.77	7.53	7.5	0
MAX	1252	24	1.4	77.5	2.25	1.2	16	24	5.8	9.2	60	0
MIN	212	2	0.5	26.6	0.84	0.9	15	15	5.8	7.1	52	0

CERTIFIED OPERATOR : JAMES MATTHEWS

CERTIFICATE NUMBI ER : 411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: DECEMBER, 1999

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1416	2	1.10	58.5	0.74	0.90	0	15	0.0	7.1	0	0
2	931	10	1.30	69.2	1.33	1.00	15	17	5.7	7.4	60	0
3	1053	12	1.30	59.4	1.01	1.00	0	16	0.0	7.1	0	0
4	1081	12	1.30	52.6	0.87	1.00	0	16	0.0	7.1	0	0
5	1019	10	1.20	51.1	0.90	1.00	0	16	0.0	7.3	0	0
6	1022	9	1.10	57.5	1.01	1.00	0	18	0.0	7.6	0	0
7	1071	13	1.10	62.4	1.04	1.10	0	19	0.0	7.6	0	0
8	1057	10	1.00	54.8	0.93	1.00	0	16	0.0	7.2	0	0
9	1054	12	1.10	63.1	1.07	1.00	13	18	5.7	7.3	55	0
10	1070	10	1.10	69.3	1.16	1.00	0	15	0.0	7.2	0	0
11	1047	14	1.10	58.1	0.99	1.00	0	17	0.0	7.2	0	0
12	1054	10	1.10	49.0	0.84	1.00	0	14	0.0	7.1	0	0
13	1092	4	0.70	63.3	1.04	1.00	0	15	0.0	7.3	0	0
14	1022	2	0.60	54.6	0.96	1.00	0	20	0.0	7.3	0	0
15	1059	20	0.60	58.6	0.99	1.00	0	20	0.0	7.5	0	0
16	1064	2	0.60	62.5	1.05	1.00	18	19	5.7	7.5	64	0
17	1003	4	0.50	58.4	1.04	0.90	0	15	0.0	7.4	0	0
18	992	8	1.20	65.0	1.17	1.00	0	18	0.0	7.4	0	0
19	1225	9	1.30	51.9	0.76	1.00	0	16	0.0	7.6	0	0
20	1036	13	1.30	59.2	1.02	0.90	0	15	0.0	7.0	0	0
21	1037	16	1.40	68.1	1.18	0.90	0	19	0.0	7.0	0	0
22	1071	14	1.30	48.9	0.82	0.90	16	20	5.7	7.7	55	0
23	1064	8	0.60	59.0	0.90	0.90	0	16	0.0	7.6	0	0
24	1225	6	0.60	71.5	1.05	0.90	0	18	0.0	7.7	0	0
25	955	0	0.50	46.4	0.87	0.90	0	19	0.0	7.7	0	0
26	988	11	1.40	59.2	1.07	1.00	0	18	0.0	7.7	0	0
27	1051	15	1.40	65.1	1.11	1.00	0	15	0.0	7.3	0	0
28	1071	16	1.30	48.9	0.82	0.90	0	17	0.0	7.2	0	0
29	1049	14	1.40	59.3	1.01	0.90	0	20	0.0	9.0	0	0
30	1069	14	1.00	64.0	1.07	1.00	16	17	5.7	7.4	70	0
31	1163	10	1.00	63.6	0.98	1.00	0	18	0.0	7.1	0	0
TOTAL	33111	310	32.5	1832.5	30.8	30.1	78	532	28.5	229.6	304	0
AVG	1068.1	10.00	1.05	59.1	0.99	0.97	2.5	17.2	0.92	7.41	9.8	0
MAX	1416	20	1.40	71.5	1.33	1.10	18	20	5.7	9.0	70	0
MIN	931	0	0.50	46.4	0.74	0.90	13	14	0	7.0	55	0

CERTIFIED OPERATOR: JAMES MATTHEWS

CERTIFICATE NUMB ER : 411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: JANUARY, 2000

