INVESTIGATION INTO ENDOCRINE DISRUPTORS AT THE CITY OF OKLAHOMA CITY'S SELECTED WASTEWATER TREATMENT PLANTS

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CHAPTER 1

INTRODUCTION

The main mission for water and wastewater treatment is the control of risk for the public health and the environment. Prior to the creation of the Environmental Protection Agency (EPA) in December of 1970, air and water pollution were widespread and posed serious health hazards to the American people (Brewer, 1997). The advancement of technology has given laboratories the ability to test for compounds at very low levels never seen before. Again, the protection of human health and the environment is the main object of these studies. But before these questions can be answered, what is present and what remains through treatment must be known.

For over 70 years, scientists have reported that certain synthetic and natural compounds could mimic natural hormones in the endocrine systems of animals (Snyder et al., 2003). There has been an increasing concern within the last decade regarding substances in the environment and the impact on both humans and wildlife, especially now that these compounds can be detected at levels present in the environment.

The endocrine system consists of glands located throughout the body, hormones - which are produced and released by the glands into the bloodstream, and the receptors in the organs and tissues that recognize and respond to the hormones. The function of the endocrine system is to regulate a wide range of biological processes from birth to death.

The substances of concern are now referred to as Endocrine Disrupting Chemicals (EDCs) and encompass a wide range of pollutants including pharmaceuticals and personal care products (PPCPs). The Environmental Protection Agency (EPA) has defined EDCs as exogenous agents that interfere with the "synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development, and /or behavior." (EPA, 1997; Snyder et al. 2003). Basically, an EDC is a pollutant that interferes with this reproductive cycle and normal growth. These emerging environmental contaminants (EECs) have been largely outside the scope of monitoring and regulation in our waterways as well as our wastewater collection systems until recently.

EDCs are not specific to any particular class of chemical. EDCs can include pharmaceuticals or personal care products. There are numerous ongoing studies to determine the potential of many EECs. Though most research to date has focused on the disruptive effects on reproduction and development, more recent efforts are examining the effects of disruption on thyroid function and the immune system (McCann, 2004).

There are over 87,000 known and/or suspected EDCs and most have not been studied for environmental impact (USEPA, 1998). With the authority provided by the Safe Drinking Water Act (SDWA), the Environmental Protection Agency (EPA) currently regulates a number of possible EDCs. However, the maximum contaminant levels for these chemicals are defined by their toxicity and cancer-causing effects rather than for their endocrine disruption. While studies and reports have demonstrated that levels of EDCs have caused changes in aquatic organisms (Ormerod et al. 2000, Hayes et

al. 2003, Reeder et al, 2005, and Willingham et al. 2000), it has not been determined what may be the effects to human health from water contamination.

In 1995, amendments to the SDWA and the Food Quality Protection Act mandated screening of all chemicals and formulations for potential endocrine activity prior to their use or manufacture where they could cause contamination of drinking water or food. The EPA has formed a committee called the Endocrine Disruptor Screening and Testing Advisory Committee, which recommended that the effects on both human and wildlife be considered. The committee has recommended the examination of estrogen, androgen, and thyroid endpoints, and assessment of all known EDCs, as well as looking at mixtures of the specific classes of EDCs with discrete chemicals[t1] listed in the US EPA, 2007, initial tier 1 screening.

In 2001, the Endocrine Disruptor Methods Validation Subcommittee was formed to evaluate and validate methods for standardization of EDC testing. Once this work is completed, it will be easier to definitively identify which chemicals are indeed EDCs (Snyder et al., 2003b).

In 2005, the EPA released the Unregulated Contaminant Monitoring Regulation (UCMR) fact sheets for public water systems. The purpose is to collect occurrence data for 25 contaminants suspected to be present in drinking water, but do not have a health-based standard set under the SDWA. Several of the contaminants on the list are suspected or known to have impacts on the endocrine system. Phase 2 (UCMR2) screening survey should be completed by 2010 for public water systems that serve over 10,000 people.

One major fact that should not be ignored is that wastewater, after it is treated and discharged into a receiving stream, often becomes another entity's drinking water. Most wastewater treatment plants (WWTPs) are designed for biological treatment of wastewater, not the removal of EDCs or other synthetic chemicals. The fairly new concern of emerging contaminants most likely will require these plants to look at alternative methods to treat the wastewater stream. First, WWTPs will need to determine if any EDCs are even present in an amount that is critical to humans and wildlife.

The primary objective of this thesis was to develop a list of possible EDCs that may be present in the City of Oklahoma City's WWTPs and test for occurrence. An evaluation of industrial waste discharges, as well as other possible sources of EDCs (such as Concentrated Animal Feeding Operations) was conducted first. After compiling a list of candidate pollutants with potential for occurrence, an evaluation of available analytical tools was performed. Then sampling and testing for the selected EDCs was conducted to determine the amounts of the pollutants - not only in the raw wastewater streams - but also at several points along the wastewater treatment process.

A review of relevant literature is presented in Chapter 2, along with background information on the City of Oklahoma City Wastewater Treatment Plants, industrial waste dischargers, and sewersheds. Recent studies of EDCs in WWTPs are also discussed with particular focus on studies relating to the pollutants selected for testing at three of the City of Oklahoma City's treatment plants. Chapter 3 is a discussion of the analytical methods and research methodologies used in testing for the selected EDCs. Chapter 4 is a presentation of the analytical testing results and discussion of occurrence and/or

removal of screened contaminants. Finally, in Chapter 5, conclusions and recommendations for future work are presented.

CHAPTER II

BACKGROUND AND LITERATURE REVIEW

2.0 Background

Advances in technology related to instrumental analytical chemistry have enabled scientists to detect chemicals in the environment at lower and lower levels, and in turn, have increased the concern of the public. As recent as a decade or so ago, detection at the microgram per liter (μg/L), or part-per-billion (ppb), level was considered state of the art in many cases, and unattainable for many compounds of interest. Today, many compounds are routinely detected at the nanogram per liter (ng/L), or part-per-trillion (ppt), levels.

With these advances in detection capability comes new information regarding the occurrence and persistence of many chemicals in our environment at ng/l (or lower) levels. The knowledge of the existence of these chemicals at trace levels has raised many questions related to their impact on the environment, aquatic species, and human health.

2.1 Endocrine System

The glands of the endocrine system and the hormones they release influence almost every cell, organ, and function of our bodies. The endocrine system is instrumental in regulating mood, growth and development, tissue function, and metabolism, as well as sexual function and reproductive processes (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

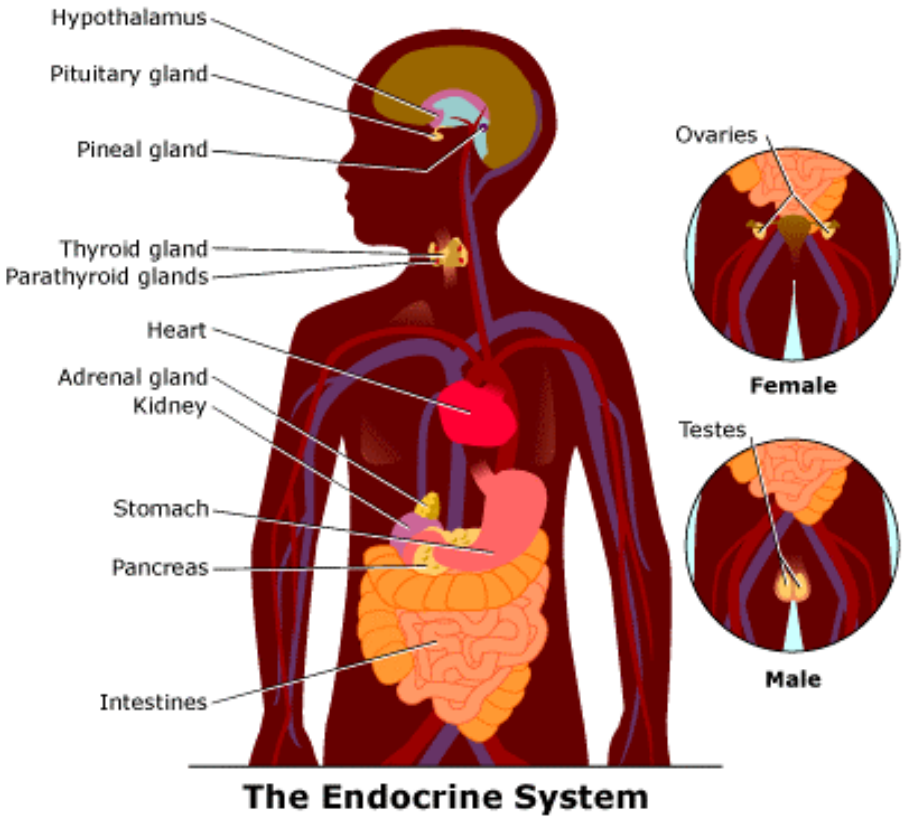


Figure 2-1 : Endocrine System (Dowshen, 2007)

As the body's chemical messengers, hormones transfer information and instructions from one set of cells to another. Although many different hormones circulate throughout the bloodstream, each one affects only the cells that are genetically

programmed to receive and respond to its message. Hormone levels can be influenced by factors such as stress, infection, and changes in the balance of fluid and minerals in blood (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The major glands that make up the human endocrine system are the hypothalamus, pituitary, thyroid, parathyroids, adrenals, pineal body, and the reproductive glands, which include the ovaries and testes. Table 2-1 lists the endocrine glands only with the hormones produced and the function of the hormones. The pancreas is also part of this hormone-secreting system, even though it is also associated with the digestive system because it also produces and secretes digestive enzymes. Although the endocrine glands are the body's main hormone producers, some non-endocrine organs - such as the brain, heart, lungs, kidneys, liver, thymus, skin, and placenta also produce and release hormones (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004). The endocrine system is shown in Figure 2-1.

TABLE 2-1: ENDOCRINE GLANDS, HORMONES PRODUCTION & FUNCTIONS

Endocrine Gland	Hormones Gland Produces	Hormone/Gland Function
Hypothalamus	Growth hormone-releasing hormone (GHRH)	Communicates with both nervous and endocrine systems; Stimulates (GHRH, TRH, CRH, GnRH) or inhibits (PIF) hormone production in the pituitary
	Thyrotropin-releasing hormone (TRH)	
	Corticotropin-releasing hormone (CRH)	
	Gonadotropin-releasing hormone (GnRH	
	Prolactin Inhibitory Factor (PIF, dopamine)	
	Oxytocin	Uterine contraction during labor
	Antidiurectic hormone (ADH)	Water balance
Pituitary	Prolactin	Milk production
	Growth Hormone (GH)	Bone growth

TABLE 2-1: ENDOCRINE GLANDS, HORMONES PRODUCTION & FUNCTIONS		
Endocrine Gland	**Hormones Gland Produces**	**Hormone/Gland Function**
	Corticotropin (ACTH)	Stimulates cortisol
	Thyroid-stimulating hormone (TSH)	Stimulates thyroid hormone
	Luteinizing hormone (LH)	Regulation of testosterone and estrogen, fertility
	Follicle-stimulating hormone (FSH)	
Thyroid	Thyroxine (T4)	Helps regulate the rate of metabolism
	Triiodothyronine (T3)	
	Calcitonin	Helps regulate bone status, blood calcium
Parathyroid	Parathyroid hormone (PTH)	Regulates blood calcium
Adrenal	Epinephrine (adrenaline) norepinephrine	Blood pressure regulation, stress reaction
	Aldosterone	Salt, water balance
	Cortisol	Stress reaction
	Dehydroepiandrosterone Sulfate (DHEA-S)	Body hair development at puberty
Ovaries	Estrogen	Female sexual characteristics
	Progesterone	
Testes	Testosterone	Male sexual characteristics
Pancreas	Insulin	Glucose regulation
	Glucagon	
	Somatostatin	
Pineal	Melatonin	Not well understood; Helps control sleep patterns, affects reproduction

As shown in Figure 2-1, the hypothalamus is located in the lower central part of the brain and produces chemicals that control the pituitary gland. The hypothalamus will stimulate or suppress hormone secretions from the pituitary (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The pituitary gland is located at the base of the brain beneath the hypothalamus (See Figure 2-1). It is the gland that produces the hormones that control several other endocrine glands. The hypothalamus relays information sensed by the brain (such as environmental temperature, light exposure patterns, and feelings) to the pituitary. The pituitary regulates the thyroid, adrenals, and reproductive glands by producing growth hormones, prolactin, thyrotropin, corticotrophin, endorphins, and oyxtocin (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

Figure 2-1 shows the location of the thyroid, it is in the front part of the lower neck and produces the thyroid hormones. The hormones produced by the thyroid control the rate at which cells burn fuels from food to produce energy, bone growth and the development of the brain and nervous system in children (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The body has two triangular adrenal glands, one on top of each kidney (See Figure 2-1). The adrenal glands have two parts, each of which produces a set of hormones and has a different function. The outer part, the adrenal cortex, produces hormones that influence or regulate salt and water balance in the body, the body's response to stress, metabolism, the immune system, and sexual development and function. The inner part, the adrenal medulla produces adrenaline (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The pineal neal gland is located in the middle of the brain (Figure 2-1) and secretes a hormone that helps regulate the wake-sleep cycle (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The gonads are the main source of sex hormones. These hormones regulate body changes associated with sexual development. For men this includes enlargement of the penis, the growth spurt that occurs during puberty and the appearance of other male secondary sex characteristics such as deepening of the voice, growth of facial and pubic hair, and the increase in muscle growth and strength. In females, ovaries produce eggs and secrete the female hormones estrogen and progesterone (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

The pancreas produces insulin and glucagon. Insulin and glucagon work together to maintain a steady level of glucose in the blood and to keep the body supplied with fuel to produce and maintain stores of energy (Dowshen, 2007; Greenstein and Wood, 2006; Watson and Miller, 2004).

2.2 Literature Review

Currently, there are approximately 87,000 chemicals in commerce in the United States and around the world (US EPA, 1998). The classes of chemicals run the gamut: from elements to very simple inorganic chemicals to complex organic compounds, which are utilized in processes ranging from pharmaceutical production to plastics manufacturing to petrochemical refining operations and all points in between.

Municipal wastewater treatment facilities in the U.S. must comply with discharge limits for BOD, TSS, and other conventional pollutants (Oppenheimer and Stephenson 2006). Many of the endocrine disrupting chemicals (EDCs) are present in raw wastewater streams and are resistant to biological degradation – the primary mechanism of removal in conventional wastewater treatment plants (Brun et al., 2006; and Carbella

et al., 2005). The environmental persistence of these compounds is an area of increasing research within the scientific community. Compounds not removed or destroyed in wastewater treatment processes are known to be present in biosolids, which often are land applied (Xia and Jeong, 2004; Johnson, 2005, EPA, 1990, and Routledge, 1998). Studies have documented cases where plants can uptake some of the persistent chemicals when they are present in the soil (Hale, 2001, Roberts et al., 2005 and Ying et al, 2004).

Chemicals that pass through wastewater treatment plants (WWTPs) and remain in natural waters inevitably are in drinking water sources used by water treatment plants. Another potential issue is the possibility of reaction intermediates when these compounds are oxidized (i.e. via chlorination or ozonation) – destruction of the parent compound does not necessarily imply that the reaction products are safer than the original compound of interest (Hirvonen et al., 2000).

