

Abstract

William J. Pate

Inhalation Exposure from Showering with
Contaminated Water

Benzene concentrations in air resulting from showering with contaminated water are estimated by air sampling and modeling. The modeling involves calculating benzene concentrations in air after measuring inlet and outlet benzene concentrations in water, water flowrate, and bathroom dimensions. Based on benzene in air concentrations, inhalation exposure is calculated and compared to exposure resulting from ingestion of the same contaminated water. The results of this project indicate that showering with contaminated water may be a major source of indoor air contaminants and that inhalation exposure may be equal to or greater than ingestion exposure.

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INTRODUCTION

Many groundwater and surface water sources are contaminated with volatile organic compounds (VOCs). This contamination may be caused by leaking underground storage tanks or spills from industrial or waste treatment facilities. Environmental and health agencies have adopted standards or guidelines for acceptable water concentrations of many VOCs. These acceptable concentrations are derived from risk assessment of ingestion exposure to water-containing VOCs. In determining acceptable concentrations, agencies have not considered inhalation or dermal absorption exposures that may occur from domestic water use. When VOC concentrations exceed the standard or guideline, agencies recommend that people not drink the water. Often people comply with this recommendation by drinking bottled water. Citizens may continue to use the contaminated water for washing clothes and dishes and for bathing. By doing this, people avoid ingestion exposure, but may be subject to inhalation and dermal exposure.

This paper evaluates indoor air contamination and inhalation exposure resulting from the use of contaminated water for showering. These concentrations and exposures are estimated by air sampling and by modeling.

II. LITERATURE REVIEW

Several scientists have evaluated the release of contaminants from water into air. Pritchard and Gesell²⁴ measured the inlet and outlet radon content of water for several specific water uses. They determined that the radon transfer efficiency from water to air was 30 to 90 percent depending on the specific water use. The transfer efficiency for showers was 63 % and for washing machines and dishwashers was 90%. Considering the volume of use and the transfer efficiency for specific water uses, Pritchard and Gesell estimate that the volume-use weighted mean transfer efficiency is approximately 50%. Hess¹⁵ determined that radon transfer efficiencies for showers was 65% and for dishwashers was 98%.

Andelman⁴ evaluated the volatilization rate of chloroform and trichloroethylene in a laboratory shower. The chemical concentration in the inlet was controlled and the water draining from the shower was sampled every 10 minutes during a 60-minute shower. Andelman varied the following parameters to evaluate their effect on volatilization: (1) contaminant concentration in water; (2) water temperature; (3) height of air sampling port; and (4) diameter of shower head holes. The study determined that increases in the magnitude of the following variables increased the extent of volatilization: water temperature; chemical concentration in water and height of shower head. The extent of volatilization increased with decreasing size of shower head holes. This study detected a volatilization rate of approximately 50% for chloroform and 80% for trichloroethylene during a 60-minute shower. Andelman found that as air concentration increases over the duration of the sixty-minute shower, the percent

volatilization decreases. The reason for this is that as the air concentration increases, the gradient between the water concentration and air concentration decreases. For example, Andelman detected 82% volatilization after 10 minutes of shower operation, 70% after 30 minutes, and 62% after 50 minutes.

Henry's law is the relationship between a chemical concentration in air and the concentration of that chemical in water, at equilibrium. Henry's law is represented by the equation: $H = C_a/C_w$, where H is Henry's law constant and C_a and C_w are concentrations of the chemical in the air and water phases, respectively. The H values can be estimated by the ratio of vapor pressure to water solubility for a specific compound. A compound with a low vapor pressure and a low water solubility may have a Henry's law constant that is similar to a Henry's law constant for a compound that has a high vapor pressure and a high water solubility.

Andelman determined that shower air concentrations are below what is predicted by Henry's law. Andelman reported that Henry's law would predict an upper limit for air concentrations.

A study by Rathbun and Tai²⁵ determined that the mass-transfer coefficient for the transfer of a chemical from water to air changes very little over several orders of magnitude of concentration. This indicates that the percent volatilization is not affected significantly by the water contaminant concentration.

McKone,¹⁸ Andelman,¹⁻⁵ and others have used modeling and measurement to estimate air contaminant concentrations resulting from the use of contaminated water. Pritchard and Gesell used a model to estimate

air concentration of radon in the bathroom when the shower operates for five (5) minutes, the bathroom volume is 30,000 liters, the water used is 75 liters, and the transfer efficiency is 63%. It should be noted that this model does not consider air exchange rate during the showering time period. Ignoring the air exchange rate should have little effect on the estimated air concentration because of the short-time duration of the shower. The model predicts the following relationship:

$$C_a = (1.6 \times 10^{-3}) C_w$$

where C_a is the air concentration and C_w is water concentration of radon in picoCurries per liter.

McKone developed a three compartment model to estimate concentrations in the shower, bathroom, and remaining house. He used transfer efficiencies of 70% for the shower, 30% for the toilet, and 66% for other household water uses. The model incorporates the following water volume uses: showers and baths, 300 liters; toilets, 300 liters; and other household uses, 400 liters. The duration of the shower is 10 minutes per individual. The volume of the bathroom is 10,000 liters, and the volume of the remaining house is 400,000 liters. The model uses a residence time of household air of 120 minutes (0.50 air changes per hour). This model was used to consider exposure to chloroform, ethylene dibromide, dibromochloropropane, methylchloroform, perchloroethylene, trichloroethylene, and carbon tetrachloride. McKone's model derived the following relationship between contaminant concentration in water and in air:

(1) for the shower compartment

$$Ca = (1.7 \text{ to } 9.3) \times 10^{-2} Cw.$$

(2) for the bathroom compartment

$$Ca = (1.8 \text{ to } 3.8) \times 10^{-3} Cw.$$

(3) for the house compartment

$$Ca = (0.10 \text{ to } 0.72) \times 10^{-4} Cw.$$

Ca is the air contaminant concentration and Cw is the water contaminant concentration in milligrams per liter.

Andelman⁴ used a one-compartment model to estimate indoor air concentrations resulting from the use of contaminated water. The model uses 50% volatilization to represent all indoor water uses and assumes "typical air exchange and other pertinent home parameters." (Andelman cites reference 27 for these assumptions.) This model derived the following relationship:

$$Ca = (0.1 \text{ to } 5) \times 10^{-4} Cw.$$

In a laboratory setting, Andelman measured 50-80 mg/m³ of trichloroethylene (TCE) in the shower air during a 60-minute shower which used water containing 3.8 mg/l TCE. McKone's model predicted that the air concentration would be 68-100 mg/m³.

Wallace et al,³⁰ as part of the TEAM studies, conducted air sampling in homes for volatile organic compounds. This sampling detected chloroform and bromodichloromethane in air in homes that had these two contaminants in water. The measured air concentrations for these compounds are consistent with McKone's model estimates for house air concentrations.

McKone used the model to calculate lifetime inhalation exposure to volatile compounds coming from the use of contaminated water. These calculations considered the exposure occurring in each of the three compartments (shower, bathroom, and house) for infants, children, and adults. Two ranges of exposure parameters were used to calculate reference and upper-bound exposure estimates. The reference estimates for adults included the following: (1) 10 minutes per shower per day; (2) 40 minutes spent in the bathroom per day; (3) 15 hours spent in the house per day; and (4) 50% uptake of chemical. The upper-bound estimates for adults included the following: (1) 20 min/shower per day; (2) 60 minutes spent in the bathroom per day; (3) 24 hours spent in the house per day; and (4) 100% uptake of chemical. McKone evaluated exposure to chloroform, ethylene dibromide, carbon tetrachloride, dibromochloropropane, 1,1,1-trichloroethane, tetrachloroethylene, and trichloroethylene. This model estimated that the inhalation exposure attributable to contaminated water can be between 0.8 and 6.0 times the exposure attributable to the consumption of 2 liters per day of contaminated water by a 70 Kg adult. McKone projects that more than half of the lifetime inhalation exposure will occur in the shower and one-third will occur in the bathroom.

Andelman² calculated inhalation exposure for the time spent in the shower and bathroom. This calculation incorporated the following assumptions: (1) 75% volatilization of the chemical from water to air; (2) shower duration of six (6) minutes; (3) time in bathroom after the shower is 12 minutes; (4) the breathing rate is 1000 liters per hour; (5) the shower water flow is 500 liters per hour; (6) the air exchange rate is 0.53

per hour; (7) the bathroom volume is 10,000 liters; and (8) there is 100% uptake of the chemical. This calculation predicted that the inhalation exposure would be equal approximately to drinking one liter of the contaminated water per day.

In addition, Andelman calculated the inhalation exposure that would occur in the entire house from use of contaminated water over a 24-hour time period. This calculation assumed 50% chemical volatilization for all water uses and estimated that inhalation exposure will be 0.1 to 5.0 times ingestion exposure when ingestion is 2 liters of water per day.

Foster and Chrostowski¹⁴ developed and used a model to estimate inhalation exposure to volatile organic compounds while showering and being in the bathroom after the shower is completed. This model was used to calculate concentrations in upper- and lower-bound scenarios. The model assumes the following:

Shower duration:	10 min. (lower-bound scenario)
	15 min. (upper-bound scenario)
Water flow rate:	10 l/min
Water temp.:	45° C
Shower room volume:	6 m ³
Air exchange rate:	1.5 hr. ⁻¹ (lower-bound scenario)
	0.5 hr. ⁻¹ (upper-bound scenario)
Water concentration:	15 ug/l (lower-bound scenario)
	75 ug/l (upper-bound scenario)
Adult weight:	= 70 Kg

The model estimates that inhalation exposure to benzene will be 0.224 to 2.26×10^{-3} mg/kg/day. Comparing this inhalation exposure to ingestion exposure resulting from drinking two (2) liters of water per day, one finds that inhalation exposure is 0.52 to 1.06 times the ingestion exposure for the lower- and upper-bound scenarios.

James and Knuiman,¹⁶ from a survey of 2500 Australian homes, report that the mean shower flow rate is eight (8) liters per minute and the mean shower duration is six (6) minutes. Based on a study of modern houses in one heating season, Nazaroff et al,²⁰ reported that the mean air exchange rate is 0.53 air changes per hour. Bond et al,⁹ report the following water consumption rates:

<u>Water Use</u>	<u>Volume (liters per person per day)</u>
toilets	35-95
showers & baths	25-75
laundry	28-44
dishwasher	14
kitchen and sinks	19-68
cleaning	13-30
TOTAL	134-326

The information reported in the literature is summarized in Tables 1, 2, and 3. Table 1 lists the volatilization rates for various contaminants for different water uses. The range of volatilization rates is from 30 to 98 percent. Table 2 lists the ratios of air concentration to water concentration in the shower, bathroom, and house. The range of ratios for the shower is 1.6 to 93×10^{-3} , for the bathroom is 1.8 to 3.8×10^{-3} ,

and for the house is 0.1 to 5×10^{-4} . Table 3 lists the ratios of inhalation exposure to ingestion exposure for inhalation exposures that occur in the shower and house. The range of ratios for the shower is 0.47 to 1.06 , and for the house is 0.1 to 6 .