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1136	10	1.20	63.4	1.00	0.90	0	16	0.0	7.1	0	0
2	1040	12	1.20	60.0	1.03	1.00	0	18	0.0	7.2	0	0
3	939	8	1.10	55.6	1.06	0.90	0	14	0.0	7.3	0	0
4	990	10	1.00	55.0	1.00	0.90	0	17	0.0	7.2	0	0
5	1057	8	1.10	62.4	1.06	1.00	0	18	0.0	7.2	0	0
6	1044	10	1.10	62.5	1.07	1.00	14	16	5.7	7.3	49	0
7	1066	12	1.10	59.0	0.99	0.90	0	15	0.0	7.1	0	0
8	1107	12	1.10	59.2	0.96	1.00	0	17	0.0	7.3	0	0
9	996	8	1.20	63.8	1.15	0.90	0	15	0.0	7.3	0	0
10	1054	11	1.10	59.5	1.01	0.80	0	15	0.0	7.2	0	0
11	1044	15	1.10	65.6	1.13	0.90	0	15	0.0	7.6	0	0
12	1079	10	0.50	57.1	0.95	0.90	0	19	0.0	8.4	0	0
13	1026	14	0.60	56.0	0.98	0.80	0	17	0.0	7.9	0	0
14	1075	8	1.10	62.7	1.04	0.80	15	25	5.8	9.7	61	0
15	1193	12	1.10	79.6	0.79	0.80	0	21	0.0	8.0	0	0
16	897	8	1.20	59.9	1.20	0.90	0	17	0.0	7.3	0	0
17	1035	10	1.20	66.4	1.15	0.90	0	16	0.0	7.3	0	0
18	1043	10	1.00	68.7	1.18	0.90	0	17	0.0	7.2	0	0
19	1032	10	1.10	85.3	1.48	1.10	0	17	0.0	7.2	0	0
20	1048	12	1.00	89.2	1.53	1.10	17	17	5.8	7.3	60	0
21	985	12	1.10	94.8	1.73	1.40	0	16	0.0	7.3	0	0
22	1064	10	1.10	62.8	1.06	1.00	0	14	0.0	7.1	0	0
23	1065	11	1.00	86.6	1.46	1.00	0	15	0.0	7.3	0	0
24	1077	11	0.90	62.1	1.04	0.90	0	17	0.0	7.5	0	0
25	1070	36	1.30	59.6	1.00	1.10	0	15	0.0	7.3	0	0
26	964	6	0.90	76.5	1.42	1.10	0	23	0.0	7.3	0	0
27	1098	8	1.00	82.6	1.35	1.00	15	15	5.7	7.3	55	0
28	1110	10	1.30	62.4	1.01	1.00	0	18	0.0	7.1	0	0
29	1108	14	1.30	81.9	1.33	1.10	0	18	0.0	7.1	0	0
30	1014	4	0.30	47.0	0.83	0.60	0	16	0.0	7.5	0	0
31	954	11	1.30	72.9	1.37	1.00	0	15	0.0	7.2	0	0
TOTAL	32410	343	32.6	2080.1	35.36	29.6	61	524	23	230.1	225	0
AVG	1045.5	11.06	1.05	67.1	1.14	0.95	2.0	16.9	0.74	7.42	7.3	0
MAX	1193	36	1.30	94.8	1.73	1.40	17	25	5.8	9.7	61	0
MIN	897	4	0.30	47.0	0.79	0.60	14	14	5.7	7.1	49	0

CERTIFIED OPERATOR:JAMES MATTHEWS

CERTIFICATE NUMBER:411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: FEBRUARY ,2000