It is very important to note that the studies to date detail effects on aquatic life and wildlife (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al. 2000). There is not currently significant literature detailing environmental impacts on human health. Regulation is only through the Safe Drinking Water Act where the maximum contaminant levels for these chemicals are defined by their toxicity and cancer causing rather than the endocrine disruptive effects.

According to their physico-chemical properties, EDCs can be divided into three main groups: lipophilic (with high K_{ow} values), neutral (non-ionic) compounds and acidic (hydrophilic and ionic) compounds (Petrovic et al., 2003). It is generally accepted that the three major classes of endocrine endpoints are estrogenic (compounds which

mimic or block natural estrogen), androgenic (compounds which mimic or block natural testosterone), and thyroidal (compounds with direct or indirect impacts to the thyroid gland) (AWWARF, 2007).

Table 2-2 contains the list of compounds tested as part of this study in Oklahoma City at the North Canadian WWTP, Deer Creek WWTP and Chisholm Creek WWTP. Also listed in Table 2-1 are the common uses for the compounds, molecular formula, molecular weights, and K_{ow}. The list in Table 2-2 is discussed in Section 3 Methodology.

TABLE 2-2

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*Formula Weight*	*Chemical Formula*	*Log K_{ow}*	*Description/Comments*
Bisphenol A (BPA)	228.29	$C_{15}H_{16}O_2$	3.4	Key monomer in production of polycarbonate plastic and epoxy resin; mimics hormonal activity of estrogen
Carbamazepine	236.27	$C_{15}H_{12}N_2O$	1.51	Anticonvulsant and mood stabilizer; anti-anxiety medication – used primarily in the treatment of epilepsy and bipolar disorder
Caffeine	194.19	$C_8H_{10}N_4O_2$	<0	Central nervous system stimulant; coffee, tea, soft drinks
Acetaminophen	151.17	$C_8H_9NO_2$	0.46	Analgesic – pain reliever, fever reducer
Ibuprofen	206.3	$C_{13}H_{18}O_2$	3.97	Analgesic – pain reliever, fever reducer, inflammation reducer
Iopromide	791.12	$C_{18}H_{24}I_3N_3O_8$	<0	Iodinated contrast media, radiopaque agent used in computed tomography

TABLE 2-2

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*Formula Weight*	*Chemical Formula*	*Log K_{ow}*	*Description/Comments*
Progesterone	314.47	$C_{21}H_{30}O_2$	3.87	Steroidal hormone – involved in female menstrual cycle, pregnancy
Testosterone	288.43	$C_{19}H_{28}O_2$		Steroid hormone from the androgen group – anabolic steroid
Estrone	270.37	$C_{18}H_{22}O_2$	3.13	One of three estrogens including estriol and estradiol
17α –ethinyl estradiol (EE2)	296.40	$C_{20}H_{24}O_2$	3.67	Synthetic steroidal estrogen used in birth control pills - derivative of estradiol (below)
17ß-estradiol (E2)	272.39	$C_{18}H_{24}O_2$	4.01	Sex hormone – in females, acts a growth hormone for tissue of reproductive organs
Trimethoprim	290.32	$C_{14}H_{18}N_4O_3$	0.91	Antibiotic – often used in conjunction with sulfamethoxazole
Triclosan	289.54	$C_{12}H_7Cl_3O_2$	4.76	Antibacterial agent used primarily in soap, toothpaste, etc.
4-Methylphenol	108.13	C_7H_8O		Industrial chemical commonly used as intermediate in organic chemicals production
DEET	191.27	$C_{12}H_{11}NO_2$	2.18	Insect repellent used in numerous commercial formulations (i.e. “OFF”)
Triphenylphosphate	326.28	$C_{18}H_{15}O_4P$	4.60	Flame retardant used in many plastics and other applications
Tris (2-chloroethyl) phosphate (TCEP)	285.49	$C_6H_{12}O_4PCl_3$	1.44	Flame retardant used in polyurethane foam
Tris (2-butoxyethyl) phosphate	398.54	$C_{18}H_{39}O_7P$	4.38	Flame retardant used as plasticizer in rubber and plastics – also used in floor polishes
TDCPP	430.91	$C_9H_{15}Cl_6O_4P$	1.7	Flame retardant
Carbaryl	201.22	$C_{12}H_{11}NO_2$	2.36	Cholinesterase inhibitor – used chiefly

TABLE 2-2

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*Formula Weight*	*Chemical Formula*	*Log K_{ow}*	*Description/Comments*
				as an insecticide
Chlorpyrifos	350.39	$C_9H_{11}Cl_3NO_3PS$	4.7	Organophosphate pesticide – inhibits acetylcholinesterase (Dursban, Lorsban)
Fluoxetine	309.3	$C_{17}H_{18}F_3NO$	1.8	Antidepressant (Prozac) – selective serotonin reuptake inhibitor
2,6-di-tert-butylphenol	206.33	$C_{14}H_{22}O$	4.5	Antioxidant for fuels, oils, gasoline
4-nonylphenol	220.35	$C_{15}H_{24}O$	3.28	"Inert" ingredient in many pesticides (used as surfactant) – mimics estrogen activity; acutely toxic, bioaccumulates
Alpha Chlordane	409.76	$C_{10}H_6Cl_8$	2.78	Organochlorine pesticide (banned)
Diazinon	304.36	$C_{12}H_{21}N_2O_3PS$	3.11	Organophosphate insecticide; inhibits acetylcholinesterase, an enzyme needed for proper nervous system function
Dieldrin	380.91	$C_{12}H_8Cl_6O$	6.2	Chlorinated hydrocarbon, insecticide
Methyl Parathion	263.2	$C_8H_{10}NO_5PS$	3.8	Organophosphate pesticide insecticide; nematicide
Gemfibrozil	250.33	$C_{15}H_{22}O_3$	4.39	Cholesterol regulator, lowers lipid levels (Lopid; Gen-Fibro)
Sulfamethoxazole	253.7	$C_{10}H_{11}N_3O_3S$	0.89	Antibiotic (i.e. Bactrim, Septrim, Septra)
Phenol	94.11	C_6H_5OH	1.46	Used as an antiseptic and as chemical feedstock in many industrial organic chemical production processes

The environmental fate and transport of a contaminant is controlled by the compound's physical and chemical properties and the nature of the media through which the compound is migrating. Compounds with log K_{ow} (solubility) > 3 are easier to remove in the treatment process. Compounds with log K_{ow} between 3 and 0 can be mutagenic and are more difficult to remove during standard treatment. Compounds with log K_{ow} < 0 are difficult to remove by treatment and analyze.

The molecular weight of compounds also plays a part in the treatment process. The higher the molecular weight the harder the compound is to remove from wastewater treatment.

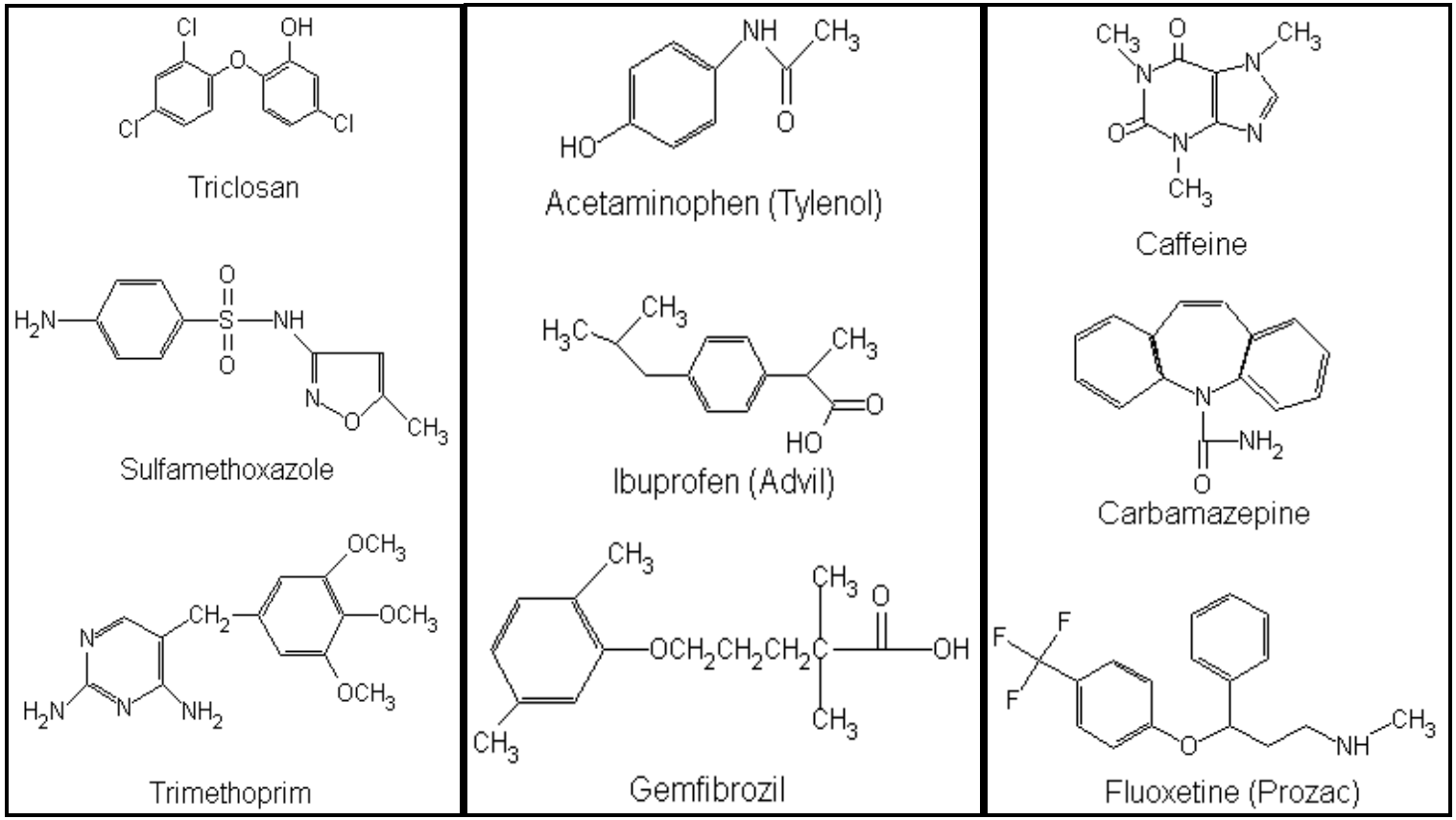
The City of Oklahoma City is the third largest city in the United States by geographic area (622 square miles) (Oklahoma City, 2006). The City owns/operates five wastewater treatment plants to serve the City of Oklahoma City. The Chisholm Creek, South Canadian, and North Canadian WWTPs plants are biological wastewater treatment plants with primary and secondary treatment. Deer Creek WWTP has sand filters for tertiary treatment. The Dunjee WWTP is a biological batch plant with only residential customers.

Oklahoma City has a possibility of receiving potential EDC contaminants from a variety of sources. The City of Oklahoma has four major hospitals within the City limits. Three of these hospitals are within the North Canadian Basin and one is within the Deer Creek Basin. The City also has a variety of industries which are spread throughout the City limits, however, the majority of them are located in the North Canadian Basin. Figure 3-1 in the Methodology section shows the City of Oklahoma City's Drainage

Basins. The Deep Fork drainage basin is pumped by lift stations into the North Canadian Drainage Basin.

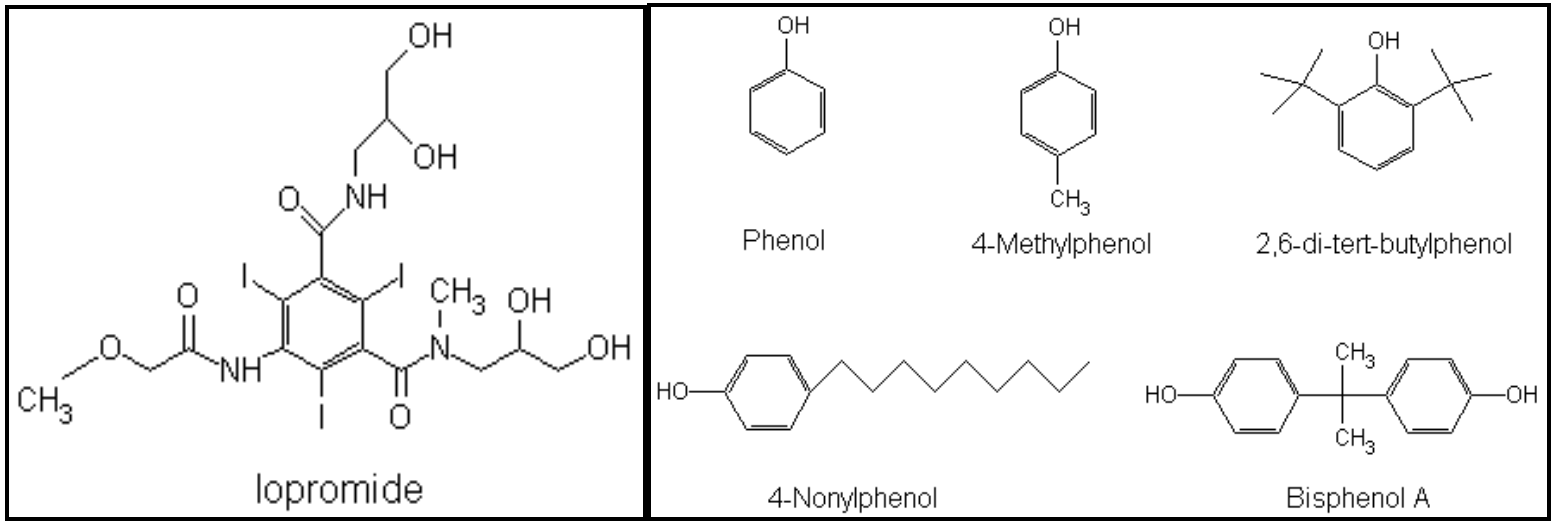
2.3 Chemical Structures

The chemical structures of natural hormones and environmental hormones are most often very different. It is not possible to determine whether a chemical is an endocrine disruptor or not by merely looking at its chemical structure. However, the chemical structure may give clues to the ability to be removed during treatment. The following pages (Figure 2-2) show the chemical structures of the final selection of EDCs tested in the Oklahoma City's three largest wastewater treatment plants.