TABLE 1
Volatilization Rates of Chemicals from
Contaminated Water

<u>Reference</u>	<u>Activity</u>	<u>Contaminant</u>	<u>Volatilization Rate (%)</u>
Pritchard & Gesell (1981)	Toilet	Radon	30
	Shower	Radon	63
	Bath	Radon	47
	Laundry	Radon	90
	Kitchen & Sinks	Radon	30
Hess et al (1983)	Toilets	Radon	30
	Showers	Radon	65
	Baths	Radon	30
	Laundry	Radon	90
	Dishwasher	Radon	98
	Kitchen & Sinks	Radon	30
Andelman (1986)	Shower	Chloroform	50
	Shower	Trichloroethylene	80

TABLE 2

Ratio of Air Concentration to Water Concentration
for Radon and VOCs

<u>Reference</u>	<u>Contaminant</u>	<u>Shower</u>	Concentration in Air/Concentration in Water ^c	
			<u>Bathroom</u>	<u>House</u>
Pritchard & Gesell (1981)	Radon	1.6×10^{-3A}		
McKone (1987)	VOCs	$1.7 \text{ to } 9.3 \times 10^{-2B}$	$1.8 \text{ to } 3.8 \times 10^{-3}$	$0.10 \text{ to } 0.72 \times 10^{-4}$
Andelman (1986)	VOCs			$0.1 \text{ to } 5 \times 10^{-4}$

^A 5 min. shower, volatilization rate 63%

^B 10 min. shower, volatilization rate 70%

^C milligrams per liter in air
milligrams per liter in water

TABLE 3

Ratio of Inhalation Exposure to Ingestion^a Exposure
for Benzene and VOCs

<u>Reference</u>	<u>Contaminant</u>	<u>Inhalation/Ingestion Exposure^b</u>	
		<u>Shower and Bathroom</u>	<u>House</u>
McKone (1987)	VOCs		0.8 - 6.0 ^a
Andelman (1986)	VOCs	0.47	0.1 - 5.0 ^c
Foster & Chrostowski (1987)	Benzene	0.52 - 1.06	

^a Assumes water ingestion intake of 2 liters per day.

^b Includes exposure in shower, bathroom, and house.

^c Does not include exposure in the shower.

^d $\frac{\text{mg/kg/day inhalation exposure}}{\text{mg/kg/day ingestion exposure}}$

III. SAMPLING PROTOCOL

Air and water sampling were conducted during shower operation in four homes that were known to have contaminated groundwater. Sampling was repeated in two of the homes so that there were six repetitions of the sampling protocol. There was a time lapse of 20 days between samples at one home and a time lapse of 47 days at another home.

Homes were selected whose water was known to be contaminated with benzene in the range of 400 to 2600 micrograms per liter (ug/l). The benzene concentrations in water at the homes changed with time, so that at the time of this study one home had nondetectable concentrations of benzene, one had approximately 3000 ug/l, and two had approximately 1000 ug/l.

Air sampling and analysis was conducted according to NIOSH method 1501, "Sampling and Analysis for Aromatic Hydrocarbons."²² This method is intended for use in occupational exposure settings and recommends sampling at 0.20 liters per minute through a charcoal tube that contains 100 milligrams of charcoal in the front section of the tube and 50 milligrams in the back-up section of the tube. The method was modified by sampling at a flow rate of 1.0 liter per minute through a charcoal tube containing 400 milligrams of charcoal in the front section of the tube and 200 milligrams in the back-up section of the tube. In addition, the method was modified to include a water filter tube¹⁷ containing 5A molecular sieve upstream of the charcoal tube. It was necessary to use the water filter tubes to protect the charcoal from the high humidity in the shower air.

The air sampling duration had to be sufficient to collect an amount of benzene that is detectable by the analytical method. Based on the following information, it was determined that the shower operation and air sampling duration be 30 minutes:

- the analytical detection limit for benzene using this sampling and analytical method is 0.02 milligrams per sample.
- the ratio of contaminant concentration in air to contaminant concentration in water is reported in the literature to be in the range of 1.6 to 9.3×10^{-3} for showers. Andelman reported that this ratio is 0.1 to 5×10^{-4} in the whole house.
- the air sampling flow rate was 1.0 liter per minute.

Air sampling was conducted in triplicate in the breathing zone for the duration of a thirty-minute shower and in the bathroom for the twenty-minute period following the shower. A fifty-minute air sample was collected in the bathroom during the shower including 20 minutes after the shower. Five air samples were collected in the bathroom for each sampling protocol.

During each thirty-minute shower period, three water samples were collected from the shower head (designated inlet samples) and from the bottom of the shower (designated outlet samples). The outlet samples were collected by placing a small pan on the floor of the shower to collect shower water. The water in the pan was transferred to a glass sample container. Inlet and outlet samples were taken at approximately 5, 15, and 25 minutes after the start of the thirty-minute shower.

The water flow rate for the shower was measured three times during each shower period by measuring the time it took to fill a volumetric container. The shower water temperature was also measured three times during the shower period. The temperature and flow rate measurements were made near the start, middle, and end of the shower. Bathroom dimensions were measured and the volume of the air space in the bathroom was calculated.

The relative humidity in the bathroom was measured during two shower periods and was found to be 100%. No further measurements of relative humidity were made.

IV. SAMPLING AND CALCULATION RESULTS

Estimation of the benzene concentrations were made by measurement and by calculation. In order to calculate benzene concentrations, it was necessary to measure the following parameters:

- benzene concentration in water, C_w
- water flow rate, F_w
- bathroom air volume, V
- percent volatilization, f

For these calculations, it was assumed that the air exchange rate was 0.53 air changes per hour, that there was complete mixing in the bathroom/shower, and that none of the benzene that volatilized from the water adhered to the walls or other surfaces in the bathroom. The following equations were used for the calculations (REFERENCE 23):

$$G = C_w \times f \times F_w \times 60$$

$$C = \frac{G}{Q} + \frac{V}{QT} \left[\frac{-G + G \exp \frac{-Qt}{V}}{Q} \right]$$

G = rate of generation of contaminant (mg/hr)

C_w = contaminant concentration in water (mg/l)

f = volatilization fraction

F_w = water flow rate (l/min)

Q = rate of ventilation (room volume X air changes per hour) (l/hr)

t = duration of shower (hr)

V = volume of bathroom

The air concentration of the contaminant was measured three times in the shower and twice in the bathroom. The five air measurements were averaged to estimate the air concentration in the bathroom. In some cases, five samples were not available because of a sample pump malfunction.

Results are shown in the following tables:

Table 4 Benzene Concentrations in Water

Table 5 Measured Water Parameters

Table 6 Measured Water and Air Concentrations of Benzene in Showers in Selected Homes

Table 7 Air Concentrations of Benzene in Showers in Selected Homes

In summary, the percent volatilization of benzene for concurrent pairs of inlet and outlet water samples ranged from 38.1% to 100%. The mean percent volatilizations for the triplicate inlet and outlet water samples for the five sample sites were 52.2%, 54.7%, 54.7%, 91.8%, and 99.8%. The ratio of measured concentration of benzene to calculated concentration for

the five sample sites ranged from 0.80 to 1.29. The ratios of the air concentration of benzene to water concentration was 4.59 to 10.16 X 10^{-3} . The literature reports that the ratio of air concentration to water concentration in shower/bathroom after a 5 to 20 minute shower is 1.6 to 93.0 X 10^{-3} .

Table 4

Benzene Concentrations in Water

<u>Home</u>	<u>Date</u>	<u>Inlet</u> (ug/m ³)	<u>Outlet</u> (ug/m ³)	<u>T°C</u>	<u>% Vol.</u>	<u>Mean</u> <u>% Vol.</u>
Coleman	2-8-90	1104.0	ND	38	100	99.8
		1094.2	ND	38	100	
		998.9	6.6	38	99.3	
Coleman	3-28-90	1962.9	754.0	37	61.6	54.7
		1766.3	755.4	36	57.2	
		1541.8	845.0	36	45.2	
Dorsey	3-8-90	2680.8	1094.1	38	59.2	52.2
		2587.3	1306.4	21	49.5	
		2793.7	1459.3	--	47.8	
Dorsey	3-28-90	3329.9	1311.3	40	60.6	54.7
		2819.6	976.9	40	65.4	
		3017.6	1868.9	24	38.1	
White	2-17-90	924.0	152.0	37	83.6	91.8
		465.1	33.5	28	92.8	
		1234.7	11.2	26	99.1	

ND - none detected

Table 5

Measured Water Parameters

<u>Home</u>	<u>Date</u>	<u>Benzene Conc. in Water (mg/l)^a</u>	<u>Volatilization Rate</u>	<u>Water Flow Rate (l/min)</u>	<u>Bathroom Air Volume (liters)</u>
Coleman	2-8-90	1.066	99.8	4.4	8580
Coleman	3-28-90	1.757	54.7	4.8	8580
Dorsey	3-8-90	2.687	52.2	6.5	6531
Dorsey	3-28-90	3.056	54.7	7.4	6531
White	2-17-90	1.079	91.8	8.1	10020

^a at shower inlet

Table 6

Measured Water and Air Concentrations of Benzene
in Showers in Selected Homes

<u>Home</u>	<u>Date</u>	<u>Water Conc. Shower Inlet (mg/l)</u>	<u>Air Conc. (ug/m³)</u>	<u>Ratio of Air to Water Concentration^{a,c}</u>
Coleman	2-8-90	1.066	10140 ^a	9.51×10^{-3}
Coleman	3-28-90	1.757	8060	4.59×10^{-3}
Dorsey	3-8-90	2.687	21250	7.91×10^{-3}
Dorsey	3-28-90	3.056	31040	10.16×10^{-3}
White	2-17-90	0.875	8820	10.07×10^{-3}

^a - one sample in shower, two in bathroom

^b - the literature reports C_a/C_w equals 1.6 to 93.0×10^{-3} for shower durations of 5 to 20 minutes

^c - $\frac{\text{mg/l}}{\text{mg/l}}$

Table 7

Air Concentrations of Benzene in Showers in
Selected Homes

<u>Name</u>	<u>Date</u>	<u>Calculated Air Conc. (ug/m³)</u>	<u>Measured Air Conc. (ug/m³)</u>	<u>Ratio of Measured to Calculated Values</u>
Coleman	2-8-90	7800	10140	1.29
Coleman	3-28-90	7300	8060	1.11
Dorsey	3-8-90	19200	21250	1.11
Dorsey	3-28-90	26100	31040	1.19
White	2-17-90	11000	8820	0.80

V. SENSITIVITY ANALYSIS

The data from the Coleman 2-8-90 sample was used to represent baseline conditions. Individual variables were changed to determine the effect on calculated air concentrations. These data are listed in Table 8. This analysis shows that changing the shower duration results in the greatest change in air concentrations. The volatilization rate and the contaminant concentration in the water have the next largest effect on the air concentration.