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1052	15	1.30	72.6	1.24	0.90	0	11	0.0	7.0	0	0
2	1044	12	1.30	76.9	1.32	0.90	0	13	0.0	7.2	0	0
3	1035	14	1.30	72.2	1.25	0.90	16	19	5.7	7.1	56	0
4	1059	14	1.30	83.1	1.41	1.00	0	16	0.0	7.3	0	0
5	1099	14	1.30	62.1	1.01	1.00	0	18	0.0	7.3	0	0
6	1066	8	0.60	76.1	1.28	1.10	0	20	0.0	9.0	0	0
7	1024	4	1.30	74.8	1.24	1.10	0	16	0.0	7.2	0	0
8	1058	8	0.60	59.6	1.01	1.00	0	16	0.0	7.3	0	0
9	1082	12	1.40	63.7	1.05	1.00	0	18	0.0	7.3	0	0
10	1068	14	1.40	73.7	1.24	1.00	12	15	5.8	7.2	51	0
11	1093	14	1.50	58.1	0.96	1.00	0	18	0.0	7.3	0	0
12	1071	16	1.40	59.2	0.99	1.00	0	19	0.0	7.3	0	0
13	983	10	1.30	59.9	1.09	1.00	0	15	0.0	6.8	0	0
14	1030	12	1.30	64.0	1.11	0.90	0	15	0.0	6.8	0	0
15	1006	18	1.30	71.3	1.27	1.20	0	16	0.0	7.3	0	0
16	1054	10	1.20	71.1	1.21	1.20	0	15	0.0	6.8	0	0
17	1051	12	1.10	64.7	1.10	1.00	15	21	5.6	8.9	58	0
18	1259	20	0.70	60.7	0.87	1.00	0	21	0.0	8.9	0	0
19	920	8	0.90	66.2	1.29	0.90	0	20	0.0	8.4	0	0
20	951	9	1.00	58.4	1.10	1.00	0	18	0.0	8.5	0	0
21	994	11	1.30	62.9	1.14	1.00	0	19	0.0	8.4	0	0
22	997	12	1.30	51.4	0.92	1.00	0	15	0.0	7.2	0	0
23	1050	12	1.30	64.5	1.10	1.00	0	15	0.0	7.2	0	0
24	1050	14	1.30	64.1	1.09	0.90	15	15	5.8	7.2	56	0
25	1049	16	1.30	60.6	1.03	0.90	0	16	0.0	7.2	0	0
26	1087	16	1.30	64.6	1.06	1.00	0	16	0.0	7.2	0	0
27	1028	12	1.30	62.4	1.09	1.00	0	20	0.0	9.1	0	0
28	1048	13	1.20	59.0	1.01	1.00	0	18	0.0	7.4	0	0
29	1071	19	1.30	64.3	1.08	0.90	0	15	0.0	7.1	0	0
30												
31												
TOTAL	30379	369	35.1	1902.2	32.56	28.8	58	489	22.9	218.9	221	0
AVG	1047.6	12.72	1.21	65.6	1.12	0.99	2.0	16.9	0.79	7.55	7.6	0
MAX	1259	20	1.50	83.1	1.41	1.20	16	21	5.8	9.1	58	0
MIN	920	4	0.60	51.4	0.87	0.90	12	11	5.6	6.8	51	0

CERTIFIED OPERAT OR:JAMES MATTHEWS

CERTIFICATE NUME ER:411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: MARCH, 2000

	WATER	CHLORINE		FLUORIDE			ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES.	USED	CALC DOSE	DIST. SYS.	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1050	8	0.80	59.3	1.01	0.80	0	18	0.0	7.3	0	0
2	1033	8	1.10	73.2	1.27	0.90	17	25	6.2	9.2	50	0
3	1036	10	1.00	53.1	0.92	0.90	0	31	0.0	9.3	0	0
4	1093	10	1.00	64.1	1.05	1.00	0	23	0.0	8.6	0	0
5	996	7	1.00	59.7	1.07	1.00	0	17	0.0	7.4	0	0
6	1071	10	1.10	64.5	1.08	1.00	0	18	0.0	8.0	0	0
7	1036	11	1.00	69.5	1.20	0.90	0	18	0.0	7.5	0	0
8	1022	14	1.70	58.2	1.02	1.30	0	21	0.0	9.3	0	0
9	434	10	1.40	55.4	2.29	1.50	16	38	5.7	10.2	60	0
10	574	4	1.00	57.9	1.81	1.80	0	18	0.0	7.8	0	0
11	1001	4	0.40	66.3	1.19	1.00	0	18	0.0	7.5	0	0
12	953	2	0.30	54.3	1.02	1.00	0	40	0.0	9.5	0	0
13	1024	6	0.90	50.2	0.88	1.20	0	14	0.0	7.2	0	0
14	0	2	0.50	27.1	1.00	1.10	0	15	0.0	7.4	0	0
15	871	2	0.30	44.8	0.92	1.00	0	17	0.0	7.3	0	0
16	1018	8	0.70	58.7	1.03	0.90	16	16	5.6	7.1	55	0
17	1002	8	0.70	58.5	1.05	0.90	0	23	0.0	9.3	0	0
18	1086	8	0.70	67.2	1.11	0.90	0	23	0.0	9.3	0	0
19	1010	6	0.70	59.5	1.06	0.90	0	15	0.0	7.3	0	0
20	1065	8	0.80	67.3	1.13	0.90	0	15	0.0	7.0	0	0
21	1084	12	0.70	58.9	0.97	0.90	0	30	0.0	9.5	0	0
22	1048	4	0.60	63.4	1.08	1.00	0	16	0.0	7.5	0	0
23	1042	8	0.80	63.6	1.09	0.90	16	17	5.8	7.6	48	0
24	1040	12	1.10	59.5	1.02	0.90	0	17	0.0	7.5	0	0
25	1089	12	1.10	65.2	1.07	1.00	0	18	0.0	7.5	0	0
26	970	8	1.10	59.2	1.09	0.90	0	17	0.0	7.5	0	0
27	1069	11	1.00	59.7	1.00	1.00	0	17	0.0	7.7	0	0
28	991	11	0.80	59.3	1.07	1.00	0	22	0.0	8.9	0	0
29	1108	12	1.00	63.2	1.02	1.10	0	19	0.0	8.1	0	0
30	981	16	1.20	55.0	1.00	1.00	19	19	5.8	7.3	56	0
31	997	16	1.10	54.2	0.97	1.00	0	14	0.0	7.2	0	0
TOTAL	29794	268	27.6	1830	34.49	31.6	84	629	29.1	249.8	269	0
AVG	961.1	8.65	0.89	59.0	1.11	1.02	2.7	20.3	0.94	8.06	8.7	0
MAX	1108	16	1.70	73.2	2.29	1.80	19	40	6.2	10.2	60	0
MIN	0	2	0.30	27.1	0.88	0.80	16	14	5.6	7.0	48	0