Antibiotics/Antimicrobials | Analgesic/Heart Medication | Psychoactive

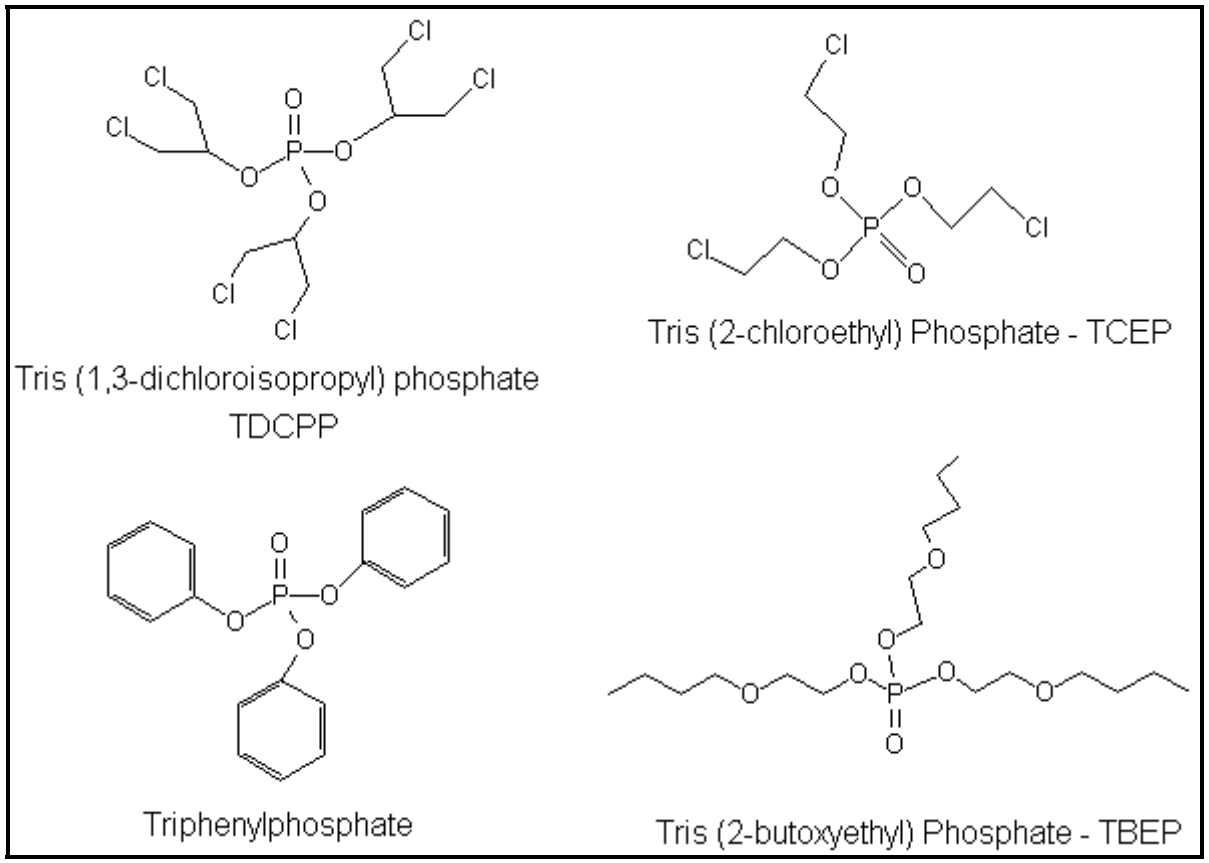
Figure 2-2: Chemical Structures



Contrast Media

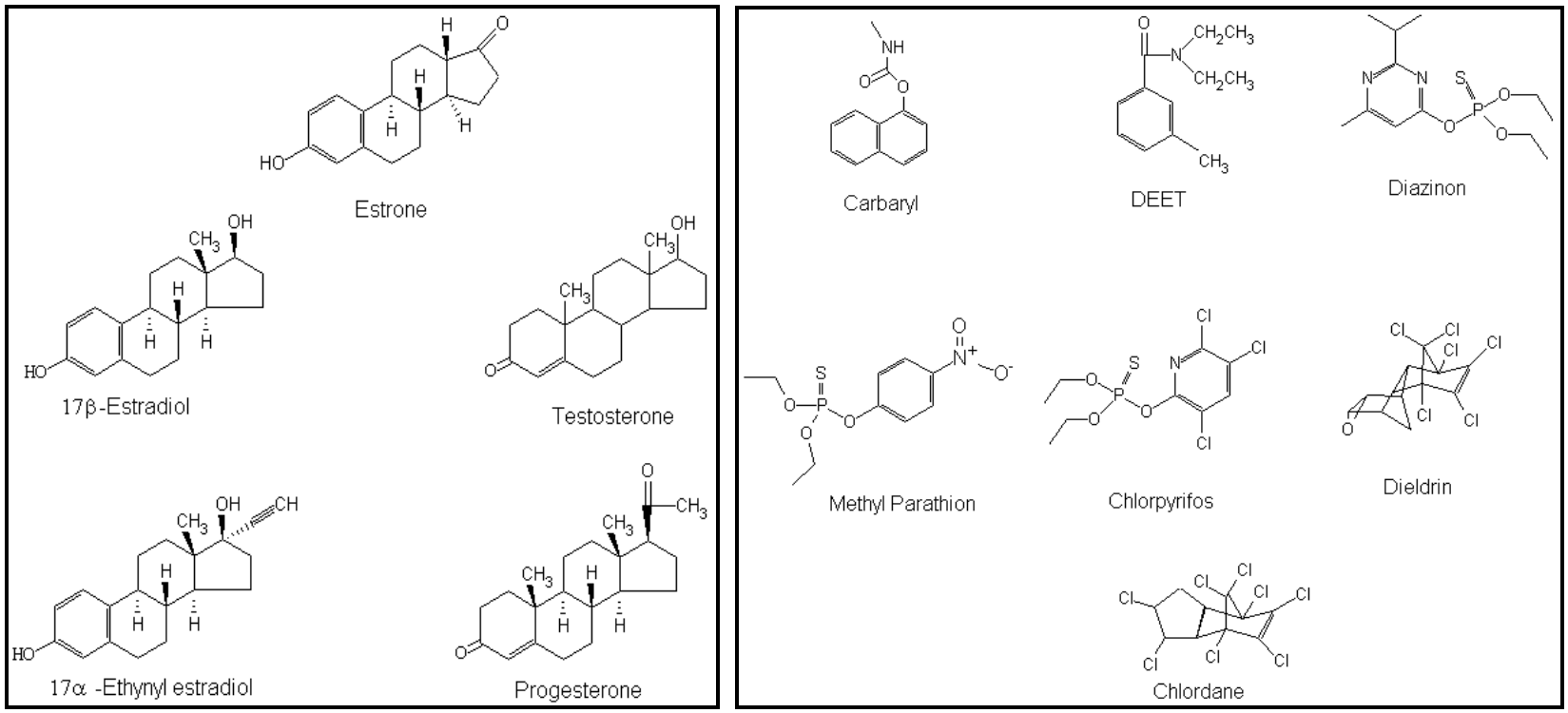
Phenols

Figure 2-2 (Cont'd): Chemical Structures



Flame Retardants

Figure 2-2 (Cont'd): Chemical Structures



Hormones

Insecticides/Pesticides

Figure 2-2 (Cont'd): Chemical Structures

According to Schmieder et al., 2004, binding affinity between chemicals and the estrogen receptor (ER) serves as an indicator of the potential to cause endocrine disruption through this receptor-mediated endocrine pathway. Estimating ER binding affinity is, therefore, one strategic approach to reducing the costs of screening chemicals for potential risks of endocrine disruption. While measuring ER binding with in vitro assays may be the first choice in prioritizing chemicals for additional in vitro or in vivo estrogenicity testing, the time and costs associated with screening thousands of chemicals is prohibitive.

Recent advances in 3-D modeling of the reactivity of flexible structures make estimating ER binding possible. A strategy has been presented for extending initial exploratory 3D QSAR models beyond current training sets to increase applicability to more diverse structures in large chemical inventories. Binding affinity between chemicals and the estrogen receptor (ER) serves as an indicator of the potential to cause endocrine disruption through this receptor-mediated endocrine pathway. Therefore, this method may be one strategic approach to reducing the costs of screening chemicals for potential risks of endocrine disruption.

2.4 Analgesics, Anti-Inflammatories, and Pain Medications

Pain medications can work one of two ways (Schere, 2002). They can block the pain where it starts, therefore, in the brain. The other way pain medication works is to prevent your body from producing chemicals that cause pain (i.e. prostaglandins).

Nonsteroidal anti-inflammatory pain medications, commonly referred to as NSAIDs are some of the most commonly prescribed medications, especially for patients with orthopedic problems such as arthritis, bursitis, and tendonitis. These medications are available over-the-counter (e.g. Ibuprofen, Motrin, Aleve) or as a prescription (e.g. Celebrex, DayPro, Relafen). NSAIDs are effective at pain relief (analgesia), and to reduce swelling (anti-inflammatory) (Cluett, 2006).

NSAIDs work to block the effect of an enzyme called cyclooxygenase. This enzyme is critical in your body's production of prostaglandins. It is prostaglandins that cause swelling and pain in a condition such as arthritis. Therefore, by interfering with cyclooxygenase, you decrease the production of prostaglandins and decrease pain and swelling associated with these conditions (Cluett, 2006).

Anti-inflammatories are taken worldwide to help with a variety of ailments. Since these are used daily by a majority of the population it makes sense to find them in wastewater streams.

Carballa et al. (2005) found Naproxen, Ibuprofen and Diazepam present in an urban wastewater treatment plant in Santiago de Compostela which is a town located in Northwest Spain. Treatment consisted of sedimentation and activated sludge. After primary treatment, Diazepam and Naproxen were only removed up to 25%, depending on the condition tested. However, Ibuprofen was not affected under any condition.

Huber et al. (2003) added Ibuprofen to four natural water samples that differed in dissolved organic carbon content and alkalinity and tried to remove it using ozone. The removal of Ibuprofen ranged from 41% to 77% in the natural waters.

Measurable quantities of acetaminophen were found in the effluent of septic tank effluent and two shallow coarse grained Missoula Aquifers in Montana in the Godfrey et al., (2007) study. Kolpin, et al (2002), found acetaminophen at detectable levels in 25% of streams sampled.

Oppenheimer et al., (2004) conducted a pilot-scale study using membrane bioreactors and reverse osmosis at the Point Loma WWTP in Pasadena, California to evaluate the removal of EDCs and PPCPs. They found that ibuprofen was consistently found in the membrane bioreactor MBR permeate, indicating that the effluent from the MBR contained the ibuprofen.

Lishman et al. (2006) detected Ketoprofen in the influent and effluent streams of 12 WWTPs along the Thames River in Ontario, Canada with a mean concentration of 0.146 µg/l and 0.125 µg/l, respectively.

Less than 20% of ibuprofen, naproxen and ketoprofen was removed during coagulation by ferric in water or wastewater at various pH conditions (Ternes et al. 2002b; Vieno, Tuhkanen and Kronberg 2005).

2.5 By Products

Nitrosodimethylamine (NDMA) is a suspected human carcinogen that has recently caused great concern in the water industry, especially among utilities engaged in intentional or unintentional potable water reuse (Mitch et al., 2003). NDMA is produced during chlorine disinfection, when chloramines react with dimethylamine (Choi and Valentine, 2002; Mitch and Sedlak, 2002) and other nitrogen-containing compounds

(Mitch and Sedlak, 2004) in wastewater effluent. Once formed, NDMA is difficult to remove by most conventional treatment processes (Sedlak et al., 2004).

The US Environmental Protection Agency does not have a regulation for NDMA, however NDMA has been included in the UCMR2. States such as California are concerned because recycled water is used to recharge groundwater by injection. The California Department of Health Services set a notification level of 10 ppt (ng/l) for NDMA (California Department of Health Services, Water Quality, 2006; Mitch, 2002) while Ontario's Ministry of the Environment has set an Interim Maximum Acceptable Concentration of 9 ng/l for NDMA (Ministry of the Environment, 2003).

In both water and wastewater treatment plants, most NDMA generating reactions occur between a source of nitrite and an amine source such as polymers (Mitch, 2002). Polymers are often used in plants as a coagulant aid.

Researchers have found NDMA generated from chlorine disinfection of wastewater (Najm and Trussell, 2000; Mitch et al., 2003) and found in recycled water. Biotransformation of NDMA has been reported in anaerobic and aerobic incubations of native microbial soil consortia (Mitch et al., 2003).

2.6 Cholesterol Regulators

Cholesterol is a fatty substance, also called a lipid, that's produced by the liver. It's also found in foods high in saturated fat, like fatty meats, egg yolks, shellfish, and whole-milk dairy products. Cholesterol is a vital part of the structure and functioning of human cells, and it's also needed for the formation of certain hormones (Wells et al., 2004).

Several medications are prescribed as cholesterol regulators, such as lipitor, gemfibrozil, mevacor and lovastatin. Kolpin (2002) in a study of United States streams for the USGS Survey found gemfibrozil at a 3.6 % frequency of detection.

Lishman et al. (2006) detected gemfibrozil in the influent and effluent streams of 12 WWTPs along the Thames River in Ontario, Canada with a mean concentration of 0.453 µg/l and 0.246 µg/l, respectively.

2.7 Disinfectants and Germicides

Disinfectants and germicides are broad-spectrum antimicrobials that are used as active ingredients in many skin and oral care consumer products, as well as cleaning supplies. To a lesser degree, certain specialized applications such as textiles and plastics utilize disinfectants to control the growth of disease and odor causing bacteria. Controlling the growth of bacteria can be an important step in preventing the spread of germs, reducing the risk of infections, preventing certain dental diseases, and controlling odors (Ciba Specialty Chemicals, 2007).

Triclosan is a widespread contaminant that has been studied extensively (AWWARF, 2007). It is used as an antiseptic agent in medical products and as an anti-micro bioactive component in a vast range of daily products. A field study of the fate of triclosan in a WWTP by Singer et al. (2002) established that triclosan is mainly degraded by biological treatment (79%), adsorbed in part to sludge and is discharged into surface waters at only 6%.

Gomez et al. (2007) found data similar to Singer et al. (2002) which showed an 88% removal in standard biological treatment. Even with this low percentage of triclosan in effluents, concentration of up to 0.4 µg/l was observed.

These results are relevant, since it has been demonstrated that the photo-degradation of triclosan yields the formation of 2,7/2,8-dibenzodichloro-p-dioxine (DCDD) as a main degradation product. DCDD was identified in wastewater samples in 80% of cases, in influents and effluents, thus indicating its input and persistence through wastewater treatment processes (Aguera et al., 2003), however, DCDD has been found to have low toxicity (2,4-Dichlorophenoxyacetic acid, 2008).

According to a USGS survey of triclosan was a chance of detected in sixty percent (60%) of U.S. streams sampled (Kolpin et al., 2002).

In Pasadena, California a pilot-scale study (Oppenheimer et al., 2004) utilized membrane bioreactors and reverse osmosis to evaluate the removal of EDCs and PPCPs. It was discovered that triclosan was consistently found in the MBR permeate.

2.8 Fire Retardants

Fires require heat, fuel, and oxygen. Fire retardants function by a variety of methods. Most fire retardants absorb energy away from the fire or prevent oxygen from reaching the fuel. Hydrated fillers such as hydrated alumina work in two ways: they absorb energy away from the fire and they release water at a specific temperature.

Fire retardants are found in a wide range of products from cars and furniture to computers. There is growing evidence that flame retardants persist in the environment and accumulate in living organisms, as well as toxicological testing that indicates these chemicals may cause liver toxicity, thyroid toxicity, and neurodevelopment toxicity (Koplin 2002, Burgess et al., 2007, and Herberer, 2002).

The USGS study by Kolpin (2002) in United States streams and later by Oppenheimer and Stephenson in 2006, they found Tris (2-chloroethyl) phosphate (TCEP) was detected in 25% to 57.6 % of the streams tested.

2.9 Hormones & Hormone Mimics

Hormones are chemical messengers that travel throughout the body coordinating complex processes like growth, metabolism, and fertility. They can influence the function of the immune system, and even alter behavior. Before birth, they guide development of the brain and reproductive system. Hormones are the reason why your arms are the same length, why you can turn food into fuel, and why you changed from head to toe at puberty. It is thanks to these chemicals that distant parts of the body communicate with one another during elaborate and important events.

The ability for natural and synthetic chemicals to mimic endogenous hormones has been known since at least the 1930's (Walker and Janney 1930; Cook et al?1934; Stroud 1940; Schueler 1946; Sluczewski and Roth 1948). In 1965, natural estrogens were discovered in wastewater treatment plant outfalls in the United States (Stumm-Zollinger and Fair 1965). Since then the work has expanded to include synthetic estrogens used as birth control pharmaceuticals (Tabak and Bunch 1970).