VI. INHALATION DOSE AND RISK ESTIMATES

Inhalation doses and cancer risks were calculated for reasonable and worse case exposures. These calculations are shown in Figure 1. The parameters for each of these exposures are presented in Table 9. The mean measurement values were used for the water flowrate and bathroom air volume parameters in the reasonable exposure estimate.

If it is assumed that the water contaminant concentration is 1.0 milligram per liter, the reasonable case estimate of inhalation dose is 0.64 milligrams per day and the worse case estimate is 10.9 milligrams per day. If an adult drinks two liters of this water per day, the ingestion dose would be 2.0 milligrams per day. Based on these parameters and calculations, the ratio of inhalation to ingestion dose is 0.3 for the reasonable case estimate and 5.5 for the worse case estimate. The ratios reported in the literature range from 0.47 to 1.06.

If the water contaminant concentration was 1.0 milligram per liter, the reasonable case estimate of increased cancer risk due to benzene exposure is 2.65 cancer cases per 10,000 people exposed for a 70-year lifetime (2.65×10^{-4}). The worse case estimate is 45.16×10^{-4} .

Table 8
Sensitivity Analysis of Air
Concentration of Benzene

<u>Variable</u>	<u>Range of Variable</u>	<u>Standard Variable</u>	<u>Effect on Air Concentration</u> ug/m ³
Volatilization Rate	40-90%	99.3%	3.0-6.8 X 10 ³
Water Flow Rate	3.0-13.0 (l/min)	4.4 (l/min)	5.1-22.2 X 10 ³
Air Exchange Rate	0.2-20.0 (hr ⁻¹)	0.53 (hr ⁻¹)	7.9-1.5 X 10 ³
Bathroom Air Volume	6000-15000 (Liters)	8580 (Liters)	10.7-4.3 X 10 ³
Shower Time	0.10-0.75 (hr)	0.50 (hr)	1.6-10.7 X 10 ³
Water Concentration	0.005-3.000 (mg/l)	1.066 (mg/l)	0.04-21.0 X 10 ³

Table 9
Parameters for Inhalation Dose and Risk Calculations
For Benzene Exposure

<u>Parameter</u>	<u>Reasonable Case</u>	<u>Worse Case</u>
Volatilization rate, f	0.70 (70%)	0.99 (99%)
Water flow rate, P_w	6.2 l/min	10.0 l/min
Time in shower, t_s	0.17 hr (10 min)	0.33 hr (20 min)
Time in bathroom after shower, t_b	0.33 hr (20 min)	0.50 hr (30 min)
Bathroom air volume, V	8048 liters	8048 liters
Air exchange rate, ACH	0.53 hr ⁻¹	0.53 hr ⁻¹
Water concentration, C_w	1.0 mg/l	1.0 mg/l
Breathing rate, B	20 l/min	20 l/min
Absorption rate, A^e	0.50 (50%)	1.00 (100%)
Ventilation rate, Q	$V \times ACH$	$V \times ACH$
Body weight	70 Kg	70 Kg
Unit cancer risk value ^{1,2}	$2.9 \times 10^{-2} \text{mg/kg/day}^{-1}$	$2.9 \times 10^{-2} \text{mg/kg/day}^{-1}$

Figure 1

Inhalation Dose and Risk Estimate Calculations
for Benzene Exposures in Showers

Reasonable case calculations

G = pollutant generation rate

$$\begin{aligned} G &= C_w \times f \times F_w \times 60 \\ &= 1 \times 0.70 \times 6.2 \times 60 \\ &= 260.4 \text{ mg/hr} \end{aligned}$$

C₁ = air concentration in shower

$$C_1 = \frac{G}{Q} + \frac{V}{Qts} \left[\frac{-G + G \exp \frac{-Qts}{V}}{Q} \right]$$

$$C_1 = 0.0022 \text{ mg/l}$$

D_{IS} = inhalation dose in shower

$$D_{IS} = C_1 \times B \times ts \times A$$

$$D_{IS} = 0.22 \text{ mg/day}$$

C₂ = air concentration in bathroom after shower

$$C_2 = \frac{V}{Qt} (C_1) \left[1 - \exp \frac{-(Q+B)V}{V} \right]$$

$$C_2 = 0.0021 \text{ mg/l}$$

D_{IB} = inhalation dose in bathroom

$$D_{IB} = C_2 \times B \times tb \times A$$

$$D_{IB} = 0.42 \text{ mg/day}$$

D_{IR} = total inhalation dose in shower and bathroom, reasonable case estimate

$$\begin{aligned} &= D_{IS} + D_{IB} \\ &= 0.64 \text{ mg/day (when water contaminant concentration is 1 mg/l)} \end{aligned}$$

Worse Case Calculations

G = pollutant generation rate

$$\begin{aligned} G &= C_w \times f \times F_w \times 60 \\ &= 1.0 \times 0.99 \times 10 \times 60 \\ &= 594 \text{ mg/day} \end{aligned}$$

Figure 1 (Cont'd)

C_1 = air concentration in shower

$$C_1 = \frac{G}{Q} + \frac{V}{Qts} \left[\frac{-G + G \exp \frac{(-Qts)}{V}}{Q} \right]$$

$$C_1 = 0.0115 \text{ mg/l}$$

D_{IS} = inhalation dose in shower

$$D_{IS} = C_1 \times B \times ts \times A$$

$$D_{IS} = 4.59 \text{ mg/day}$$

C_2 = air concentration in bathroom after shower

$$C_2 = \frac{V}{Qt} (C_1) \left[1 - \exp \frac{(-Qtb)}{V} \right]$$

$$C_2 = 0.0106 \text{ mg/l}$$

D_{IB} = inhalation dose in bathroom

$$D_{IB} = C_2 \times B \times tb \times A$$

$$D_{IB} = 6.33 \text{ mg/day}$$

D_{TW} = total inhalation dose in shower and bathroom, worse case scenario

$$= D_{IS} + D_{IB}$$

$$= 10.9 \text{ mg/day (when water contaminant concentration is 1 mg/l)}$$

Reasonable Case Calculation

$$\text{Cancer risk} = D_{TW} \times \frac{1}{\text{Body Weight}} \times \text{Unit cancer risk value}$$

$$= 0.64 \text{ mg/day} \times \frac{1}{70 \text{ kg}} \times 2.9 \times 10^{-2} \text{ mg/kg/day}^{-1}$$

$$= 2.65 \times 10^{-4}$$

Worse Case Calculation

$$\text{Cancer risk} = D_{TW} \times \frac{1}{\text{Body Weight}} \times \text{Unit cancer risk value}$$

$$= 10.9 \text{ mg/day} \times \frac{1}{70 \text{ kg}} \times 2.9 \times 10^{-2} \text{ mg/kg/day}^{-1}$$

$$= 45.16 \times 10^{-4}$$

VII. SUMMARY

This study detected benzene volatilization rates of 38 to 100% and benzene in air concentrations of 8000 to 31,000 micrograms per cubic meter when contaminated water was used for 30-minute showers. These data indicate that showering with contaminated water may be a major source of indoor air contaminants. Inhalation exposure to these concentrations while showering may result in inhalation dose that may be greater than the ingestion dose that would occur if a person consumed 2 liters per day of the same water. Table 10 lists the volatilization rates, ratio of air concentration to water concentration, and the ratio of inhalation to ingestion dose for this study and for data reported in the literature.

In order to obtain more information about inhalation exposures resulting from the use of contaminated water, the following studies would be helpful:

- Conduct air sampling in showers while the shower operates for 10 minutes. Based on the literature, shower duration is 6-10 minutes.
- Conduct air sampling for other constituents including chloroform and tetrachloroethylene.
- Conduct air sampling in the living area and bedroom for a 24-hour time period.
- Collect and analyze urine or breath samples to evaluate exposure.
- Collect air samples with evacuated canisters¹³ if this sampling and analytical method has sufficient detection limit.

Table 10
Data Summary

	<u>Current Study</u>	<u>Literature Values</u>
Volatilization rate	38.1 - 100.0%	50 - 80%
Air/Water Concentration	4.59 - 10.16 X 10 ^{-3A}	1.6 - 93.0 X 10 ^{-3B}
Inhalation/Ingestion Dose	0.3 - 5.5	0.47 - 1.06

A - for thirty minute showers

B - for five to 20 minute showers

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DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Charlie White DATE 2-17-90
ADDRESS 2002 West C Street I.H. Pate
Kannapolis, NC 28081 PHONE 704-932-6879

SAMPLING DATA

Parameter							
Sampling Location	Living Room	Shower	Shower	Shower	Bathroom	bedroom	bedroom
Pump #	35084	36322	213	34863	36321	34911	213
Filter/Impinger #	31	32 ^P	33 [*]	34 [*]	35 ^D	36	37
Time On	10:22	11:00	11:00	11:00	11:00	11:30	11:30
Time Off	12:02	Flow stopped	11:30	11:30	11:50		11:50
Total Time (min.)	100		30	30	50		20
Flow Rate	1.39	1.02	0.90	1.00	0.95		0.90
Volume liters	139.0		27.0	30.0	47.5		18.0
Sample Weight mgs	<0.020		0.208	0.256	0.418		0.184
Concentration	<0.144		7.704	8.533	8.800		10.222

CALIBRATION

Pump #	Pre	Post	
35084	1.48	1.50	
36322	1.02		
213	1.00	1.00	1.00
34863	1.10		
36321	1.05	1.05	1.05
34911	1.05		
34912	1.05		

COMMENTS

*Charged drying tubes at mid run
^D drying tube
Cigarette smoker

WATER SAMPLES

Date: 2-17-90

Location: Charlie White 2002 West C Street Kannapolis, NC 28081

Shower Start: 11:00

Shower Stop: 11:30

I. Water Samples

<u>Sample #</u>	<u>Time</u>	<u>Location</u>
<u>31-I</u>	<u>11:05</u>	<u>Shower inlet</u>
<u>32-O</u>	<u>11:07</u>	<u>Shower outlet</u>
<u>33-I</u>	<u>11:18</u>	<u>Shower inlet</u>
<u>34-O</u>	<u>11:18</u>	<u>Shower outlet</u>
<u>35-I</u>	<u>11:25</u>	<u>Shower inlet</u>
<u>36-O</u>	<u>11:26</u>	<u>Shower outlet</u>

II. Water Volumetric Rate

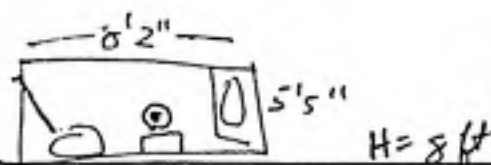
<u>Clock Time</u>	<u>Volume</u>	<u>Elapsed Time</u>	<u>Water Temperature</u>	<u>Liters/min.</u>
<u>11:09</u>	<u>830</u>	<u>6.00</u>	<u>37 °C</u>	<u>8.3</u>
<u>11:19</u>	<u>900</u>	<u>7.19</u>	<u>28 °C</u>	<u>6.8</u>
<u>11:22</u>	<u>830</u>	<u>5.41</u>	<u>26 °C</u>	<u>9.2</u>