CERTIFIED OPERAT OR:JAMES MATTHEWS

CERTIFICATE NUME ER:411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: APRIL,2000

	WATER	CHLORINE		FLUORIDE			ALKALINITY MG/L		PH SU		FREE CO2 MG/L	
DATE	TREATED X1000	USED LBS	FREE RES MG/L	USED GALS	CALC DOSE MG/L	DIST SYS MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1057	16	1.00	51.3	0.87	0.90		16		7.3		0
2	982	15	1.30	55.4	1.01	0.90		15		7.4		0
3	1068	9	0.30	59.3	0.99	0.90		17		7.4		0
4	1023	6	0.70	50.6	0.89	0.90		18		7.2		0
5	1026	10	1.00	72.0	1.26	1.20		17		7.2		0
6	982	10	0.50	68.9	1.26	1.20	16	16	5.8	7.5	49	0
7	1095	14	1.30	72.8	1.19	1.10		17		7.3		0
8	1071	12	1.40	68.6	1.15	1.10		15		7.3		0
9	1034	14	1.40	66.8	1.16	1.10		16		7.4		0
10	1039	14	1.30	71.1	1.23	1.10		17		7.2		0
11	1027	18	1.30	64.6	1.13	1.10		17		7.2		0
12	1022	14	1.30	63.8	1.12	1.20		20		7.8		0
13	1107	18	1.30	72.4	1.17	1.20	15	16	5.8	7.4	65	0
14	945	14	1.30	64.5	1.22	1.10		19		7.4		0
15	1071	10	1.10	68.6	1.15	1.10		22		7.3		0
16	1010	11	1.10	68.6	1.22	1.10		17		7.3		0
17	1044	11	1.20	67.4	1.16	1.10		15		7.3		0
18	1052	10	0.80	67.3	1.15	1.10		16		7.4		0
19	1110	8	0.90	72.4	1.17	1.10		15		7.2		0
20	1040	10	0.90	68.3	1.18	1.10	12	19	5.7	9.1	59	0
21	1086	8	0.90	71.5	1.18	1.10		23		8.9		0
22	1122	12	1.00	72.9	1.16	1.10		21		8.0		0
23	1111	11	1.10	53.1	0.86	1.10		16		7.3		0
24	1046	11	1.10	63.3	1.08	1.00		16		7.3		0
25	1019	16	1.10	72.6	1.28	1.10		25		9.0		0
26	1082	12	1.10	49.1	0.81	1.20		16		7.2		0
27	1191	10	0.60	81.1	1.22	1.00	14	21	5.8	8.9	55	0
28	970	10	1.00	49.1	0.91	1.10		24		8.6		0
29	1104	10	1.00	62.8	1.02	1.10		23		8.6		0
30	1007	9	1.10	62.8	1.12	1.00		15		7.3		0
31												
TOTAL	31543	353	31.4	1953	33.32	32.4	57	540	23.1	229.7	228	0
AVG	1051.4	11.77	1.05	65.1	1.11	1.08	14.3	18.0	5.78	7.66	7.6	0
MAX	1191	18	1.40	81.1	1.28	1.20	16	25	5.8	9.1	65	0
MIN	945	6	0.30	49.1	0.81	0.90	12	15	5.7	7.2	49	0