Servos et al. (2005) examined selected Canadian WWTPs and found average influent values for E1 and E2 of 0.049 and 0.016 µg/L. Lishman et al. (2006) examined Canadian WWTPs and found influent values for E1 and E2 of 0.030 and 0.008 µg/L. Effluent values were also presented for these studies showing an 80 to 100 percent reduction.

Bisphenol A is a well known industrial chemical. It has been reported as being slightly to moderately toxic and easily biodegradable, but its importance lies in its well documented estrogenic activity (Hunt et al., 2003). This means that bisphenol A can be considered as a priority hazardous compound (Harris et al., 2000).

Bisphenol A is an estrogen mimicking compound studied by Kolpin et al., 2002, USGS survey. This EDC was detected in forty five percent (45%) of the U.S. streams.

Gomez et al, 2007, reported a mean value of bisphenol A of 1.4 µg/l in the influent and 0.38 µg/l in the effluent in Barcelona, Spain. Reductions have been reported in the final effluents of WWTPs from 85% to 95% which do not impede the environment according to Kolpin et al. (2002) and Gomez (2007).

Lishman et al. (2006) in Ontario, Canada detected estrone in the influent and effluent streams of 12 WWTPs along the Thames River with a mean concentration of 0.0295 µg/l and 0.0076 µg/l, respectively.

The natural estrogens, such as 17β-estradiol and estrone, are mineralized in both aerobic and anoxic zones during the biological wastewater treatment (Huyard et al., 2007). However, 17α-ethinylestradiol (a synthetic product) is degraded only in aerobic conditions. For natural estrogen, it is stated that the classical WWTPs have a removal capacity varying from 0% to 90% whereas the synthetic ethinylestradiol is found to be removed proportionally less (Nasu et al., 2001; Johnson et al., 2005; Servos et al., 2005).

It has been determined that hormones at very low levels adversely affect various aquatic life (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al. 2000) although there are no studies that say these compounds affect human health. These concentrations have been as low as 0.1 ppb.

2.10 Insecticides and Pesticides

A pesticide is any substance or mixture of substances used to destroy, suppress or alter the life cycle of any pest. A pesticide can be a naturally derived or synthetically produced substance. Pesticides include bactericides, baits, fungicides, herbicides, insecticides, lures, rodenticides and repellents. Pesticides control pest organisms by physically, chemically or biologically interfering with their metabolism or normal behavior (EPA, 2004).

Oppenheimer et al. (2004) conducted a pilot-scale study using membrane bioreactors and reverse osmosis at the Point Loma WWTP in Pasadena, California to evaluate the removal of EDCs and PPCPs. They found that N, N-diethyl-m-toluamide (DEET) was consistently found in the MBR permeate.

Loraine and Pettigrove (2006) tested for DEET in Southern California's two main potable water sources: the Colorado River and the Sacramento-San Joaquin River Basin. Sewage treatment plant effluent heavily impacts both of these sources. DEET was found in the raw water, however, it was not found in the finished drinking water.

Secondary treatment performance was studied by Oppenheimer and Stephenson (2006). DEET was detected between 40% and 70% of the samples taken at eight different WWTPs around the United States. These samples had a 50^{th} percentile value of 120 ng/l. However, DEET removal was less than fifty percent (50%).

2.11 Preservatives

Preservatives work by killing or stopping the growth of microorganisms. All organisms require a narrow range of conditions in which to live: too acid or too sweet and nothing, not even bacteria can live. Sulphur dioxide, the most widely used preservative, has actually been in use since the Middle Ages (Food Additives and Ingredients Association, 2008).

The more modern preservatives such as potassium sorbate and sodium benzoate are specific inhibitors of bacteria; in effect they are broad-spectrum antibiotics (Food

Additives and Ingredients Association, 2008). Most of the preservatives are simple chemicals, very closely related to natural substance.

2.12 Plasticizers

Plasticizers are frequently incorporated to improve the workability of polymers to transform a rigid plastomer into a soft and ductile material (Ram, 1998). Many plasticizers are based on phthalic (or adipic) esters, the most common in the U.S. is dioctyl-phthalate (DOP) (Ram, 1998).

Again, in the Loraine and Pettigrove (2006) study they also tested for phthalates. All of the plasticizers found in the raw water were found in the finished drinking water. The conventional biological treatment plants were not able to completely remove all of the EDCs and PPCPs.

Kolpin (2002) surveyed United States streams for the USGS Survey sited earlier in other sections. Bis (2-ethylhexyl) adipate (4) and bis (2-ethylhexyl) phthalate (4) were detected with 3.5 % to 10.6 % frequency, respectively in the streams tested. Bisphenol A was detected in 41.2 % and triphenyl phosphate was found in 14.1 % of the streams tested.

Secondary treatment performance was studied by Oppenheimer and Stephenson (2006). Triphenylphosphate was found in less than 25% of the secondary effluent samples taken at eight different WWTPs around the United States.

2.13 Stimulants

When stimulants are taken, they increase the amount of chemicals, called neurotransmitters, that control how the brain functions. These chemicals cause the brain to become more active and result in increases in alertness, attention and energy (Stimulant, 2008).

A compound also identified as a major constituent in municipal wastewater is the stimulant caffeine (Buerge et al., 2003). Its widespread occurrence in wastewater, surface water and groundwater worldwide has led to its consideration as a marker for wastewater contamination of natural water (Buerge et al., 2003).

Gomez et al. (2007) found caffeine and its main metabolite 1,7-dimethylxanthine in every sample taken for their study at mean concentration levels of 118 and 19 µg/l in the influent and at 12 and 18 µg/l in the effluent from a WWTP in Spain. There high loads were attributed to direct disposal of coffee or beverages containing these compounds.

The presence of measurable quantities (10 µg/l)of caffeine were found in septic tank effluent and two shallow coarse grained Missoula Aquifers in Montana by Godfrey et al. (2007).

Henderson et al. (2001), tested raw and drinking water in Atlanta. Of 47 wastewater tracers and EDCs analyzed, 15 were detected in raw drinking water samples, and 14 in finished drinking water samples. In that study, caffeine was present in all raw waters and some finished waters. Of the United States streams sampled in the Kolpin et al., 2002 study, caffeine was detected in seventy five percent (75%).

Oppenheimer et al. (2004) conducted a pilot-scale study using membrane bioreactors and reverse osmosis at the Point Loma WWTP in Pasadena, California to evaluate the removal of EDCs and PPCPs. They found that caffeine was consistently found in the MBR permeate.

In another Oppenheimer and Stephenson (2006) study, caffeine was detected in more than 75% of the samples taken at eight different WWTPs around the United States. These samples had a 50^{th} percentile value of 1,900 ng/L in the effluent. However, greater than eighty percent (80%) of caffeine was removed by biological treatment.

2.14 Sunscreens

Sunscreen works by combining organic and inorganic active ingredients. Inorganic ingredients like zinc oxide or titanium oxide reflect or scatter ultraviolet (UV) radiation. Organic ingredients like octyl methoxycinnamate (OMC) or oxybenzone absorb UV radiation, dissipating it as heat (Helmenstine, 2008).

The pilot-scale study conducted by Oppenheimer et al. (2004) in found that oxybenzone was consistently found in the MBR permeate. This study was conducted at a WWTP in Point Loma, California.

Secondary treatment performance was studied by Oppenheimer and Stephenson (2006). Oxybenzone was detected in more than 75% of the samples taken at eight different WWTPs around the United States. These samples had a 50^{th} percentile value of 1,870 ng/l in the effluent. However, greater than eighty percent (80%) of oxybenzone was removed.

2.15 X-Ray Contrast Agents (Iopromide)

There are two basic types of contrast agents used in X-ray examinations. One type of contrast agent is based on barium sulfate, an insoluble white powder. This is mixed with water and some additional ingredients to make the contrast agent. As the barium sulfate doesn't dissolve, this type of contrast agent is an opaque white mixture. It is only used in the digestive tract; it is usually swallowed or administered via an enema.

The other type of contrast agent is based on iodine. This may be bound either in an organic (non-ionic) compound or an ionic compound. Ionic agents were developed first and are still in widespread use depending on the examination required. Ionic agents have a poorer side effect profile. Many of the side effects are due to the hyperosmolar solution being injected (they deliver more iodine atoms per molecule). Iodine based contrast media are clear, colorless, water solutions. Most often these agents are taken intravenously (Radio Contrast, 2008).

The occurrence of iodinated X-ray contrast media has been documented in raw water sources. AWWA Research Foundation (2004) conducted a study on the efficiency of treatment technologies used in waterworks for the removal of iodinated contrast media (this project was not completed as a formal AWWA Research Foundation Publication). Seven contrast media were found in rivers and lakes in Germany. The study determined that to significantly remove the contrasting agents; high levels of ozone and H_2O_2 are needed. It was concluded that this compound is not easily eliminated in waterworks with technology used into today's treatment plants.

However, Vanderford et al. (2003) observed a 58% reduction in the target compounds in the presence of natural waters. An 8.8 % to 20 % reduction occurred by natural attenuation in surface waters with varying degrees of wastewater influence.

2.16 Mood Stabilizers

Most mood stabilizers are purely antimanic agents, meaning that they are effective at treating mania and mood cycling and shifting, but are not effective at treating depression. While an anti-manic agent, such as carbamazepine, cannot treat depression directly, it is widely thought to help ward off depression in bipolar patients by keeping them out of mania and thus preventing their moods from cycling (Mood Stabilizer, 2008).

Carbamazepine has been observed to be persistent in the environment and was not affected by coagulation in wastewater, even at an influent concentration as high as 1000 ng/l (Ternes et al. 2002b).

Researchers also found carbamazepine to be fairly persistent in the effluents of WWTPs located in Lake Greifensee, Switzerland. Concentrations reached levels up to 0.95 µg/l (Tixier, 2003).

2.17 Phenols

Phenol is widely used in the preparation of antiseptics, dyes, antirust products, synthetic resin, photographic, chemicals inks, etc (Xin-gang et al., 2006). Its derivatives are present in wastewater of many industries such as oil refineries, chemical plants and coke ovens (Sitting, 1997; Nemerow, 1978; Patterson, 1985, Xin-gang et al., 2006).

Phenols or hydroxylated aromatic compounds (HACs) are considered as the primary pollutants in a wide variety of industrial wastewaters due to their high toxicity, high oxygen demand (theoretically, 2.4 mg O_2/mg phenol), low biodegradability, relatively high solubility, and environmental mobility (Ghasempur et al., 2007; Korbahti et al., 2003; Khetan and Human, 2007; Huang and Weber, 2004).

Although the toxicity and environmental impacts of HACs vary depending on the numbers, types, and positions of substituted groups on the aromatic ring(s), these chemicals are considered to be toxic to various organisms including humans. In addition, some have been shown to have carcinogenic and mutagenic effects and remain biologically effective even at very low concentrations (Ghasempur et al., 2007; Korbahti et al., 2003; Huang and Weber, 2005; Park et al., 1999).

The compound 4-nonylphenol is used extensively as a surfactant in industrial and sewage treatment processes and is thus extremely widespread in the aquatic environment. Rainbow trout exposed to 4-NP over a 5 day period showed a decreased shoaling tendency, were more likely to be attacked by other fish, and were less successful when competing for food resources than control fish (Ward et al., 2006).

Cresols are chemicals used in cleaners, disinfectants, solvents, degreasing compounds, paintbrush cleaners, fumigants, photographic developers, ore flotation processes, explosives, and synthetic food flavors (National Toxicity Program, 2007). The report not yet finalized by the National Toxicity Program exposed rats to cresols which resulted in a significant increase in hyperplasia, which is the constant dividing of cells causing organs to enlarge. The same study exposed mice to cresols with the same results.

Bisphenol A is used in compact discs, CD-ROMs, CDs, DVDs, resins for metal and glass and many more (Institute for Collaborative Biotechnologies 2008). This includes food can lining for fruits, vegetables, soda, infant formula and other commercial goods (Environmental Working Group, 2007).

CHAPTER III

METHODOLOGY

3.0 Background

Endocrine Disrupting Chemicals (EDCs) are the new permitting challenge for the 21st century. The definition of an EDC is very general and encompasses a wide range of pollutants. Simply stated an EDC is a chemical that interferes with normal growth and reproduction (Kobylinski and Hunter, 2007). Selection of EDCs to test for in the wastewater is a difficult task. Several criteria listed in Table 3-1 were used to define a list of possible EDCs to test for occurrence in the wastewater streams in Oklahoma City.

TABLE 3-1

EDC CRITERIA METHODOLOGY

No.	***Criteria***
1	Historical Data
2	Typical Usage of Drainage Basin (Residential, Industrial, Hospitals)
3	Type of Treatment at the Wastewater Plants
4	Initial Endocrine Disrupting Compounds (EDCs) Candidate List
5	Testing Methodologies and Laboratory Equipment
6	Sample Collection
7	Summary

As shown in Figure 3-1, Oklahoma City has five wastewater treatment plants (WWTP) that serve six sewershed basins. The basin for the Dunjee WWTP encompasses two residential areas and is not shown in Figure 3-1. The North Canadian WWTP is located on the northeast side of Oklahoma City (approximately N. Anderson Road and Memorial Road). Deer Creek and Chisholm Creek WWTP are located north of Oklahoma City Limits (Portland and NW 206th, Western and 220th, respectively). South Canadian WWTP is located on the south side of Oklahoma City at approximately SW 149th and May Avenue. Dunjee WWTP is the smallest plant, located east of Oklahoma City at Anderson Road and N.E. 36th.