III. Air Temperature

<u>Time</u>	<u>WB</u>	<u>DB</u>	<u>%RH</u>
<u>11:13</u>	<u>79</u>	<u>79</u>	<u> </u>
<u>11:23</u>	<u>76</u>	<u>76</u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

ave 8.1

Bathroom Dimensions



Fan Flowrate



Fan cover open on two sides
10" x 1" on each side

Over

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient,
or Supply: Charlie White

Address: 2002 West C Street Kannapolis 28081

County: Rowan

Report To: Bill Pate

Address: Eno. Epi



Date Collected: 2-17-90

Collected By: Bill Pate

Analysis Desired: Volatiles in air - charcoal tubes

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904330	31	Collected in large charcoal	
904331	33	tubes; Desorbed in 1ml CS ₂	
904332	34		
904333	35		
904334	37		
904335	Blank		
			SEE ATTACHED SHEET(S)

Date Received 2-19-90 AA

Date Reported 3-12-90

Date Extracted

Date Analyzed 3-1-90 mmo 2/22/90 JPM

Reported By: John P. Neal

DEPARTMENT OF HUMAN RESOURCES - DIVISION OF HEALTH SERVICES
LABORATORY SECTION
OCCUPATIONAL HEALTH

G C REPORT SHEET

COMPANY: Charlie White

DATE OF ANALYSIS: 2/22/90 JPM

TOTAL MILLIGRAMS

SAMPLE #	*Butane	Benzene	p-xylene	m-xylene	O-xylene					
904330	0.052	<0.020	<0.020	<0.020	<0.020					
904331	0.057	0.208	0.026	0.032	0.038					
904332	0.062	0.256	0.032	0.040	0.052					
904333	0.100	0.418	0.054	0.066	0.086					
904334	0.041	0.184	0.022	0.028	0.036					
904335	<0.020	<0.020	<0.020	<0.020	<0.020					
Other early peaks were present, but not identified.										
*Note: Tentative ID; may be 2-methyl propane; This calculation based on Hexane.										

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient.

or Supply: Charlie White

Address: 2002 ^{West} NC Street Kannapolis 28081

County: Rowan

Report To: Bill Pate

Address: Env. Epi

Date Collected: 2-17-90

Collected By: Bill Pate

Analysis Desired: Volatiles in water



Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904323	31-I		
904324	32-0		
904325	33-I		
904326	34-0		
904327	35-I		
904328	36-0		
904329	Blank		
			SEE ATTACHED SHEET(S)

Date Received 2-19-90 AA

Date Reported 3-7-90

Date Extracted

Date Analyzed VOC 2/28/90 JPM

Reported By: JPM R. Neal

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904323

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	U
✓Vinyl Chloride	U
Bromomethane	U
Chloroethane	U
Trichlorofluoromethane	U
✓1,1-Dichloroethylene	U
Methylene Chloride	1K
tert-Butyl Methyl Ether	U
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	4.9
1,1-Dichloroethane	U
2,2-Dichloropropane	U
(Cis) 1,2-Dichloroethylene	U
Chloroform	U
(BCM) Bromochloromethane	U
✓1,1,1-Trichloroethane	U
1,1-Dichloropropene	U
✓Carbon Tetrachloride	U
✓Benzene	924.0
✓1,2-Dichloroethane	187.7
✓Trichloroethylene	U
1,2-Dichloropropane	1K
Bromodichloromethane	U
Dibromomethane	U
Toluene	3.3
1,1,2-Trichloroethane	Trace
Tetrachloroethene	U
1,3-Dichloropropane	U
Dibromochloromethane	U
1,2-Dibromoethane (EDB)	11.8
1-Chlorohexane	U
Tetrahydrofuran	24.4

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	U
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 350.5
m-Xylene	U
o-Xylene	307.6
Styrene	U
Bromoform	U
Isopropylbenzene	U
1,1,2,2-Tetrachloroethane	U
Bromobenzene	U
n-Propylbenzene	U
1,2,3-Trichloropropane	U
2-Chlorotoluene	U
1,3,5-Trimethylbenzene	109.2 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	U
Pentachloroethane	U
1,2,4-Trimethylbenzene	49.4 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	U
1,3-Dichlorobenzene	U
✓1,4-Dichlorobenzene	U
n-Butylbenzene	U
1,2-Dichlorobenzene	U
(Bis) 2 Chloroisopropyl Ether	U
1,2-Dibromo-3 Chloropropane	U
1,2,4-Trichlorobenzene	U
Hexachlorobutadiene	U
Naphthalene	U
1,2,3-Trichlorobenzene	U

COMMENTS: Numerous unidentified peaks present

MOL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

1/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DH5 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904324

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	U
✓Vinyl Chloride	U
Bromomethane	U
Chloroethane	U
Trichlorofluoromethane	U
✓1,1-Dichloroethylene	U
Methylene Chloride	U
tert-Butyl Methyl Ether	U
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	2.1
1,1-Dichloroethane	U
2,2-Dichloropropane	U
(Cis) 1,2-Dichloroethylene	U
Chloroform	U
(BCM) Bromochloromethane	U
✓1,1,1-Trichloroethane	U
1,1-Dichloropropene	U
✓Carbon Tetrachloride	U
✓Benzene	152.0
✓1,2-Dichloroethane	94.7
✓Trichloroethylene	U
1,2-Dichloropropane	1K
Bromodichloromethane	U
Dibromomethane	U
Toluene	U
1,1,2-Trichloroethane	U
Tetrachloroethene	U
1,3-Dichloropropane	U
Dibromochloromethane	U
1,2-Dibromoethane (EDB)	4.2
1-Chlorohexane	U
Tetrahydrofuran	30.0

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	U
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 80.0
m-Xylene	3
o-Xylene	101.4
Styrene	U
Bromoform	U
Isopropylbenzene	U
1,1,2,2-Tetrachloroethane	U
Bromobenzene	U
n-Propylbenzene	U
1,2,3-Trichloropropane	U
2-Chlorotoluene	U
1,3,5-Trimethylbenzene	13.2 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	U
Pentachloroethane	U
1,2,4-Trimethylbenzene	4.3 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	U
1,3-Dichlorobenzene	U
✓1,4-Dichlorobenzene	U
n-Butylbenzene	U
1,2-Dichlorobenzene	U
(Bis) 2 Chloroisopropyl Ether	U
1,2-Dibromo-3 Chloropropane	U
1,2,4-Trichlorobenzene	U
Hexachlorobutadiene	U
Naphthalene	U
1,2,3-Trichlorobenzene	U

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904325

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	
(Trans) 1,2-Dichloroethylene	↓
Isopropyl ether	5.9
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	465.1
✓1,2-Dichloroethane	214.8
✓Trichloroethylene	U
1,2-Dichloropropane	1.0
Bromodichloromethane	U
Dibromomethane	
Toluene	↓
1,1,2-Trichloroethane	trace
Tetrachloroethene	U
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	17.5
1-Chlorohexane	U
Tetrahydrofuran	26.5

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	↓
1,1,1,2-Tetrachloroethane	
p-Xylene	2 80.3
m-Xylene	3
o-Xylene	280.8
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	29.6 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	↓
1,2,4-Trimethylbenzene	1.9 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Numerous unidentified peaks present

MOL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904326

PURGEABLE COMPOUNDS

Date of Analysis 2/23/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	
(Trans)1,2-Dichloroethylene	
Isopropyl ether	3.2
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	33.5
✓1,2-Dichloroethane	149.7
✓Trichloroethylene	U
1,2-Dichloropropane	1K
Bromodichloromethane	U
Dibromomethane	
Toluene	
1,1,2-Trichloroethane	Trace
Tetrachloroethene	U
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	4.3
1-Chlorohexane	U
Tetrahydrofuran	35.5

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	
1,1,1,2-Tetrachloroethane	
p-Xylene	2 45.7
m-Xylene	3
o-Xylene	142.6
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	19.6 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	1.2 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	

COMMENTS: Numerous Unidentified Peaks Present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904327

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	U
✓Vinyl Chloride	U
Bromomethane	U
Chloroethane	U
Trichlorofluoromethane	U
✓1,1-Dichloroethylene	U
Methylene Chloride	U
tert-Butyl Methyl Ether	U
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	6.1
1,1-Dichloroethane	U
2,2-Dichloropropane	U
(Cis) 1,2-Dichloroethylene	U
Chloroform	U
(BCM) Bromochloromethane	U
✓1,1,1-Trichloroethane	U
1,1-Dichloropropene	U
✓Carbon Tetrachloride	U
✓Benzene	1234.7
✓1,2-Dichloroethane	234.7
✓Trichloroethylene	U
1,2-Dichloropropane	1.2
Bromodichloromethane	U
Dibromomethane	U
Toluene	8.1
1,1,2-Trichloroethane	trace
Tetrachloroethene	U
1,3-Dichloropropane	U
Dibromochloromethane	U
1,2-Dibromoethane (EOB)	22.8
1-Chlorohexane	U
Tetrahydrofuran	42.8

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	U
1,1,1,2-Tetrachloroethane	U
p-Xylene	292.7
m-Xylene	U
o-Xylene	352.9
Styrene	U
Bromoform	U
Isopropylbenzene	U
1,1,2,2-Tetrachloroethane	U
Bromobenzene	U
n-Propylbenzene	U
1,2,3-Trichloropropane	U
2-Chlorotoluene	U
1,3,5-Trimethylbenzene	68.6
4-Chlorotoluene	U
(Tert) Butyl Benzene	U
Pentachloroethane	U
1,2,4-Trimethylbenzene	18.8
(Sec) Butyl Benzene	U
p-Isopropyltoluene	U
1,3-Dichlorobenzene	U
✓1,4-Dichlorobenzene	U
n-Butylbenzene	U
1,2-Dichlorobenzene	U
(Bis) 2 Chloroisopropyl Ether	U
1,2-Dibromo-3 Chloropropane	U
1,2,4-Trichlorobenzene	U
Hexachlorobutadiene	U
Naphthalene	U
1,2,3-Trichlorobenzene	U

COMMENTS:

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
LHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 20047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904328

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	
(Trans) 1,2-Dichloroethylene	✓
Isopropyl ether	2.6
1,1-Dichloroethane	u
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	11.2
✓1,2-Dichloroethane	133.5
✓Trichloroethylene	u
1,2-Dichloropropane	1K
Bromodichloromethane	u
Dibromomethane	
Toluene	✓
1,1,2-Trichloroethane	trace
Tetrachloroethene	u
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	8.2
1-Chlorohexane	u
Tetrahydrofuran	35.6

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	
1,1,1,2-Tetrachloroethane	✓
p-Xylene	3 1.1
m-Xylene	3
o-Xylene	67.5
Styrene	u
Bromofom	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	2.7 J
4-Chlorotoluene	u
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: *Numerous unidentified peaks present*

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
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- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904329