CERTIFIED OPERAT OR:JAMES MATTHEWS

CERTIFICATE NUME ER:411-31-0061

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
MONTHLY OPERATIONAL REPORT

NAME OF WATER UTILITY: TOWN OF COLLIERVILLE
NAME OF WATER TREATMENT PLANT: WATER PLANT #2

PWSID: 0000126
COUNTY: SHELBY

MONTH OF: MAY,2000

	WATER	CHLORINE			FLUORIDE		ALKALINITY		PH		FREE CO2	
	TREATED	USED	FREE RES	%USED	CALC DOSE	DIST SYS	MG/L		SU		MG/L	
DATE	X1000	LBS	MG/L	GALS	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	RAW	FINISHED
1	1098	10	1.10	66.8	1.09	1.00		14		7.1		0
2	1040	13	1.30	69.0	1.19	1.00		17		7.6		0
3	1158	10	1.10	52.9	0.82	1.20		18		7.6		0
4	984	9	1.00	58.6	1.07	0.90	14	18	5.7	7.8	63	0
5	1063	15	1.20	71.9	1.21	1.00		18		8.0		0
6	1037	9	1.00	71.5	1.24	1.00		18		8.1		0
7	1099	19	1.10	76.4	1.25	1.10		19		8.0		0
8	1092	12	1.00	76.7	1.26	1.10		17		7.9		0
9	1036	24	1.20	82.4	1.43	1.00		18		7.9		0
10	1102	8	1.10	65.5	1.06	1.20		19		8.1		0
11	967	12	1.20	62.6	1.16	1.00	17	22	5.7	8.0	54	0
12	1115	11	1.10	64.3	1.03	0.80		18		7.7		0
13	1074	14	1.10	72.5	1.21	1.10		19		7.8		0
14	1072	17	1.10	79.0	1.32	1.20		21		8.0		0
15	1089	14	1.10	67.2	1.11	1.20		21		7.9		0
16	1056	18	1.20	75.5	1.28	1.00		17		7.8		0
17	1134	16	1.50	84.5	1.34	1.10		18		7.9		0
18	1181	18	1.20	76.2	1.16	1.00	15	19	5.7	8.2	61	0
19	993	13	1.30	71.2	1.29	1.00		17		8.0		0
20	982	15	1.20	67.6	1.23	1.10		20		8.0		0
21	1099	14	1.20	74.8	1.22	1.10		21		8.0		0
22	1171	12	1.20	71.9	1.10	1.10		18		7.9		0
23	1019	12	1.30	68.1	1.20	1.00		18		8.0		0
24	1200	14	1.30	72.3	1.08	1.00		16		8.1		0
25	973	14	1.20	67.5	1.24	1.10	16	19	5.9	8.2	60	0
26	1120	15	1.20	71.7	1.15	1.00		19		8.1		0
27	1004	15	0.90	64.1	1.14	1.00		17		7.9		0
28	984	18	1.00	71.4	1.30	1.20		19		8.0		0
29	1053	16	1.00	67.5	1.15	1.10		18		7.9		0
30	1195	14	0.60	71.1	1.07	1.00		19		8.6		0
31	416	2	0.60	29.7	1.28	1.00		16		8.0		0
TOTAL	32606	423	34.6	2142.4	36.68	32.6	62	568	23	246.1	238	0
AVG	1051.8	13.65	1.12	69.1	1.18	1.05	15.5	18.3	5.75	7.94	59.5	0
MAX	1200	24	1.50	84.5	1.43	1.20	17	22	5.9	8.6	63	0
MIN	416	2	0.60	29.7	0.82	0.80	14	14	5.7	7.1	54	0

CERTIFIED OPERATOR: JAMES MATTHEWS

CERTIFICATE NUMBER: 411-31-0061