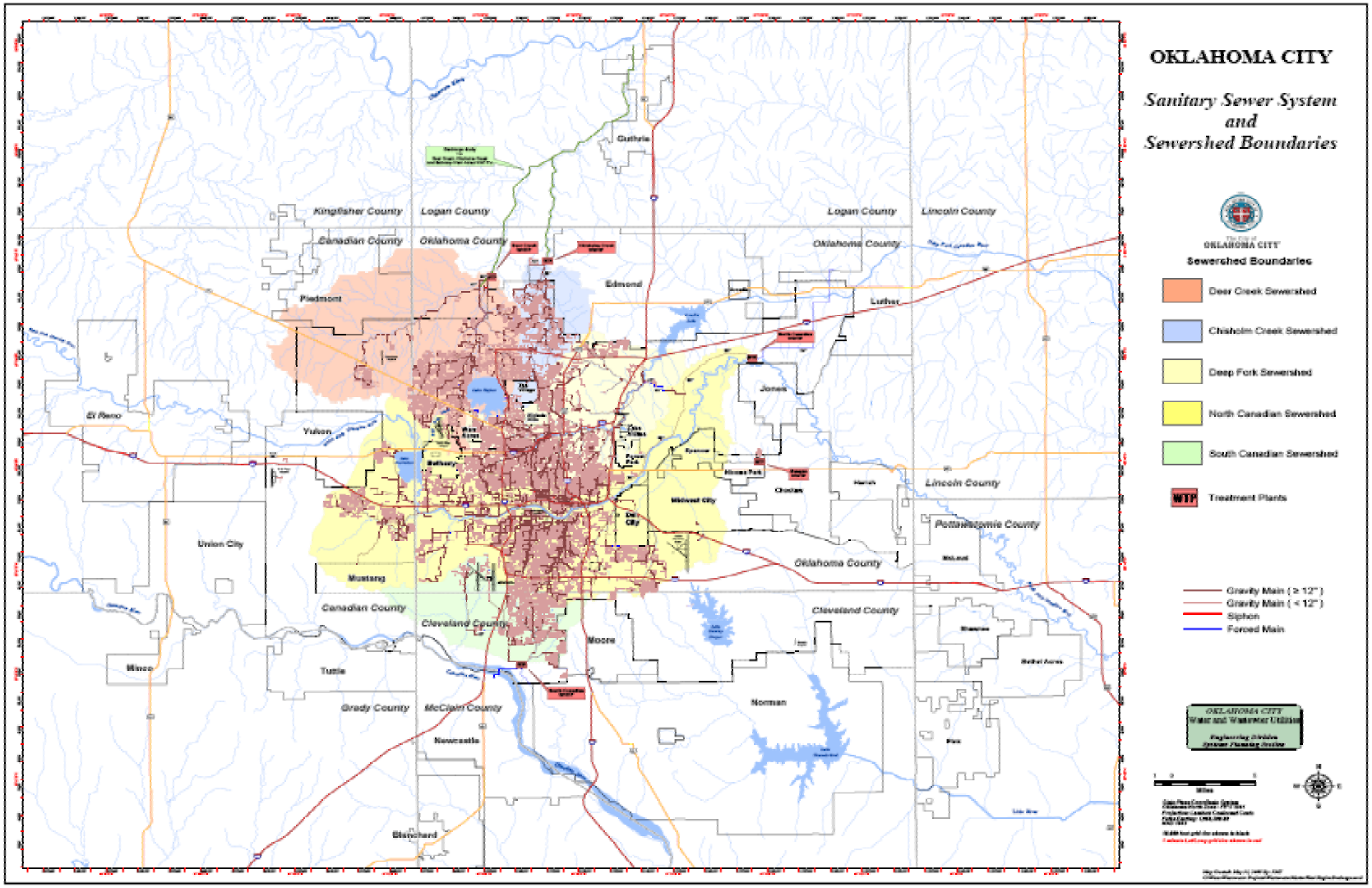


FIGURE 3-1: Oklahoma City Sewer Shed Boundaries

3.1 Historical Data

As part of the pretreatment program for the City of Oklahoma City, a comprehensive local limits study is conducted every five years. This study produces a list of pollutants of concern based on screening the 125 toxic pollutants identified in 40 CFR Part 403, and additional pollutants listed in the State water quality standards.

The City of Oklahoma City analyzes the wastewater received at the North Canadian, South Canadian, Deer Creek, and Chisholm Creek WWTPs four times a year for metals and once a year for total toxic organics. EPA (USEPA, 1987) guidance established arsenic, cadmium, chromium, copper, cyanide, lead, mercury, molybdenum, nickel, selenium, silver, zinc, BOD, TSS, and ammonia as pollutants of concern regardless of reported concentrations.

Sampling data collected by the City at the North Canadian, Deer Creek, and Chisholm Creek wastewater treatment plants (WWTPs) ranging from 1993 through 2007 were evaluated. The last 12 months of data was used in the study as it represents the most current conditions at the treatment plants. Table 3–2 lists the pollutants of concern determined for the City of Oklahoma City. All metals from this list were added to the list of possible EDCs to consider for occurrence testing.

TABLE 3-2 POLLUTANTS OF CONCERN	
Pollutant	***Pollutant***
Arsenic	Mercury
Cadmium	Nickel
Chromium	Silver
Copper	Zinc
Molybdenum	Selenium
Cyanide	Animal-based oil and grease
Lead	Petroleum-based oil and grease
TDS	Sulfate
Chloride	

3.2 Typical Usage of Drainage Basin (Residential, Industrial, Hospitals)

The City of Oklahoma City has five main drainage basins, Deer Creek, Chisholm Creek, Deep Fork, North Canadian, and South Canadian that flow to four main wastewater treatment plants as shown in Figure 3-1. The Deep Fork basin is pumped into the North Canadian basin by an 80 MGD pump station called the Witcher Pump Station.

The Deer Creek Basin is predominantly residential, with one of the largest hospitals in Oklahoma City also discharging to the WWTP. This drainage basin is considered, as part of the wastewater master plan, to be one of the largest future growth areas for residential. The Deer Creek basin contains two categorical industrial users and four non-significant (minor) industrial users regulated by City code.

The Chisholm Creek Basin is almost completely developed and is predominantly residential. The only industrial facility is a non-significant (minor) industrial user. The Chisholm Creek Basin does not have any major hospitals but does include several retirement homes.

The North Canadian and Deep Fork Basin together comprise the largest basin in Oklahoma City. The majority of the industry for Oklahoma City is located within this basin, as well as three major hospitals, downtown Oklahoma City, the County Jail, and a large residential population. This basin includes 28 categorical industrial users, 54 significant non-categorical industrial users, and 108 non-significant (minor) industrial users regulated by City code. The time of travel for sewage from the west side of the North Canadian Basin to the east side is approximately sixteen hours (16 hrs).

The South Canadian Basin is also 95% residential. This basin has three categorical industrial users and one non-significant (minor) industrial user regulated by City code. This basin flows to the South Canadian WWTP, which was not selected as one of the plants to test for EDCs. This is further discussed in the next Section.

The three sites chosen for this experiment were at the Deer Creek WWTP, Chisholm Creek WWTP and the North Canadian WWTP. These three plants treat the majority of the industrial and residential flow for the City of Oklahoma City.

Section 3.3 Type of Treatment at the Wastewater Plants

The City owns/operates five wastewater treatment plants to serve the City of Oklahoma City. The plant names and capacities are listed in Table 3-3.

Table 3 - 3 : OKC's WWTPs

Wastewater Treatment Plant	Design Capacity (MGD)
Dunjee	0.2
South Canadian	6
Chisholm Creek	5
Deer Creek	15
North Canadian	80

The South Canadian WWTP is a sequencing batch reactor (SBR) plant located south of S.W. 149th Street and May Avenue and averages 3.7 MGD. After the bar screens and SBRs the flow is sent to the aeration basins, filters and chlorination/de-chlorination facility during the summer months.

The majority of the final effluent (grey water) for the South Canadian plant is purchased by the McClain Power Plant (OG&E). Therefore, most of the flow year-round is not discharged to the stream. This fact, difficulty for sampling after the SBRs, and the location of this plant compared to the other three major plants, eliminated this plant for testing EDCs.

The Dunjee WWTP is a biological batch plant with only residential customers. This plant averages 0.2 MGD and was eliminated from the EDCs study at this time due to cost, which is discussed in Section 3.7.

Chisholm Creek WWTP

The Chisholm Creek WWTP is a conventional biological treatment plant, with an average influent flow of 4.5 MGD. The schematic for this plant is shown in Figure 3-2. The raw sewage is screened, sent to the primary clarifiers, aeration basins, secondary clarifiers, nitrification basins, chlorination/de-chlorination facility (during summer months only) and discharged to Chisholm Creek, the receiving stream.

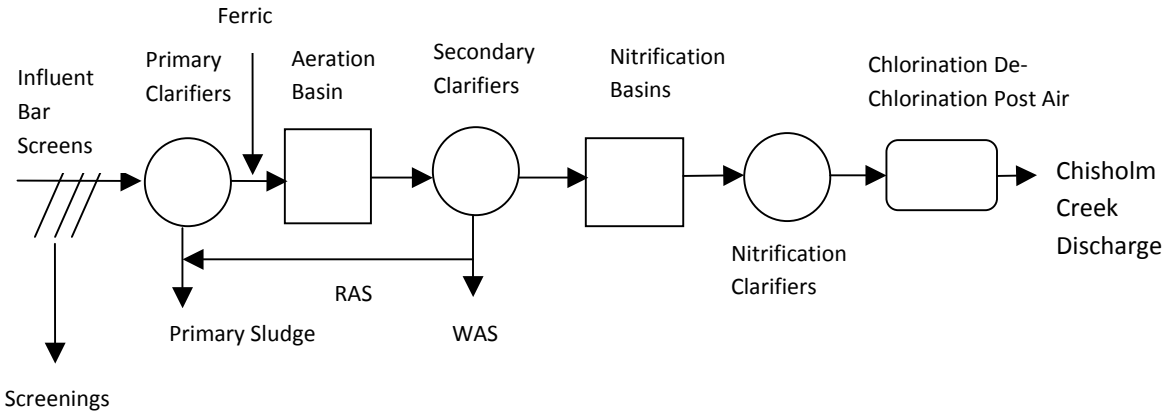


FIGURE 3-2: Chisholm Creek WWTP Process Schematic

Deer Creek WWTP

The Deer Creek WWTP averages 9.2 MGD and is also a biological treatment plant. This plant is very similar to the Chisholm Creek WWTP with the exception of rotating biological contactors (RBCs) and filters as shown is Figure 3-3. The filters are only used during the summer months and the effluent is discharged to Deer Creek, therefore, no filters were in use during this sampling event.

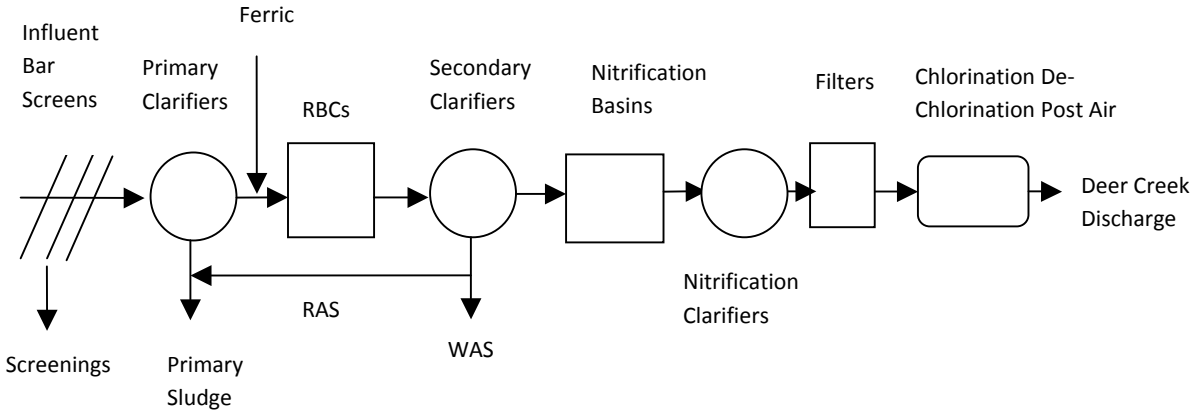


FIGURE 3 – 3: Deer Creek WWTP Process Schematic

North Canadian WWTP

The North Canadian WWTP is the largest plant owned/operated by Oklahoma City. This plant averages 54.6 MGD and is a biological treatment plant. As shown in Figure 3-4, the influent flow is processed through primary clarifiers, aeration basins, secondary clarifiers and chlorination/de-chlorination facilities (in the summer months). The effluent is discharged to the North Canadian River.

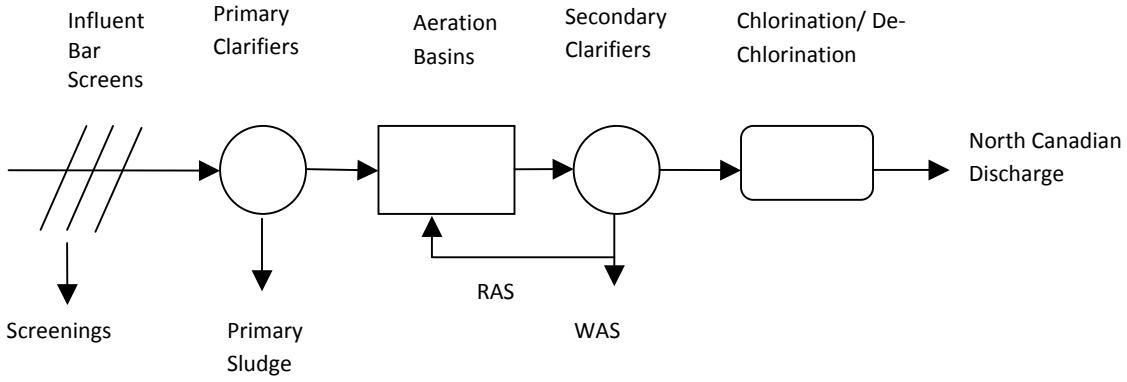


FIGURE 3 – 4: North Canadian WWTP Process Schematic

The North Canadian, Chisholm Creek and Deer Creek wastewater treatment plants were chosen as the three sites to test for the occurrence of EDCs.

Section 3.4 Initial Endocrine Disrupting Compounds (EDCs) Candidate List

Three different criteria were considered when trying to determine a list of possible EDCs for screening. The first criteria was to look into the most commonly prescribed drugs in the United States. The second criteria was to investigate drugs prescribed in Oklahoma City. The last criteria for developing a possible EDC list was to look at what other cities have tested.

A site on the internet called RxList provides a list of the top 200 to 300 prescribed drugs per year. These lists were downloaded and evaluated from the following years, 2000 to 2005, and can be viewed in Appendix B.

No data could be found for a list of commonly prescribed drugs in Oklahoma City. Therefore, the four major hospitals and their pharmaceutical departments were contacted on several occasions to locate any information they could provide. Only one of the hospitals answered the letters sent. This facility never provided a list for this study, however, they had many questions about the proper disposal of unused medicine!

The last criteria was to look at what other cities similar to Oklahoma City were looking for in their research. A detailed review of these reports is located in Chapter 2, Literature Review.

Oklahoma City's industrial makeup is predominantly hospitals, stockyards, food processing companies, and correctional facilities, coatings and metal finishing facilities (Aillet et al., 2008). Most cities testing for EDCs are larger than Oklahoma City and have a different industrial base.

An initial list was developed from the historical data, typical usage of drainage basins, type of treatment at the wastewater plants, commonly prescribed drugs, analytical tests available and other studies. This list is presented below in Table 3-4.