PURGEABLE COMPOUNDS

Date of Analysis 2/28/90

COMPOUND	µg/l
Dichlorodifluoromethane	L
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	
(Trans)1,2-Dichloroethylene	
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	
✓1,2-Dichloroethane	
✓Trichloroethylene	
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	
1,1,2-Trichloroethane	
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	
1-Chlorohexane	✓

COMPOUND	µg/l
Chlorobenzene	L
Ethylbenzene	
1,1,1,2-Tetrachloroethane	
p-Xylene	
m-Xylene	
o-Xylene	
Styrene	
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS:

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Nancy Coleman DATE 2-8-90
ADDRESS Rt 1 Box 6 I.H. Pete
Jennifer Subdivision PHONE 919-371-6002
Leland, NC 28451

SAMPLING DATA

Parameter						
Sampling Location	Living Rm	Shower B	Shower	Shower		
Pump #	34863	36321	34911 35084	36322	35086	35085
Filter/Impinger #	11	12, 12W	13, 13W	14, 14W	15	16
Time On	11:45	12:42	12:42	12:42		
Time Off	14:22	13:12	13:12	13:12		
Total Time (min.)	157	30	30	30		
Flow Rate	1.03	0.88	1.00	0.95		
Volume liters	161.7	26.4	30.0	28.5		
Sample Weight Benzene mg	0.048	0.280	<0.020	<0.02		
Concentration $\mu\text{g}/\text{m}^3$	0.2968	10.606				

CALIBRATION

Flow = 0.99895 (rate) - 0.102

Pump #	Pre	Post
34911		
34963	1.15	1.10
36321	1.00	0.95
35084	1.70	A
36322	1.05	1.05
35086	0.95	
35085	1.40	

COMMENTS

A - could not get a th. pump to run for post test flow rate measurement

W - dust drying tube

DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Nancy Coleman DATE 2-8-90
ADDRESS _____ I.H. Pate

PHONE _____

SAMPLING DATA

Parameter						
Sampling Location	<u>Bathroom</u>	<u>Bathroom</u>				
Pump #	<u>36321</u> <u>35088</u>	<u>34910</u>				
Filter/Impinger #	<u>17, NW</u>	<u>18, ^{18W} FE</u>				
Time On	<u>13:12</u>	<u>12:42</u>				
Time Off	<u>13:32</u>	<u>13:32</u>				
Total Time (min.)	<u>20</u>	<u>50</u>				
Flow Rate	<u>0.80</u>	<u>1.08</u>				
Volume	<u>16.0</u>	<u>54.0</u>				
Sample Weight	<u>0.170</u>	<u>0.498</u>				
Concentration	<u>10.6</u>	<u>9.22</u>				

CALIBRATION

Pump #	Pre	Post
<u>35088</u>	<u>1.25</u>	
<u>34910</u>	<u>1.23</u>	<u>1.12</u>
<u>36321</u>	<u>0.85</u>	<u>0.85</u>

0.95

COMMENTS

N - denotes drying tube

WATER SAMPLES

Date: 2-8-90

Location: Nancy Coleman

Shower Start: 12:42

Shower Stop: 13:12

I. Water Samples

<u>Sample #</u>	<u>Time</u>	<u>Location</u>
<u>11 I</u>	<u>12:47</u>	<u>Shower Inlet</u>
<u>14-0</u>	<u>12:49</u>	<u>Shower Outlet</u>
<u>12 I</u>	<u>12:57</u>	<u>Shower Inlet</u>
<u>15-0</u>	<u>12:59</u>	<u>Shower Outlet</u>
<u>13 I, 17-I</u>	<u>13:10</u>	<u>Shower inlet</u>
<u>16-0</u>	<u>13:12</u>	<u>Shower outlet</u>

II. Water Volumetric Rate

<u>Clock Time</u>	<u>Volume</u>	<u>Elapsed Time</u>	<u>Water Temperature</u>	<u>Liters/min.</u>
<u>12:50</u>	<u>900 ml</u>	<u>11.44 sec</u>	<u>38 °C</u>	<u>4.7</u>
<u>13:00</u>	<u>950 ml</u>	<u>12.10 sec</u>		<u>4.7</u>
<u>13:10</u>	<u>960 ml</u>	<u>14.89</u>		<u>3.9</u>

III. Air Temperature

<u>Time</u>	<u>WB</u>	<u>DB</u>	<u>%RH</u>
<u>12:56</u>	<u>76</u>	<u>76</u>	<u> </u>
<u>13:05</u>	<u>73</u>	<u>75</u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

Note - dropped cap on 13 I ∴ repeat sampling - sample # 17 I

Bathroom Dimensions

Fan Flowrate

Did not run fan in bathroom during shower or during after shower ~~per~~ time period.

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient
or Supply: Nancy Coleman
Address: Leland, NC
County: Brunswick
Report To: Bill Pate
Address: Env. Epid

Date Collected: 2-8-90

Collected By: Bill Pate

Analysis Desired: Organics on charcoal tubes - air samples

Collected in large charcoal tubes
Described in 1 ml CS₂

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904215	11		
904216	12		
904217	13		
904218	14		
904219	17		
904220	18		
			SEE ATTACHED SHEET(S)

Date Received 2-9-90 BR

Date Reported 3-12-90

Date Extracted _____

Date Analyzed 3-1-90 ^{GC/MS} 2/19/90 ^{GC/MS}

Reported By: John P. Neal

DEPARTMENT OF HUMAN RESOURCES - DIVISION OF HEALTH SERVICES
LABORATORY SECTION
OCCUPATIONAL HEALTH

G C REPORT SHEET

COMPANY: Nancy Coleman

DATE OF ANALYSIS: 2/19/90 4pm

TOTAL MILLIGRAMS

SAMPLE #	*Butane	Benzene	Toluene	Ethylbenzene	p-xylene	m-xylene	o-xylene			
904215	<0.020	0.048	0.028	<0.020	<0.020	<0.020	<0.020			
904216	0.158	0.280	0.134	<0.020	0.030	0.024	0.038			
904217	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020			
904218	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020			
904219	0.074	0.170	0.084	<0.020	<0.020	<0.020	0.022			
904220	0.252	0.498	0.246	0.032	0.058	0.048	0.070			
Also present are early unidentified peaks.										
Note: Tentative ID; may be 2-methyl propane; Calculations based on Hexane										

DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Nancy Coleman DATE 3/28/90
ADDRESS _____ I.H. Pete

PHONE _____

SAMPLING DATA

Parameter	VOC	VOC	VOC	VOC	VOC	VOC
Sampling Location	Shower	Shower	Shower	Bathroom	Bathroom	Liv Rm
Pump #	36321	213	36322	34863	36321	34911
Filter/Impinger #	51 ⁺	52 ⁺	53 ⁺	54 ⁺	55 ⁺	57
Time On	11:10	11:10	11:10	11:10	11:40	10:38
Time Off	11:40	11:40	11:40	12:00	12:00	stopped sometime before 1:00
Total Time (min.)	30	30	30	50	20	142
Flow Rate <i>l/min</i>	1.00	1.00	1.01	0.98	0.90	1.42
Volume <i>liters</i>	30.0	30.0	30.3	49.0	18	201.6
Sample Weight <i>mg</i>	0.232	0.248	0.252	0.390	0.144	0.054
Concentration <i>mg/m³</i>	7.73	8.27	8.32	7.96	8.00	0.27

CALIBRATION

Pump #	Pre	Post
36321	1.10	1.09
213	1.10	1.10
36322	1.10	1.12
34863	1.10	1.15
34861		
34911	1.52	

2nd Run
Pre Post
1.00 1.10

COMMENTS

+ - drying tubes
Changed drying tube at 11:25

WATER SAMPLES

Date: 3/28
 Location: Nancy Coleman
 Shower Start: 11:10
 Shower Stop: 11:40

I. Water Samples

<u>Sample #</u>	<u>Time</u>	<u>Location</u>
<u>51 I</u>	<u>11:14</u>	<u>shower inlet</u>
<u>52 O</u>	<u>11:16</u>	<u>shower outlet</u>
<u>53 I</u>	<u>11:26</u>	<u>shower inlet</u>
<u>54 O</u>	<u>11:26</u>	<u>shower outlet</u>
<u>55 I</u>	<u>11:36</u>	<u>shower inlet</u>
<u>56 O</u>	<u>11:37</u>	<u>shower outlet</u>
<u>2357</u>		<u>cold water tap</u>

II. Water Volumetric Rate

<u>Clock Time</u>	<u>Volume</u>	<u>Elapsed Time</u>	<u>Water Temperature</u>	<u>Liters/min.</u>
<u>11:17</u>	<u>930</u>	<u>11:32</u>	<u>37 °C</u>	<u>4.93</u>
<u>11:28</u>	<u>930</u>	<u>11:83</u>	<u>36 °C</u>	<u>4.72</u>
<u>11:34</u>	<u>950</u>	<u>12:33</u>	<u>36 °C</u>	<u>4.62</u>

ave = 4.8

III. Air Temperature

<u>Time</u>	<u>WB</u>	<u>DB</u>	<u>%RH</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Bathroom Dimensions

Fan Flowrate

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient
or Supply: Nancy Coleman

Address: Blair, NC

County: Brunswick

Report To: Bill Pate

Address: Env. Epid

Date Collected: 2-8-90

Collected By: Bill Pate

Analysis Desired: volatile organics in water



Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904227	11 I		
904228	12 I		
904229	14-0		
904230	150		
904231	16-0		
904232	17 I		
			SEE ATTACHED SHEET(S)

Date Received 2-9-90 BNS

Date Reported 3-12-90

Date Extracted

Date Analyzed 2/21 - 2/23/90 gpm

Reported By:

John L. Neal

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904227

PURGEABLE COMPOUNDS

Date of Analysis 2/21/90

COMPOUND	ug/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	3.9
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	1104.0
✓1,2-Dichloroethane	14.3
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	392.8
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	1.2
1-Chlorohexane	U

COMPOUND	ug/l
Chlorobenzene	U
Ethylbenzene	13.9
1,1,1,2-Tetrachloroethane	U
p-Xylene	264.4
m-Xylene	3
o-Xylene	197.6
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	48.9
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	139.1
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 ug/l.

J - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected.
NA - Not analyzed.
1/ - Tentative identification.
✓ - Regulated VOC
T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No.

904228

PURGEABLE COMPOUNDS

Date of Analysis

2/22/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	↓
Methylene Chloride	
tert-Butyl Methyl Ether	7.7
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	↓
1,1-Dichloropropene	
✓Carbon Tetrachloride	↓
✓Benzene	1094.2
✓1,2-Dichloroethane	15.6
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	397.0
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	2.1
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	3.8
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 384.0
m-Xylene	↓
o-Xylene	245.6
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	68.7 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	223.1 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

1/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 306B-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904229

PURGEABLE COMPOUNDS

Date of Analysis 2/22/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	2.5
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	
✓1,2-Dichloroethane	4.1
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	
1,1,2-Trichloroethane	
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	Trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	
1,1,1,2-Tetrachloroethane	
p-Xylene	47.4
m-Xylene	
o-Xylene	21.7
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	12.8 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	31.3 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected.
NA - Not analyzed.
I/ - Tentative identification.
✓ - Regulated VOC
T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No.

904230

PURGEABLE COMPOUNDS

Date of Analysis

2/22/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	↓
✓Vinyl Chloride	↓
Bromomethane	↓
Chloroethane	↓
Trichlorofluoromethane	↓
✓1,1-Dichloroethylene	↓
Methylene Chloride	↓
tert-Butyl Methyl Ether	2.6
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	↓
1,1-Dichloroethane	↓
2,2-Dichloropropane	↓
(Cis) 1,2-Dichloroethylene	↓
Chloroform	↓
(BCM) Bromochloromethane	↓
✓1,1,1-Trichloroethane	↓
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	↓
✓1,2-Dichloroethane	4.5
✓Trichloroethylene	u
1,2-Dichloropropane	↓
Bromodichloromethane	↓
Dibromomethane	↓
Toluene	↓
1,1,2-Trichloroethane	↓
Tetrachloroethene	↓
1,3-Dichloropropane	↓
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	↓
1,1,1,2-Tetrachloroethane	↓
p-Xylene	80.7
m-Xylene	↓
o-Xylene	44.8
Styrene	u
Bromoform	↓
Isopropylbenzene	↓
1,1,2,2-Tetrachloroethane	↓
Bromobenzene	↓
n-Propylbenzene	↓
1,2,3-Trichloropropane	↓
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	17.9 J
4-Chlorotoluene	u
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	58.6 J
(Sec) Butyl Benzene	u
p-Isopropyltoluene	↓
1,3-Dichlorobenzene	↓
✓1,4-Dichlorobenzene	↓
n-Butylbenzene	↓
1,2-Dichlorobenzene	↓
(Bis) 2 Chloroisopropyl Ether	↓
1,2-Dibromo-3 Chloropropane	↓
1,2,4-Trichlorobenzene	↓
Hexachlorobutadiene	↓
Naphthalene	↓
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904231

PURGEABLE COMPOUNDS

Date of Analysis 2/22/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	✓
Methylene Chloride	
tert-Butyl Methyl Ether	4.0
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	6.6
✓1,2-Dichloroethane	6.7
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	
1,1,2-Trichloroethane	
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	✓
1,1,1,2-Tetrachloroethane	✓
p-Xylene	2 111.9
m-Xylene	3
o-Xylene	64.6
Styrene	u
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	24.1 J
4-Chlorotoluene	u
(Tert) Butyl Benzene	
Pentachloroethane	✓
1,2,4-Trimethylbenzene	82.7 J
(Sec) Butyl Benzene	u
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Unidentified peaks present

HDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-O (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904232

PURGEABLE COMPOUNDS

Date of Analysis 2/22/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	↓
Methylene Chloride	
tert-Butyl Methyl Ether	7.5
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	
✓Benzene	998.9
✓1,2-Dichloroethane	15.7
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	259.5
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	1.5
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	↓
1,1,1,2-Tetrachloroethane	
p-Xylene	379.7
m-Xylene	
o-Xylene	242.2
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	129.6 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	↓
1,2,4-Trimethylbenzene	230.5 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present.

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient
or Supply: Nancy Coleman

Address: Leland NC

County: Brunswick

Report To: Bill Pate

Address: Env. Epid.

Cooper Bldg

Date Collected: 3-28-90

Collected By: Bill Pate

Analysis Desired: Volatile organic compounds in Air



Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904305	51		
904306	52		
904307	53		
904308	54		
904309	55		
904310	57		
904311	56	Blank	
			SEE ATTACHED SHEET(S)
Collected in large charcoal tubes; Desorbed in 1.0 ml CS ₂ .			

Date Received 3-29-90 AA, TM

Date Reported 5-1-90

Date Extracted

Date Analyzed 4/4 - 4/5/90 ^{GC/MS} 4-20-90

Reported By: John L. Neal

G C REPORT SHEET

DATE OF ANALYSIS: 4/4-4/5/90

TOTAL MILLIGRAMS

* Calculations based on response to Hexane

Other peaks present upon tentative IDed by GC/MS: 2-methyl butane; pentane; 2,2 dimethyl butane; ethyl cyclobutane; 3 methyl-pentane,

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient
or Supply: Nancy Coleman

Address: Leland, NC

County: Brunswick

Report To: Bill Pate

Address: Env. Epid

Cooper Bldg

Date Collected: 3-28-90

Collected By: Bill Pate

Analysis Desired: Volatile organic compounds in water

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904312	51-I		
904313	52-0		
904314	53-I		
904315	54-0		
904316	55-I		
904317	57		
904318	56-0		SEE ATTACHED SHEET(S)

Date Received 3-29-90 AA, JM

Date Reported 4-5-90

Date Extracted _____

Date Analyzed ^{VOC} 3/30 - 4/2/90 JPM

Reported By: JPM R. Neal

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904812

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	U
✓Vinyl Chloride	U
Bromomethane	U
Chloroethane	U
Trichlorofluoromethane	U
✓1,1-Dichloroethylene	U
Methylene Chloride	U
tert-Butyl Methyl Ether	3.4
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	2.0
1,1-Dichloroethane	U
2,2-Dichloropropane	U
(Cis) 1,2-Dichloroethylene	U
Chloroform	U
(BCM) Bromochloromethane	U
✓1,1,1-Trichloroethane	U
1,1-Dichloropropene	U
✓Carbon Tetrachloride	U
✓Benzene	1962.9
✓1,2-Dichloroethane	14.3
✓Trichloroethylene	U
1,2-Dichloropropane	U
Bromodichloromethane	U
Dibromomethane	U
Toluene	778.5
1,1,2-Trichloroethane	U
Tetrachloroethene	U
1,3-Dichloropropane	U
Dibromochloromethane	U
1,2-Dibromoethane (EDB)	1.0
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	187.4
1,1,1,2-Tetrachloroethane	U
p-Xylene	406.2
m-Xylene	U
o-Xylene	337.7
Styrene	U
Bromoform	U
Isopropylbenzene	6.7 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	U
n-Propylbenzene	U
1,2,3-Trichloropropane	U
2-Chlorotoluene	U
1,3,5-Trimethylbenzene	75.4 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	U
Pentachloroethane	U
1,2,4-Trimethylbenzene	278.9 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	U
1,3-Dichlorobenzene	U
✓1,4-Dichlorobenzene	U
n-Butylbenzene	U
1,2-Dichlorobenzene	U
(Bis) 2 Chloroisopropyl Ether	U
1,2-Dibromo-3 Chloropropane	U
1,2,4-Trichlorobenzene	U
Hexachlorobutadiene	U
Naphthalene	U
1,2,3-Trichlorobenzene	U

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904813

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	↓
Methylene Chloride	↓
tert-Butyl Methyl Ether	2.0
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	trace
1,1-Dichloroethane	u
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	↓
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	754.0
✓1,2-Dichloroethane	6.3
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	284.0
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	64.3
1,1,1,2-Tetrachloroethane	u
p-Xylene	? 152.5
m-Xylene	↓
o-Xylene	129.2
Styrene	u
Bromoform	↓
Isopropylbenzene	2.6 J
1,1,2,2-Tetrachloroethane	u
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	↓
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	27.7 J
4-Chlorotoluene	u
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	108.5 J
(Sec) Butyl Benzene	u
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
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- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904814

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	3.9
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	2.0
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	1766.3
✓1,2-Dichloroethane	14.0
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	736.7
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	1K
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	177.0
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 389.1
m-Xylene	5
o-Xylene	317.7
Styrene	U
Bromoform	✓
Isopropylbenzene	6.6 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	76.2 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	✓
1,2,4-Trimethylbenzene	277.0 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904815

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	1.6
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	Trace
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	755.4
✓1,2-Dichloroethane	6.1
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	298.4
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	1K
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	67.5
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 155.2
m-Xylene	3
o-Xylene	131.8
Styrene	U
Bromoform	
Isopropylbenzene	2.4 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	29.3 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	112.5 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	

COMMENTS: *Unidentified peaks present*

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected.
NA - Not analyzed.
I/ - Tentative identification.
✓ - Regulated VOC
T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904816

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	3.7
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	1541.8
✓1,2-Dichloroethane	12.6
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	603.8
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	IK
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	137.6
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 312.0
m-Xylene	3
o-Xylene	258.5
Styrene	U
Bromoform	
Isopropylbenzene	5.5 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	58.8 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	✓
1,2,4-Trimethylbenzene	218.5 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: *Unidentified peaks present.*

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 26047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904817

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	↓
tert-Butyl Methyl Ether	2.8
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	1524.0
✓1,2-Dichloroethane	12.2
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	655.3
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	1K
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	143.6
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 315.7
m-Xylene	↓
o-Xylene	263.7
Styrene	U
Bromoform	↓
Isopropylbenzene	6.3 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	64.4 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	↓
1,2,4-Trimethylbenzene	234.6 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: *Unidentified peaks present*

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904818

PURGEABLE COMPOUNDS

Date of Analysis 3/30/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	↓
tert-Butyl Methyl Ether	2.3
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	1.2
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	845.0
✓1,2-Dichloroethane	10.8
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	↓
Dibromomethane	↓
Toluene	339.9
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	↓
Dibromochloromethane	↓
1,2-Dibromopropane (EDB)	1K
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	75.7
1,1,1,2-Tetrachloroethane	U
p-Xylene	7 182.4
m-Xylene	↓
o-Xylene	158.6
Styrene	U
Bromoform	↓
Isopropylbenzene	28 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	↓
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	34.5 J
4-Chlorotoluene	U
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	135.0 J
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

1/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DH5 3068-0 (1/89 Laboratory)

DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Rick and Darlene Dorsey DATE 3/28/90
ADDRESS _____ I.H. Pate

PHONE _____

SAMPLING DATA

Parameter	VOC	VOC	VOC	VOC	VOC	VOC
Sampling Location	Shower	Shower	Shower	Bathroom	Bathroom	Liv Rm
Pump #	213	36322	36321	34863	213	34912
Filter/Impinger #	61 ⁺	62 ⁺	63 ⁺	64 ⁺	65 ⁺	66
Time On	12:50	12:50	12:50	12:50	1:20	12:26
Time Off	1:20	1:20	1:21	1:10	1:40	1:56
Total Time (min.)	30	30	30	30 20	20	90
Flow Rate ℓ/min	0.93	1.01	1.03	0.95	0.96	1.52
Volume ℓ	27.9	30.3	30.9	28.5 19.0	19.2	136.8
Sample Weight mg	0.884	1.002	0.992	0.430	0.686	0.104
Concentration mg/m^3	31.68	33.07	32.10	22.63 15.04	35.73	0.76

CALIBRATION

Pump #	Pre	Post
34912	1.58	1.65
213	1.05	1.00
36322	1.10	1.12
36321	1.10	1.15
34861	1.05	
34863	1.05	