TABLE 3-4

INITIAL EDC SCREENING LIST

Endocrine Disruptor	***Use***	***Chemical Equation***	***Molecular Weight (g/mol)***	***log Kow***
Ibuprofen	Analgesic	$C_{13}H_{18}O_2$	206.28	3.97
Hydrocodone	Analgesic	$C_{18}H_{21}NO_3$	299.36	2.16
Acetaminophen	Analgesic	$C_8H_9NO_2$	151.16	0.46
Amoxicillin	Antibiotic	$C_{16}H_{19}N_3O_5S$	365.41	0.87
Ketoprofen	Anti-inflammatory	$C_{16}H_{14}O_3$	254.28	3.14
Naproxen	Anti-inflammatory	$C_{14}H_{14}O_3$	230.26	3.18
N-nitrosodimethylamine (NDMA)	By-Product	$C_8H_{10}N_2O_8$	74.08	<0
Gemfibrozil	Cholesterol Regulator	$C_{15}H_{22}O_3$	250.33	4.39
Triclosan	Disinfectant/Germicide	$C_{12}H_7Cl_3O_2$	289.54	4.76
Chloroxylenol	Disinfectant/Germicide	$C_8H_9Cl\ O$	156.61	-
Tris (2-chloroethyl) phosphate (TCEP)	Fire retardant	$C_6H_{12}Cl_3O_4P$	285.49	1.44
Triphenyl Phosphate	Fire retardant	$C_{18}H_{15}O_4P$	326.29	4.6
bisphenol A (estrogen)	Hormones/ Plasticizer	$C_{15}H_{16}O_2$	228.29	3.4
17α-dihydroequilin	Hormones	$C_{18}H_{21}NaO_5S$	372.41	4.1
17α-estradiol (E2)	Hormones	$C_{18}H_{24}O_2$	272.38	4.01
Estrone (E1)	Hormones	$C_{18}H_{22}O_2$	270.4	3.13
Estriol (E3)	Hormones	$C_{27}H_{36}O_6$	456.6	2.6
Progesterone	Hormones	$C_{21}H_{30}O_2$	314.46	3.87
17α –ethinyl estradiol (EE2)	Hormones	$C_{20}H_{24}O_2$	296.40	3.67
Octylphenol	Industrial	$C_{14}H_{22}O$	206.32	4.12

TABLE 3-4

INITIAL EDC SCREENING LIST

Endocrine Disruptor	*Use*	*Chemical Equation*	*Molecular Weight (g/mol)*	*log Kow*
Deet	Insecticide	$C_{12}H_{17}NO$	191.27	2.18
Atrazine	Pesticide	$C_8H_{14}ClN_5$	215.68	2.61
Butyl benzyl phthalate	Plasticizer	$C_{19}H_{20}O_4$	312.36	4.77
Bis(ethylhexyl) phthalate	Plasticizer	$C_{24}H_{38}O_4$	390.56	4.89
Benzophenone	Preservative	$C_{13}H_{10}O$	182.22	5.86
Methylparaben	Preservative	$C_8H_8O_3$	152.15	1.72
Butylated Hydroxyanisol	Preservative	$C_{11}H_{16}O_2$	180.24	4.78
Caffeine	Stimulant	$C_8H_{11}N_4O_4$	194.19	<0
Hydrocinnamic acid	Sunscreen	$C_9H_{10}O_2$	150.17	2.66-4.18
Benzyl salicylate	Sunscreen	$C_{14}H_{12}O_3$	228.24	2.26
Oxybenzone	Sunscreen	$C_{14}H_{12}O_3$	228.24	3.79
Iopromide	X-ray contrast agent	$C_{18}H_{24}I_3N_3O_8$	791.11	<0
Mercury	Heavy Metals	Hg	200.6	
Nickel	Heavy Metals	Ni	58.7	
Copper	Heavy Metals	Cu	63.5	
Lead	Heavy Metals	Pb	207.2	
Cadmium	Heavy Metals	Cd	112.4	
Chromium	Heavy Metals	Cr	52	
Zinc	Heavy Metals	Zn	65.4	

3.5 Testing Methodologies and Laboratory Equipment

The next step was to determine the suitable analytical methods, standard protocols and laboratory equipment needed to test for the EDCs initially chosen. Although the Oklahoma City Laboratory had recently purchased equipment to begin testing for EDCs, the lab had not established standard protocols and did not have all the specialized equipment such as solid-phase micro-extraction (SPME) fibers, certified reference

materials, and silanized bottles require for EDC testing. Certified reference materials of controlled substances (i.e. carbamazepine, fluoxetine, etc.) are very difficult to obtain.

Due to the complexity of the methods and the time constraints of this study, it was necessary to use an outside testing laboratory. The outside laboratory selected was Montgomery Watson Harza (MWH) Laboratories in Monrovia, California. MWH had already established standard protocols for testing of specific target compounds and grouped these compounds into several categories. The two categories chosen for testing EDCs from the MWH lab were the EDC2 and EDC4 groups. EDC 2 are tested using Liquid chromatography and EDC 4 are tested using gas chromatography. Table 3-5 lists the target compounds tested.

TABLE 3-5

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	***EDC MWH Lab Group***	***Formula Weight***	***Chemical Formula***	***Log K_{OW}***	***Description / Comments***
Bisphenol A (BPA)	EDC4	228.29	$C_{15}H_{16}O_2$	3.4	Key monomer in production of polycarbonate plastic and epoxy resin; mimics hormonal activity of estrogen
Carbamazepine	EDC2	236.27	$C_{15}H_{12}N_2O$	1.51	Anticonvulsant and mood stabilizer; anti-anxiety medication – used primarily in the treatment of epilepsy and bipolar disorder
Caffeine	EDC2	194.19	$C_8H_{10}N_4O_2$	< 0	Central nervous system stimulant;

TABLE 3-5

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*EDC MWH Lab Group*	*Formula Weight*	*Chemical Formula*	*Log K_{OW}*	*Description / Comments*
					coffee, tea, soft drinks
Acetaminophen	EDC2	151.17	$C_8H_9NO_2$	0.46	Analgesic – pain reliever, fever reducer
Ibuprofen	EDC2	206.3	$C_{13}H_{18}O_2$	3.97	Analgesic – pain reliever, fever reducer, inflammation reducer
Iopromide	EDC2	791.12	$C_{18}H_{24}I_3N_3O_8$	< 0	Iodinated contrast media, radiopaque agent used in computed tomography
Progesterone	EDC2	314.47	$C_{21}H_{30}O_2$	3.87	Steroidal hormone – involved in female menstrual cycle, pregnancy
Testosterone	EDC2	288.43	$C_{19}H_{28}O_2$		Steroid hormone from the androgen group – anabolic steroid
Estrone	EDC2	270.37	$C_{18}H_{22}O_2$	3.13	One of three estrogens including estriol and estradiol
17α –ethinyl estradiol (EE2)	EDC2	296.40	$C_{20}H_{24}O_2$	3.67	Synthetic steroidal estrogen used in birth control pills - derivative of estradiol (below)
17ß-estradiol (E2)	EDC2	272.39	$C_{18}H_{24}O_2$	4.01	Sex hormone – in females, acts a growth hormone for tissue of reproductive organs

TABLE 3-5

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*EDC MWH Lab Group*	*Formula Weight*	*Chemical Formula*	*Log K_{OW}*	*Description / Comments*
Trimethoprim	EDC2	290.32	$C_{14}H_{18}N_4O_3$	0.91	Antibiotic – often used in conjunction with sulfamethoxazole
Triclosan	EDC2	289.54	$C_{12}H_7Cl_3O_2$	4.76	Antibacterial agent used primarily in soap, toothpaste, etc.
4-Methylphenol	EDC4	108.13	C_7H_8O		Industrial chemical commonly used as intermediate in organic chemicals production
DEET	EDC4	191.27	$C_{12}H_{11}NO_2$	2.18	Insect repellent used in numerous commercial formulations (i.e. "OFF")
Triphenylphosphate	EDC4	326.28	$C_{18}H_{15}O_4P$	4.60	Flame retardant used in many plastics and other applications
Tris (2-chloroethyl) phosphate (TCEP)	EDC4	285.49	$C_6H_{12}O_4PCl_3$	1.44	Flame retardant used in polyurethane foam
Tris (2-butoxyethyl) phosphate	EDC4	398.54	$C_{18}H_{39}O_7P$	4.38	Flame retardant used as plasticizer in rubber and plastics – also used in floor polishes
TDCPP	EDC4	430.91	$C_9H_{15}Cl_6O_4P$	1.7	Flame retardant
Carbaryl	EDC4	201.22	$C_{12}H_{11}NO_2$	2.36	Cholinesterase inhibitor – used chiefly as an insecticide

TABLE 3-5

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*EDC MWH Lab Group*	*Formula Weight*	*Chemical Formula*	*Log K_{OW}*	*Description / Comments*
Chlorpyrifos	EDC4	350.39	$C_9H_{11}Cl_3NO_3PS$	4.7	Organophosphate pesticide – inhibits acetylcholinesterase (Dursban, Lorsban)
Fluoxetine	EDC2	309.3	$C_{17}H_{18}F_3NO$	1.8	Antidepressant (Prozac) – selective serotonin reuptake inhibitor
2,6-di-tert-butylphenol	EDC4	206.33	$C_{14}H_{22}O$	4.5	Antioxidant for fuels, oils, gasolines
4-nonylphenol	EDC4	220.35	$C_{15}H_{24}O$	3.28	"Inert" ingredient in many pesticides (used as surfactant) – mimics estrogen activity; acutely toxic, bioaccumulates
Alpha Chlordane	EDC4	409.76	$C_{10}H_6Cl_8$	2.78	Organochlorine pesticide (banned)
Diazinon	EDC4	304.36	$C_{12}H_{21}N_2O_3PS$	3.11	Organophosphate insecticide; inhibits acetylcholinesterase, an enzyme needed for proper nervous system function
Dieldrin	EDC4	380.91	$C_{12}H_8Cl_6O$	6.2	Chlorinated Hydrocarbon, insecticide
Methyl Parathion	EDC4	263.2	$C_8H_{10}NO_5PS$	3.8	Organophosphate pesticide insecticide; nematicide

TABLE 3-5

INITIAL ENDOCRINE DISRUPTING CHEMICAL (EDC) LIST

EDC/PPCP	*EDC MWH Lab Group*	*Formula Weight*	*Chemical Formula*	*Log K_{OW}*	*Description / Comments*
Gemfibrozil	EDC2	250.33	$C_{15}H_{22}O_3$	4.39	Cholesterol regulator, lowers lipid levels (Lopid; Gen-Fibro)
Sulfamethoxazole	EDC2	253.7	$C_{10}H_{11}N_3O_3S$	0.89	Antibiotic (i.e. Bactrim, Septrim, Septra)
Phenol	EDC4	94.11	C_6H_5OH	1.46	Used as an antiseptic and as chemical feedstock in many industrial organic chemical production processes

Testing was performed using modified versions of United States Geological Survey (USGS) procedures for EDCs and pharmaceutical compounds (MWH Laboratory, 2006).

3.6 Sample Collection

MWH Laboratories sent silanized bottles to the Oklahoma City's laboratory. Each grab sample was collected in triplicate in silanized bottles and had a total volume of approximately 1 liter. The sample bottles were labeled with the site of the sample, where the sample was taken (i.e. unit process), and time and date of the sample. Collected

samples were packed in ice and shipped overnight to MWH Laboratories in Monrovia, California

Collection was performed at North Canadian and Deer Creek in November 2007, while Chisholm Creek samples were collected in December 2007. Chlorination/De-Chlorination is not required during this time of the year. The results of the testing are discussed in Chapter 4, Results and Discussion. The actual data sheets are presented in Appendix A.

3.7 Summary

The three wastewater treatment plants chosen to test for EDCs were the North Canadian, Deer Creek and Chisholm Creek. The list of EDCs were selected from available testing suites provided by MWH laboratories in Monrovia, California, which is an established laboratory with regard to EDC and pharmaceutical pollutant testing in water and wastewaters. Samples were collected at the influent, primary effluent and final treated effluent from each of the three WWTPs. Collection was performed at North Canadian and Deer Creek in November 2007, while Chisholm Creek samples were collected in December 2007. Collected samples were shipped overnight to MWH Laboratories in Monrovia, CA. Testing was performed using modified versions of United States Geological Survey (USGS) procedures for EDCs and pharmaceutical compounds and the results are discussed in Chapter 4.

CHAPTER IV

RESULTS and DISCUSSION

4.0 Introduction

The primary objective of this study was to determine the occurrence of endocrine disrupting compounds (EDCs) and selected pharmaceutical pollutants in the wastewaters of Oklahoma City. The secondary objective was to determine if any of the detected compounds were removed through the unit processes at the City's wastewater treatment plants. Samples were collected from the influent, primary effluent and final effluent streams at Oklahoma City's three largest wastewater treatment plants: North Canadian, Deer Creek, and Chisholm Creek.

Collected samples were tested for thirty-one (31) different compounds using USGS analytical methods detailed in Chapter 3. Seventeen compounds were detected in the final effluent at North Canadian, while twenty-three were found in Deer Creek final effluent and twenty compounds were present at detectable levels in the Chisholm Creek final effluent.

4.1 General

Table 4-1 lists the endocrine disrupting compounds detected in one or more of the wastewater treatment plants sampled. Also provided in Table 4-1 is the common application for each EDC compound found.

The EDCs selected for testing were based off set groups of analytes from the Montgomery Watson Laboratory. Table 4-2 lists the eight endocrine disrupting chemicals from MWH laboratory standard groups not detected at North Canadian, Deer Creek or Chisholm Creek WWTPs.

Testing data generated by MWH Laboratory can be found in Appendix A. These results represent a single snapshot of water quality at each plant during the winter. The results vary from plant to plant and at each stage of treatment tested.

TABLE 4-1

DETECTED ENDOCRINE DISRUPTING CHEMICALS (EDCs)

ENDOCRINE DISRUPTOR	***APPLICATION***
Acetaminophen	Analgesic
Ibuprofen	Analgesic
Caffeine	Stimulant
Carbamazepine	Antipsychotic
Fluoxetine	Antipsychotic
Estrone	Hormone
Estradiol	Hormone
Ethinyl Estradiol - 17 α	Hormone
Progesterone	Hormone
Testosterone	Hormone
Sulfamethoxazole	Antibiotic
Trimethoprim	Antibiotic
Gemfibrozil	Cholesterol Regulator
Iopromide	Radiological Contrast Agent
Triclosan	Disinfectant/Germicide
4-Methylphenol	Antioxidant
Phenol	Antioxidant
DEET	Insecticide/Pesticide
Bis Phenol A (BPA)	Fire Retardant/Plasticizer
(TDCPP)	Fire Retardant/Plasticizer
Tris (2-butoxyethyl) phosphate (TBEP)	Fire Retardant/Plasticizer
Tris (2-Chloroethyl) phosphate (TCEP)	Fire Retardant/Plasticizer
Triphenylphosphate	Fire Retardant/Plasticizer

TABLE 4-2 NON-DETECTED ENDOCRINE DISRUPTING CHEMICALS (EDCs)	
ANALYTE	***APPLICATION***
2,6-di-tert-butylphenol	Antioxidant
4-Nonyl phenol	Antioxidant
Alpha Chlordane	Insecticide/Pesticide
Carbaryl	Insecticide/Pesticide
Chlorpyrifos	Insecticide/Pesticide
Diazinon	Insecticide/Pesticide
Dieldrin	Insecticide/Pesticide
Methyl Parathion	Insecticide/Pesticide

Even though the compounds in Table 4-2 were not detected during this single sampling event, occurrence of these compounds is more likely during months when residential and agricultural users are applying pesticides and fertilizers.

4.2 Metals

Metals from the City of Oklahoma City's Wastewater Masterplan (2008), pollutants of concern list were added to the list of possible EDCs to consider testing for occurrence. Table 4-3 lists the average concentration of metals detected in the influent and effluent at the three plants in this study.

TABLE 4-3

Historical Metal Concentrations

	North Canadian		Deer Creek		Chisholm Creek	
	Ave Influent Flow (ug/l)	Ave Effluent Flow (ug/l)	Ave Influent Flow (ug/l)	Ave Effluent Flow (ug/l)	Ave Influent Flow (ug/l)	Ave Effluent Flow (ug/l)
Arsenic	2.47	0.66	1.34	0.54	1.78	1.08
Cadmium	1.18	0.38	0.53	0.54	0.33	0.27
Chromium	16.28	7.83	2.45	1.26	3.33	1.16
Copper	64.16	16.40	29.01	7.58	47.43	12.30
Lead	14.14	1.33	1.95	1.16	3.21	1.03
Mercury	0.26	0.00	0.10	0.05	0.14	0.04
Molybdenum	4.61	2.84	3.83	1.20	2.79	1.97
Nickel	12.05	6.24	5.15	5.02	3.13	6.58
Selenium	2.30	1.60	0.59	0.56	0.96	0.00
Silver	6.02	0.07	5.31	0.69	1.87	0.38
Thallium	1.96	0.00	2.36	3.75	1.88	2.55
Zinc	321.52	65.59	78.98	41.26	139.13	52.29

Kaltreider *et al*. show that very low levels of arsenic equivalent to about 10 parts per billion selectively inhibit the ability of glucocorticoid and its receptor to turn on genes normally under glucocorticoid control. Martin and coworkers, 2003, discovered that cadmium chloride is a potent estrogen mimic in female rats, at doses as low as 5-10 µg/kg. The levels of arsenic and cadmium at the Oklahoma City WWTPs were detected at lower limits then these studies.

Various testes sizes were observed in catfish exposed to molybdenum in the Yamaguchi et al., study. Chromium has been proven to be toxic at high concentrations

and information about low concentration is insufficient in the literature (Corrêa et al., 2005).

According to laboratory data (Anadu et al., 1989; Hobson and Birge, 1989; Kito et al., 1982; Pascoe and Beattie, 1979; Sinley et al., 1974), brown trout previously exposed to Cadmium or Zinc were more resistant to lethal doses of metals than brown trout previously unexposed to metals.

Metals detected at the Oklahoma City WWTPs were at lower concentrations then the previous studies found to effect aquatic life.

4.3 North Canadian

Figure 4–1 and Figure 4–2 show the low and high concentrations, respectively, of each drug tested in the influent, primary effluent, and final effluent. Six compounds were found to have concentrations around 3,000 ng/l or greater in the primary effluent as

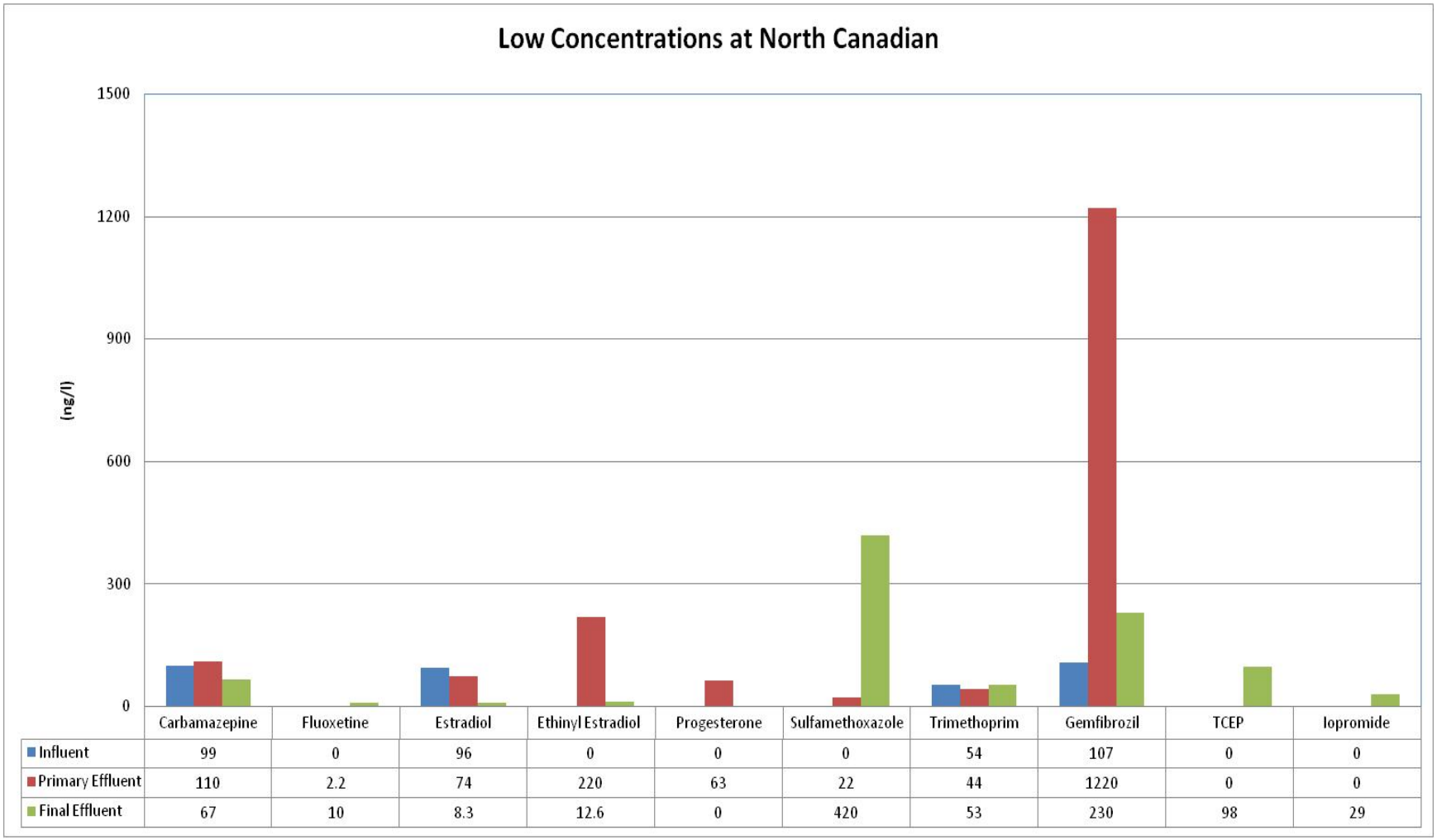
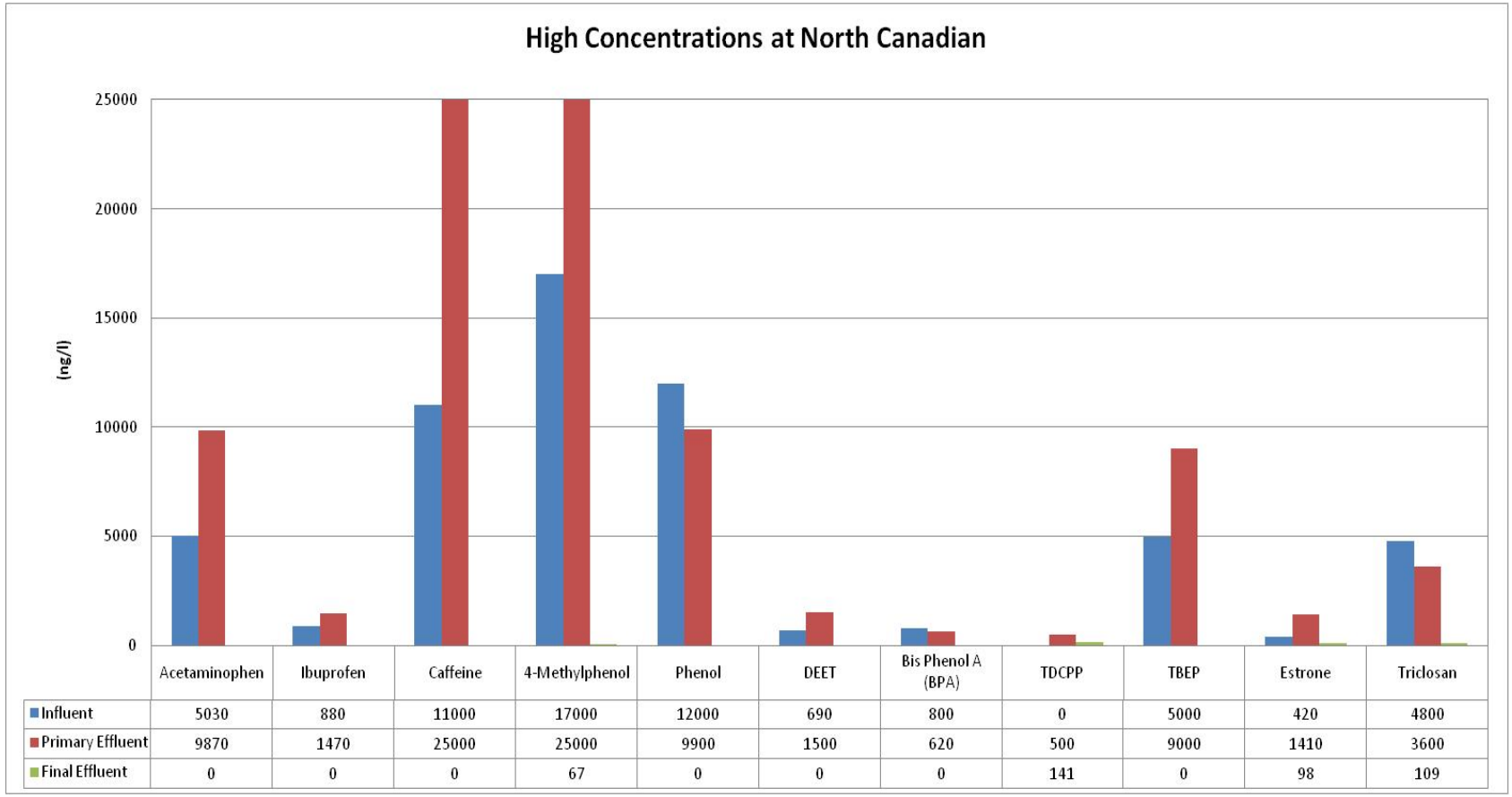


FIGURE 4 – 1: Low Concentrations at North Canadian



	Acetaminophen	Ibuprofen	Caffeine	4-Methylphenol	Phenol	DEET	Bis Phenol A (BPA)	TDCPP	TBEP	Estrone	Triclosan
Influent	5030	880	11000	17000	12000	690	800	0	5000	420	4800
Primary Effluent	9870	1470	25000	25000	9900	1500	620	500	9000	1410	3600
Final Effluent	0	0	0	67	0	0	0	141	0	98	109

FIGURE 4 – 2: High Concentrations at North Canadian

listed in Table 4–4.

TABLE 4-4

COMPOUNDS WITH LEVELS > 3,000 ng/l AT NORTH CANADIAN

Compound	***Influent (ng/l)***	***Primary Effluent (ng/l)***	***Final Effluent (ng/l)***
Acetaminophen	5,030	9,870	0
4-Methylphenol	17,000	25,000	67
Phenol	12,000	9,900	0
Caffeine	11,000	25,000	0
TBEP	5,000	9,000	0
Triclosan	4,800	3,600	109

As shown in Figure 4-1 and Figure 4-2, acetaminophen, caffeine, 4-methylphenol, and phenol were detected at approximately 10,000 ng/l or greater. Significant removal of these compounds occurred with biological treatment at the North Canadian WWTP.

Caffeine has been found at influent concentrations approaching 150,000 ng/L in previous studies (Ternes, 2001) and 42,000 ng/L (Thomas and Foster, 2004). Effluent concentrations were on average much lower than those found in any European study (Ollers et al., 2001; Lindstrom et al., 2002; Heberer, 2002), but were comparable to those found in North America (Phillips et al., 2003; Boyd et al., 2003; Soliman et al., 2004; Miao et al., 2002, Thomas and Foster, 2004). These variations are likely because of differences in the efficiency of wastewater treatment among plants or the differences in sampling and testing.

Removal efficiency of greater than 80% of the laboratory-scale MBR and the full-scale CAS process was comparable for acetaminophen in a previous study (Radjenovic,

2007). Ibuprofen, progesterone, DEET, bisphenol A, estrone, estradiol, ethinyl estradiol, triclosan, and TBEP appeared in lower quantities in different phases of the treatment process; however, they were almost entirely, and in some cases completely, removed through biological treatment.

Phillips et al., 2003 study is consistent with the compounds DEET and TBEP detecting reductions greater than 95%. A mass balance assessment of triclosan was conducted in the Heidler and Halden, 2006 study also showed a 98% reduction during conventional treatment which is consistent with this study; however high concentrations were found in the digested sludge concentrations.

Estrone, estradiol, and ethinyl estradiol were reduced between 88% to 100% through primary treatment in several studies (Suidan et al., 2004;, Schoenberg, 2005).

Greater than 80% removal was detected in ibuprofen in a previous study in a laboratory-scale MBR and the full-scale CAS process (Radjenovic, 2007).

Figure 4-3 illustrates the concentration of constituents in the final plant effluent sample only. This graph demonstrates the magnitude of the concentrations ranging from 25,000 ppt down to less than 10 ppt.

Although there is no definite answer if any of the compounds in Figure 4-3 effect human health, it has been determined that hormones at very low levels adversely affect various aquatic life (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al. 2000).

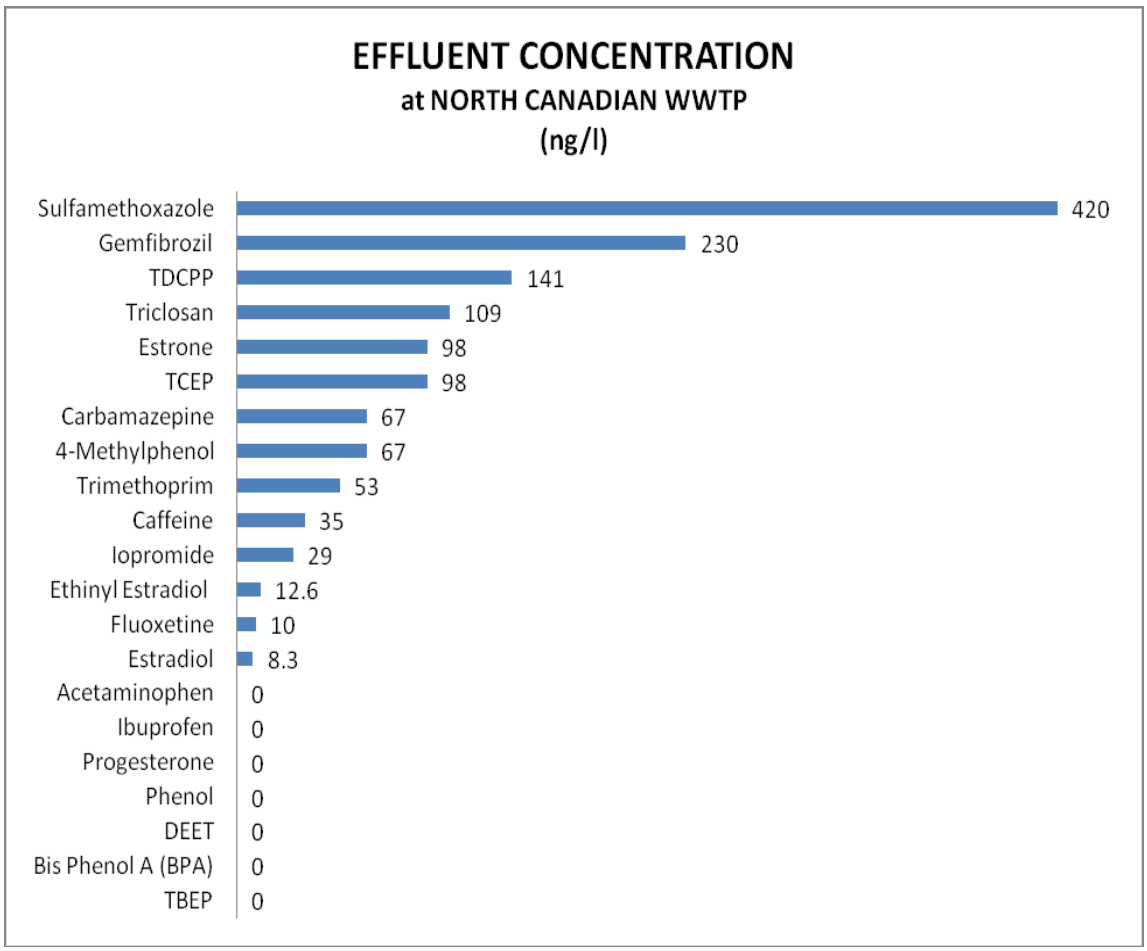


FIGURE 4 – 3: Effluent Concentration at North Canadian

Table 4-5 lists the effluent concentration in parts per billion (ppb) by the application. Antibiotics detected include sulfamethoxazole, trimethoprim, and triclosan at 0.59 ppb. The psychoactive compounds detected were caffeine and fluoxetine at 0.11 ppb. Detected hormones include estrone, ethinyl estradiol and estradiol at 0.12 ppb. The flame retardants detected were TCEP and TDCPP at 0.24 ppb. Gemfibrozil, iopromide and 4-methylphenol were the only detected analgesics/heart medicine, contrast media, and phenolic at 0.23, 0.03, and 0.07 respectively.