2nd Run
Pre Post
1.12 1.00

COMMENTS

+ drying tubes
Changed drying tube at 1:05

WATER SAMPLES

Date: 3-28-90

Location: Dorsey

Shower Start: 12:50

Shower Stop: 1:20

I. Water Samples

<u>Sample #</u>	<u>Time</u>	<u>Location</u>
<u>61 - I</u>	<u>12:55</u>	<u>Shower inlet</u>
<u>62 - O</u>	<u>12:56</u>	<u>Shower outlet</u>
<u>63 - I</u>	<u>1:05</u>	<u>Shower inlet</u>
<u>64 - O</u>	<u>1:09</u>	<u>Shower outlet</u>
<u>65 - I</u>	<u>1:10</u>	<u>Shower inlet</u>
<u>66 - O</u>	<u>1:16</u>	<u>Shower outlet</u>
<u>67</u>		<u>Cold water tap</u>

II. Water Volumetric Rate

<u>Clock Time</u>	<u>Volume</u>	<u>Elapsed Time</u>	<u>Water Temperature</u>	<u>Liters/min.</u>
<u>12:57</u>	<u>840</u>	<u>6:17</u>	<u>40°C</u>	<u>8.17</u>
<u>1:03</u>	<u>780</u>	<u>6:21</u>	<u>40°C</u>	<u>7.54</u>
<u>1:14</u>	<u>750 850</u>	<u>8 7:90</u>	<u>24°C</u>	<u>6.46</u>
				<u>7.4</u>

III. Air Temperature

<u>Time</u>	<u>WB</u>	<u>DB</u>	<u>%RH</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

Bathroom Dimensions

Fan Flowrate

G C REPORT SHEET

DATE OF ANALYSIS: 4/3 - 4/5/90

[illegible]

N.C. Division of Health Services
DHS 3068 (6/83 Laboratory)

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report



Name of Owner, Patient
or Supply: Rick & Darlene Dorsey

Address: Leland NC

County: Brunswick

Report To: Bill Pate

Address: Env. Epid.

Cooper Bldg

Date Collected: 3-28-90

Collected By: Bill Pate

Analysis Desired: Volatile organic compounds in water

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904792	61-I		
904793	62-0		
904794	63-I		
904795	64-0		
904796	65-I		
904797	66-0		
904798	67		
			SEE ATTACHED SHEET(S)

Date Received 3-29-90 AA, JM

Date Reported 4-5-90

Date Extracted

Date Analyzed VOC 3/30 - 4/2/90 gfm

Reported By: John P. Neal

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No.

904792

PURGEABLE COMPOUNDS

Date of Analysis

3/30/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	↓
Methylene Chloride	↓
tert-Butyl Methyl Ether	5.9
(Trans)1,2-Dichloroethylene	u
Isopropyl ether	trace
1,1-Dichloroethane	u
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	↓
✓Benzene	3329.9
✓1,2-Dichloroethane	26.2
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	↓
Dibromomethane	↓
Toluene	4.4
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	↓
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	16.1
1,1,1,2-Tetrachloroethane	u
p-Xylene	
m-Xylene	
o-Xylene	
Styrene	
Bromoform	↓
Isopropylbenzene	13.4 J
1,1,2,2-Tetrachloroethane	u
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	trace
4-Chlorotoluene	u
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	trace
(Sec) Butyl Benzene	u
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
OHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST., RALEIGH, N.C. 27611

Laboratory No. 904793

PURGEABLE COMPOUNDS

Date of Analysis 3/30/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	3.2
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	1311.3
✓1,2-Dichloroethane	11.4
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	1.7
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	5.4
1,1,1,2-Tetrachloroethane	u
p-Xylene	2 trace
m-Xylene	3
o-Xylene	trace
Styrene	u
Bromoform	✓
Isopropylbenzene	4.5 J
1,1,2,2-Tetrachloroethane	u
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-D (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904794

PURGEABLE COMPOUNDS

Date of Analysis 3/30/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	✓
Methylene Chloride	
tert-Butyl Methyl Ether	5.5
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	↓
✓Benzene	2819.6
✓1,2-Dichloroethane	22.9
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	3.6
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EOB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	12.0
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 } trace
m-Xylene	3 }
o-Xylene	trace
Styrene	U
Bromoform	✓
Isopropylbenzene	10.0 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	trace
4-Chlorotoluene	U
(Tert) Butyl Benzene	↓
Pentachloroethane	✓
1,2,4-Trimethylbenzene	trace
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHIS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904795

PURGEABLE COMPOUNDS

Date of Analysis 3/3/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	↓
Methylene Chloride	↓
tert-Butyl Methyl Ether	2.6
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	↓
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	↓
✓Benzene	976.9
✓1,2-Dichloroethane	9.0
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	1.1
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	3.7
1,1,1,2-Tetrachloroethane	U
p-Xylene	} trace
m-Xylene	
o-Xylene	trace
Styrene	U
Bromoform	↓
Isopropylbenzene	3.1 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904796

PURGEABLE COMPOUNDS

Date of Analysis 3/30/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	↓
tert-Butyl Methyl Ether	6.0
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	trace
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	↓
✓Carbon Tetrachloride	
✓Benzene	30/7.6
✓1,2-Dichloroethane	25.5
✓Trichloroethylene	U
1,2-Dichloropropane	↓
Bromodichloromethane	
Dibromomethane	↓
Toluene	4.0
1,1,2-Trichloroethane	U
Tetrachloroethene	↓
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	13.9
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 trace
m-Xylene	3
o-Xylene	trace
Styrene	U
Bromoform	↓
Isopropylbenzene	11.2 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	↓
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	↓
1,3,5-Trimethylbenzene	trace
4-Chlorotoluene	U
(Tert) Butyl Benzene	↓
Pentachloroethane	↓
1,2,4-Trimethylbenzene	trace
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904797

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	u
✓Vinyl Chloride	u
Bromomethane	u
Chloroethane	u
Trichlorofluoromethane	u
✓1,1-Dichloroethylene	u
Methylene Chloride	u
tert-Butyl Methyl Ether	6.1
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	u
1,1-Dichloroethane	u
2,2-Dichloropropane	u
(Cis) 1,2-Dichloroethylene	u
Chloroform	u
(BCM) Bromochloromethane	u
✓1,1,1-Trichloroethane	u
1,1-Dichloropropene	u
✓Carbon Tetrachloride	u
✓Benzene	1868.9
✓1,2-Dichloroethane	17.2
✓Trichloroethylene	u
1,2-Dichloropropane	u
Bromodichloromethane	u
Dibromomethane	u
Toluene	2.5
1,1,2-Trichloroethane	u
Tetrachloroethene	u
1,3-Dichloropropane	u
Dibromochloromethane	u
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	7.3
1,1,1,2-Tetrachloroethane	u
p-Xylene	trace
m-Xylene	trace
o-Xylene	trace
Styrene	u
Bromoform	u
Isopropylbenzene	6.1 J
1,1,2,2-Tetrachloroethane	u
Bromobenzene	u
n-Propylbenzene	u
1,2,3-Trichloropropane	u
2-Chlorotoluene	u
1,3,5-Trimethylbenzene	trace
4-Chlorotoluene	u
(Tert) Butyl Benzene	u
Pentachloroethane	u
1,2,4-Trimethylbenzene	trace
(Sec) Butyl Benzene	u
p-Isopropyltoluene	u
1,3-Dichlorobenzene	u
✓1,4-Dichlorobenzene	u
n-Butylbenzene	u
1,2-Dichlorobenzene	u
(Bis) 2 Chloroisopropyl Ether	u
1,2-Dibromo-3 Chloropropane	u
1,2,4-Trichlorobenzene	u
Hexachlorobutadiene	u
Naphthalene	u
1,2,3-Trichlorobenzene	u

COMMENTS: Unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904798

PURGEABLE COMPOUNDS

Date of Analysis 4/2/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	10.0
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	trace
1,1-Dichloroethane	U
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	2990.5
✓1,2-Dichloroethane	22.9
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	3.6
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	12.3
1,1,1,2-Tetrachloroethane	U
p-Xylene	
m-Xylene	
o-Xylene	
Styrene	
Bromoform	✓
Isopropylbenzene	10.8 J
1,1,2,2-Tetrachloroethane	U
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	✓
1,3,5-Trimethylbenzene	trace
4-Chlorotoluene	U
(Tert) Butyl Benzene	
Pentachloroethane	✓
1,2,4-Trimethylbenzene	trace
(Sec) Butyl Benzene	U
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: *Unidentified peaks present*

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

1/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DH5 3068-0 (1/89 Laboratory)

DEPARTMENT OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES
DIVISION OF EPIDEMIOLOGY
ENVIRONMENTAL EPIDEMIOLOGY SECTION

AIR SAMPLING DATA

NAME Rick and Darlene Dorsey

DATE 3-8-90

ADDRESS P.O. Box 34

I.H. Pate

Leland, NC 28451

PHONE 763-4581 (W)

Rick at Atlantic Mack

SAMPLING DATA

Parameter							
Sampling Location	Living Area	Shower	Shower	Shower	Shower	Bathroom	Bathroom
Pump #	34910	213	34863	36322	34912	36321	213
Filter/Impinger #	46	41 ⁺	42 ⁺	44 ⁺	→ 44 ⁺	45 ⁺	47 ⁺
Time On	11:28	11:50	11:50	11:50	12:02	11:50	12:25
Time Off	1:02	12:20	Stopped at 12:00	** 12:00	12:20	12:40	12:40
Total Time (min.)	94	30	10	10	18	50	15
Flow Rate	0.98	0.99	1.00	1.10	0.95	0.93	0.99
Volume <i>liters</i>	92.1	29.7	10	11.0	17.1	46.5	14.9
Sample Weight <i>mg</i>	0.104	0.648	<0.020	10.534		1.034	0.328
Concentration	1.13	21.8	<2.0	1.0 19.0		22.2	22.0

CALIBRATION

Pump #	Pre	Post
34910	1.05	1.10
213	1.10	1.08
34863	1.10	
34912	1.00	1.10
36322	1.20	
36321	0.95	1.10

erratic

2nd run 213 1.10 1.08

COMMENTS

** Pump # 36322 stopped - switched to pump # 34912 at 12:02
+ drying tube used

WATER SAMPLES

Date: 3-8-90

Location: Dorsey

Shower Start: 11:50

Shower Stop: 12:20

I. Water Samples

<u>Sample #</u>	<u>Time</u>	<u>Location</u>
<u>41 I</u>	<u>11:56</u>	<u>Inlet</u>
<u>42 0</u>	<u>11:57</u>	<u>Outlet</u>
<u>43 I</u>	<u>12:07</u>	
<u>44 0</u>	<u>12:07</u>	
<u>45 I</u>	<u>12:14</u>	
<u>46 0</u>	<u>12:14</u>	
<u>47-Tap</u>		

II. Water Volumetric Rate

<u>Clock Time</u>	<u>Volume</u>	<u>Elapsed Time</u>	<u>Water Temperature</u>	<u>Liters/min.</u>
<u>11:59</u>	<u>730</u>	<u>7.7</u>	<u>38°C</u>	<u>5.7</u>
<u>12:09</u>	<u>850</u>	<u>7.9</u>	<u>20.5</u>	<u>6.5</u>
<u>12:16</u>	<u>860</u>	<u>7.0</u>	<u>—</u>	<u>7.4</u>

ave = 6.5

III. Air Temperature

<u>Time</u>	<u>WB</u>	<u>DB</u>	<u>%RH</u>
<u>12:18</u>	<u>—</u>	<u>23.5</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

Bathroom Dimensions

90" x 54" x 82"

Fan Flowrate

No

N.C. Dept. of Environment, Health and Natural Resources
 Division of Laboratory Services
 State Laboratory of Public Health
 P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient or Supply: Rick Dorsey
 Address: Leland NC
 County: Brunswick
 Report To: Bill Pate
 Address: Envr Epid Section



Date Collected: 3-8-90
 Collected By: Bill Pate
 Analysis Desired: VOC's in air - charcoal tubes

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
804496	41		
804497	42		
804498	44		
804499	45		
804500	46		
804501	47		
804502	Blank		
Collected in large charcoal tubes. Desorbed in 1.0 ml of CS ₂			

Date Received 3-8-90VP Date Reported 3-21-90
 Date Extracted _____ Date Analyzed 3/12/90 JPM
 Reported By: John P. Neel

DEPARTMENT OF HUMAN RESOURCES - DIVISION OF HEALTH SERVICES
LABORATORY SECTION
OCCUPATIONAL HEALTH

G C REPORT SHEET

COMPANY: Rick Dorsey

DATE OF ANALYSIS: 3/12/90

TOTAL MILLIGRAMS

SAMPLE #	Butane *	3-Methyl * 1 Hexane	Benzene						
904496*	0.335	0.431	0.648						
904497	<0.020	<0.020	<0.020						
904498*	0.245	0.304	0.534						
904499*	0.465	0.555	1.034						
904500*	0.398	0.826	0.104						
904501*	0.159	0.141	0.328						
904502	<0.020	<0.020	<0.020						
Note: *1 Calculations based on Hexane Standard									
* Other unidentified peaks present.									

N.C. Dept. of Environment, Health and Natural Resources
Division of Laboratory Services
State Laboratory of Public Health
P.O. Box 28047, Raleigh, N.C. 27611

Environmental Sciences Analysis Report

Name of Owner, Patient
or Supply: Rick Dorsey
Address: Leland NC
County: Brunswick
Report To: Bill Pate
Address: Env. Epid Section



Date Collected: 3-8-90
Collected By: Bill Pate
Analysis Desired: VOC's in water -

Laboratory Number	Sample Number	Sample Description or Remarks	Results In
904503	41 I		
904504	42 - 0		
904505	43 I		
904506	44 - 0		
904507	45 I		
904508	46 - 0		
904509	47 Top		
904510	Blank		
			SEE ATTACHED SHEET(S)

Date Received 3-8-90 VP Date Reported 3-15-90
Date Extracted _____ Date Analyzed VOC's 3/12/90 9pm
Reported By: John L. Neal

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904523

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	7.1
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	2680.8
✓1,2-Dichloroethane	24.0
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	3.5
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	11.2
1,1,1,2-Tetrachloroethane	u
p-Xylene	✓ trace
m-Xylene	✓
o-Xylene	trace
Styrene	u
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 306B-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904504

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	✓
Methylene Chloride	
tert-Butyl Methyl Ether	3.4
(Trans) 1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	✓
✓Carbon Tetrachloride	✓
✓Benzene	1094.1
✓1,2-Dichloroethane	11.0
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	1.3
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	3.8
1,1,1,2-Tetrachloroethane	U
p-Xylene	2 trace
m-Xylene	3
o-Xylene	trace
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	!
1,2,3-Trichlorobenzene	✓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- 1/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 305 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904505

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	6.6
(Trans) 1,2-Dichloroethylene	11
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	2587.3
✓1,2-Dichloroethane	24.5
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	3.2
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	10.2
1,1,1,2-Tetrachloroethane	U
p-Xylene	} trace
m-Xylene	
o-Xylene	trace
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	

COMMENTS: Numerous unidentified peaks present.

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904506

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	u
✓Vinyl Chloride	u
Bromomethane	u
Chloroethane	u
Trichlorofluoromethane	u
✓1,1-Dichloroethylene	u
Methylene Chloride	u
tert-Butyl Methyl Ether	4.6
(Trans)1,2-Dichloroethylene	u
Isopropyl ether	u
1,1-Dichloroethane	u
2,2-Dichloropropane	u
(Cis) 1,2-Dichloroethylene	u
Chloroform	u
(BCM) Bromochloromethane	u
✓1,1,1-Trichloroethane	u
1,1-Dichloropropene	u
✓Carbon Tetrachloride	u
✓Benzene	1306.4
✓1,2-Dichloroethane	14.7
✓Trichloroethylene	u
1,2-Dichloropropane	u
Bromodichloromethane	u
Dibromomethane	u
Toluene	1.7
1,1,2-Trichloroethane	u
Tetrachloroethene	u
1,3-Dichloropropane	u
Dibromochloromethane	u
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	4.8
1,1,1,2-Tetrachloroethane	u
p-Xylene	trace
m-Xylene	trace
o-Xylene	trace
Styrene	u
Bromoform	u
Isopropylbenzene	u
1,1,2,2-Tetrachloroethane	u
Bromobenzene	u
n-Propylbenzene	u
1,2,3-Trichloropropane	u
2-Chlorotoluene	u
1,3,5-Trimethylbenzene	u
4-Chlorotoluene	u
(Tert) Butyl Benzene	u
Pentachloroethane	u
1,2,4-Trimethylbenzene	u
(Sec) Butyl Benzene	u
p-Isopropyltoluene	u
1,3-Dichlorobenzene	u
✓1,4-Dichlorobenzene	u
n-Butylbenzene	u
1,2-Dichlorobenzene	u
(Bis) 2 Chloroisopropyl Ether	u
1,2-Dibromo-3 Chloropropane	u
1,2,4-Trichlorobenzene	u
Hexachlorobutadiene	u
Naphthalene	u
1,2,3-Trichlorobenzene	u

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

J - Estimated value.

K - Actual value is known to be less than value given.

L - Actual value is known to be greater than value given.

U - Material was analyzed for but not detected.

NA - Not analyzed.

1/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904507

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	↓
tert-Butyl Methyl Ether	7.2
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	↓
✓Benzene	2793.7
✓1,2-Dichloroethane	24.9
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	↓
Toluene	3.6
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	↓
1,2-Dibromopropane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	12.8
1,1,1,2-Tetrachloroethane	u
p-Xylene	2 trace
m-Xylene	3
o-Xylene	trace
Styrene	u
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

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- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904508

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	U
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	4.9
(Trans)1,2-Dichloroethylene	U
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	1459.3
✓1,2-Dichloroethane	15.4
✓Trichloroethylene	U
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	1.9
1,1,2-Trichloroethane	U
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	U

COMPOUND	µg/l
Chlorobenzene	U
Ethylbenzene	5.4
1,1,1,2-Tetrachloroethane	U
p-Xylene	trace
m-Xylene	trace
o-Xylene	trace
Styrene	U
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

- J - Estimated value.
- K - Actual value is known to be less than value given.
- L - Actual value is known to be greater than value given.
- U - Material was analyzed for but not detected.
- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904509

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	u
Chloromethane	
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	✓
tert-Butyl Methyl Ether	6.3
(Trans) 1,2-Dichloroethylene	u
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	✓
✓Benzene	220.0
✓1,2-Dichloroethane	22.2
✓Trichloroethylene	u
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	✓
Toluene	2.8
1,1,2-Trichloroethane	u
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	✓
1,2-Dibromoethane (EDB)	trace
1-Chlorohexane	u

COMPOUND	µg/l
Chlorobenzene	u
Ethylbenzene	9.4
1,1,1,2-Tetrachloroethane	u
p-Xylene	trace
m-Xylene	trace
o-Xylene	trace
Styrene	u
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	✓

COMMENTS: Numerous unidentified peaks present

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

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- NA - Not analyzed.
- I/ - Tentative identification.
- ✓ - Regulated VOC
- T - Trihalomethane

N.C. Division of Health Services
DHS 306B-0 (1/89 Laboratory)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON ST, RALEIGH, N.C. 27611

Laboratory No. 904510

PURGEABLE COMPOUNDS

Date of Analysis 3/12/90

COMPOUND	µg/l
Dichlorodifluoromethane	11
Chloromethane	↑
✓Vinyl Chloride	
Bromomethane	
Chloroethane	
Trichlorofluoromethane	
✓1,1-Dichloroethylene	
Methylene Chloride	
tert-Butyl Methyl Ether	
(Trans)1,2-Dichloroethylene	
Isopropyl ether	
1,1-Dichloroethane	
2,2-Dichloropropane	
(Cis) 1,2-Dichloroethylene	
Chloroform	
(BCM) Bromochloromethane	
✓1,1,1-Trichloroethane	
1,1-Dichloropropene	
✓Carbon Tetrachloride	
✓Benzene	
✓1,2-Dichloroethane	
✓Trichloroethylene	
1,2-Dichloropropane	
Bromodichloromethane	
Dibromomethane	
Toluene	
1,1,2-Trichloroethane	
Tetrachloroethene	
1,3-Dichloropropane	
Dibromochloromethane	
1,2-Dibromoethane (EDB)	
1-Chlorohexane	↓

COMPOUND	µg/l
Chlorobenzene	11
Ethylbenzene	
1,1,1,2-Tetrachloroethane	
p-Xylene	
m-Xylene	
o-Xylene	
Styrene	
Bromoform	
Isopropylbenzene	
1,1,2,2-Tetrachloroethane	
Bromobenzene	
n-Propylbenzene	
1,2,3-Trichloropropane	
2-Chlorotoluene	
1,3,5-Trimethylbenzene	
4-Chlorotoluene	
(Tert) Butyl Benzene	
Pentachloroethane	
1,2,4-Trimethylbenzene	
(Sec) Butyl Benzene	
p-Isopropyltoluene	
1,3-Dichlorobenzene	
✓1,4-Dichlorobenzene	
n-Butylbenzene	
1,2-Dichlorobenzene	
(Bis) 2 Chloroisopropyl Ether	
1,2-Dibromo-3 Chloropropane	
1,2,4-Trichlorobenzene	
Hexachlorobutadiene	
Naphthalene	
1,2,3-Trichlorobenzene	↓

COMMENTS:

MDL - Minimum Detection Limit for water (EPA Method 502.2), is 1.0 µg/l.

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NA - Not analyzed.

I/ - Tentative identification.

✓ - Regulated VOC

T - Trihalomethane

N.C. Division of Health Services
DHS 3068-0 (1/89 Laboratory)