Antibiotics had the highest concentration at 0.59 ppb and pesticides were not detected at this plant. These numbers could change dramatically for pesticides and insecticides if testing is continued in the summer months when insecticides and pesticides are applied frequently.

TABLE 4-5

EFFLUENT CONCENTRATION BY APPLICATION AT NORTH CANADIAN

Application	***Final Effluent (ppb)***
Antibiotics	0.59
Psychoactive	0.11
Hormones	0.12
Flame Retardants	0.24
Analgesics/Heart Medicine	0.23
Contrast Media	0.03
Phenolics	0.07
Pesticides/Insecticides	ND
TOTAL =	**1.39 ppb**

Nine compounds were not detected in the influent, however, these compounds were found in the primary effluent and/or the final effluent. These compounds, with their concentrations for each treatment stage, are shown in Table 4-6.

Obviously, to have these compounds appear later in the treatment process, demonstrates that at some point the substance was in the influent. Secondly, the compounds could be leaching back from the biosolids and integrating back into the effluent. Researchers (Gobel et al., 2005; Huyard et al., 2007; Hale, 2001; and Roberts,

2005) have found pharmaceuticals and personal care products in biosolids at various WWTPs.

TABLE 4-6

INFLUENT CONCENTRATION EQUAL TO ZERO

Compound	***Influent (ng/l)***	***Primary Effluent (ng/l)***	***Final Effluent (ng/l)***
TDCPP	0	500	141
Tris (2-Chloroethyl) phosphate	0	0	98
Ethinyl Estradiol - 17 alpha	0	220	12.6
Fluoxetine	0	2.2	10
Iopromide	0	0	29
Progesterone	0	63	0
Sulfamethoxazole	0	22	420

Figure 4-4 shows all the compounds that increased in concentration through the treatment process. Most of these compounds started with zero concentration in the influent. In Chapter 2, Figure 2-1, the chemical structures for these compounds are shown. Most of these compounds are halogenated structures.

TCEP, fluoxetine, and iopromide are halogenated structures, which have disinfectant properties. The stability of halogenated compounds is what is appealing for application in industrial processes. However, halogenated compounds have disinfectant properties and are typically refractory to biological treatment (Howard et al., 2007; Aarestrup, 2005; Jones and Mitchell, 1998).

Sulfamethoxazole and triclosan are molecules expressly designed to have antimicrobial properties. Since the North Canadian WWTP is a biological plant, these

compounds are resistant to degradation at this facility in a similar fashion to the halogenated compounds TCEP, fluoxetine, and iopromide. Hartig et al., 1999, reported sulfamethoxazole level in the primary effluent of a German WWTP of 2.4 µg/l and a secondary treated sewage of 1.5 µg/l which is not consistent with this study. Singer et al. (2002) established that triclosan is mainly degraded by biological treatment which is not consistent with this study.

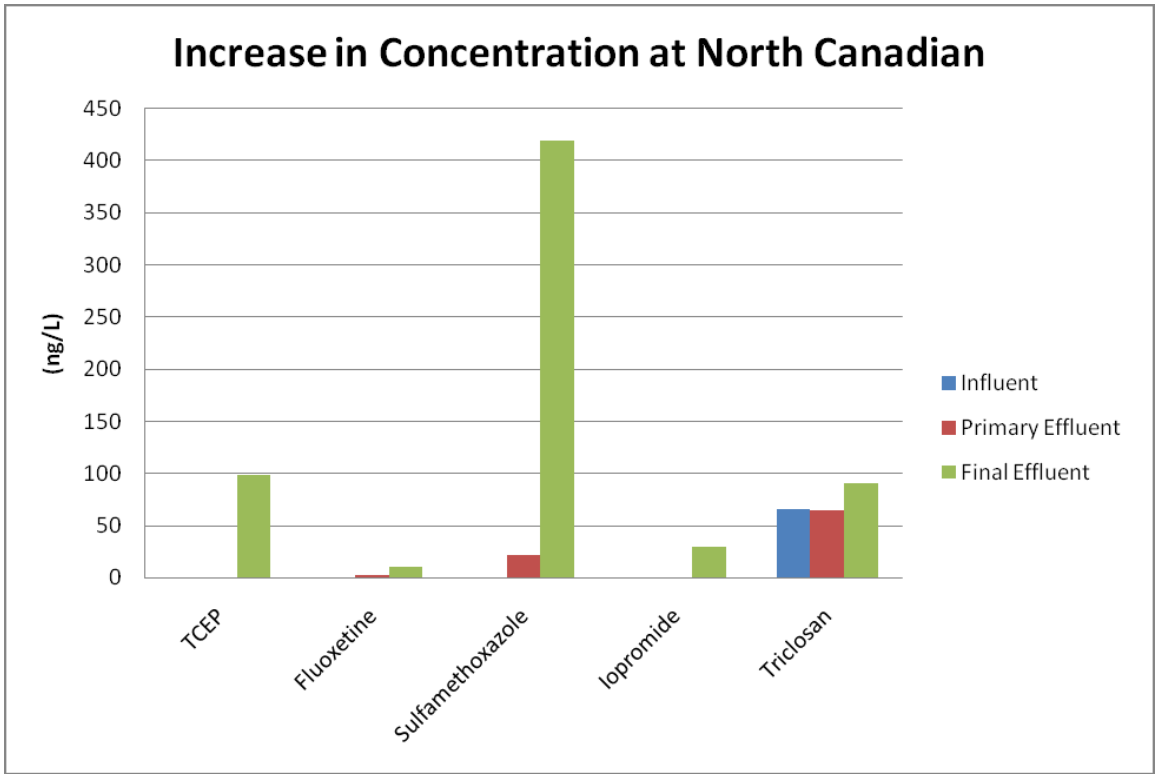


FIGURE 4 – 4: Compounds that Increased Through Treatment at North Canadian

Several compounds remained relatively consistent throughout the treatment process. The minor fluctuations of these compounds are shown in Figure 4-5. Carbamazepine and trimethoprim both had minor fluctuation in the North Canadian

WWTP and the Chisholm Creek WWTP. The minor fluctuations could be due to the fact that biological treatment had no effect on these compounds.

Less than 8% removal of carbamazepine has been detected at WWTPs studied by Heberer, 2002. This is consistent with the data shown in Figure 4-5. Carbamazepine was the most persistent pharmaceutical in the Radjenovic, 2007 study as it passed through both the MBR and CAS systems untransformed. The results of trimethoprim are consistent with the Gobel et al., 2005 and Halling-Sorensen et al., 2000 studies. These biodegradation studies performed with trimethoprim showed that degradation had not reached 50% at day 25.

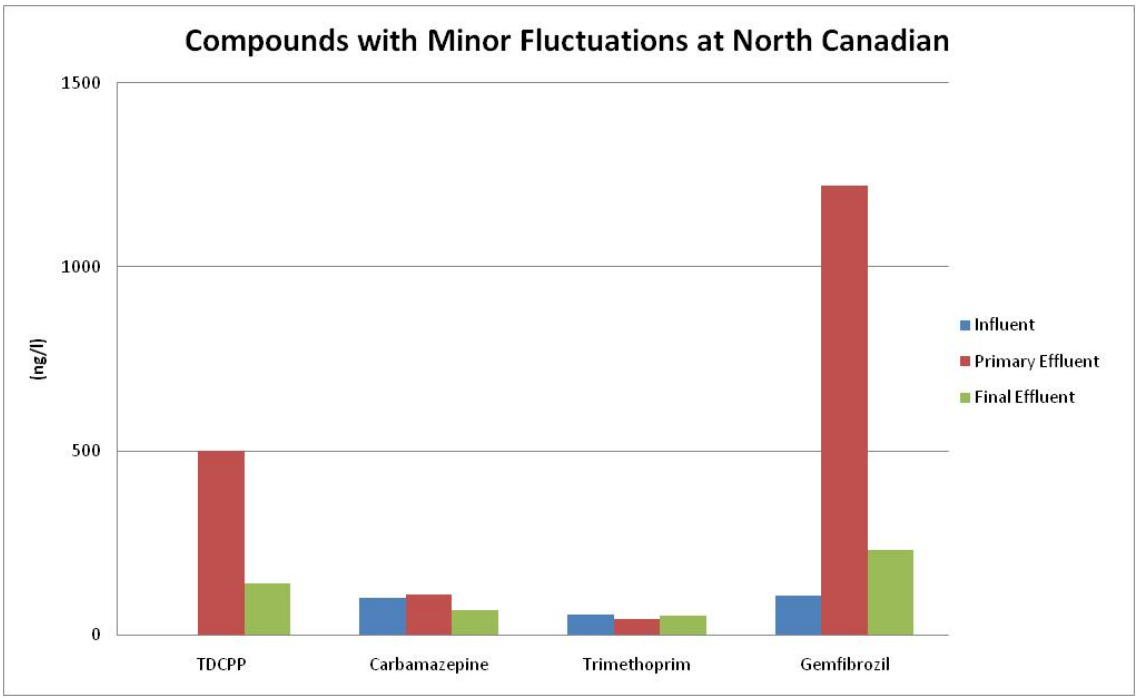


FIGURE 4 – 5: Compounds with Minor Fluctuations at North Canadian

The largest increase observed was estrone with an 11.4 % increase from the influent concentration. The highest concentrations of any compounds found at this plant were 4-Methylphenol and Caffeine (both approximately 25,000 ng/l). One of the key constituents detected in the Schussler and Nitschke, 1999, effluent study was caffeine at approximately 69,000 ng/l.

4.4 Deer Creek

The low and high concentrations of each compound detected at the Deer Creek WWTP are shown in Figure 4-6 and 4-7 respectively. The same seven compounds with highest concentrations at North Canadian effluent were also present at high concentrations in the Deer Creek effluent. Data for these compounds are shown in Table 4-7. The highest concentration detected at this plant was caffeine, at 96,800 ng/l in the primary effluent.

Final effluent concentrations at this facility were generally observed to be higher than at North Canadian or Chisholm Creek. This could be attributable to the fact that a large hospital is a main contributor to the Deer Creek Drainage Basin. Since the samples were taken in November, the Deer Creek WWTP was not running the effluent through the filters (not required by permit). Therefore, a difference may be noticed if sample were to continue in the spring and summer.

TABLE 4-7

HIGH CONCENTRATIONS AT DEER CREEK

Compound	***Influent (ng/l)***	***Primary Effluent (ng/l)***	***Final Effluent (ng/l)***
Acetaminophen	23,300	7,090	3,930
Caffeine	7,180	96,800	5,850
4-Methylphenol	19,000	76,800	9,910
Phenol	3,300	2,510	421
Caffeine by GCMS LLE	20,000	35,700	8,140
Tris (2-butoxyethyl) phosphate	3,100	9,840	2,440
Triclosan	3,400	2,460	1,170

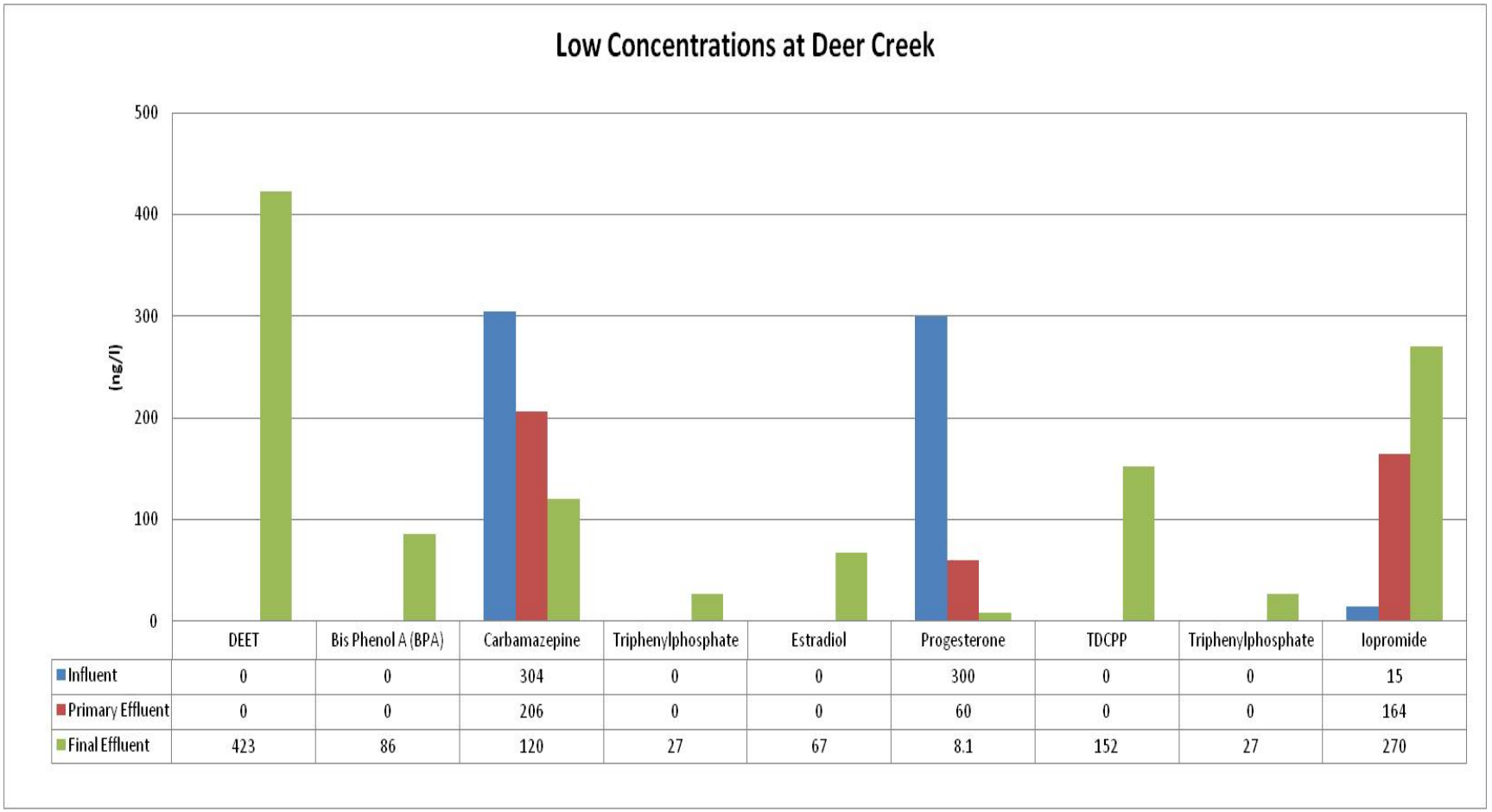
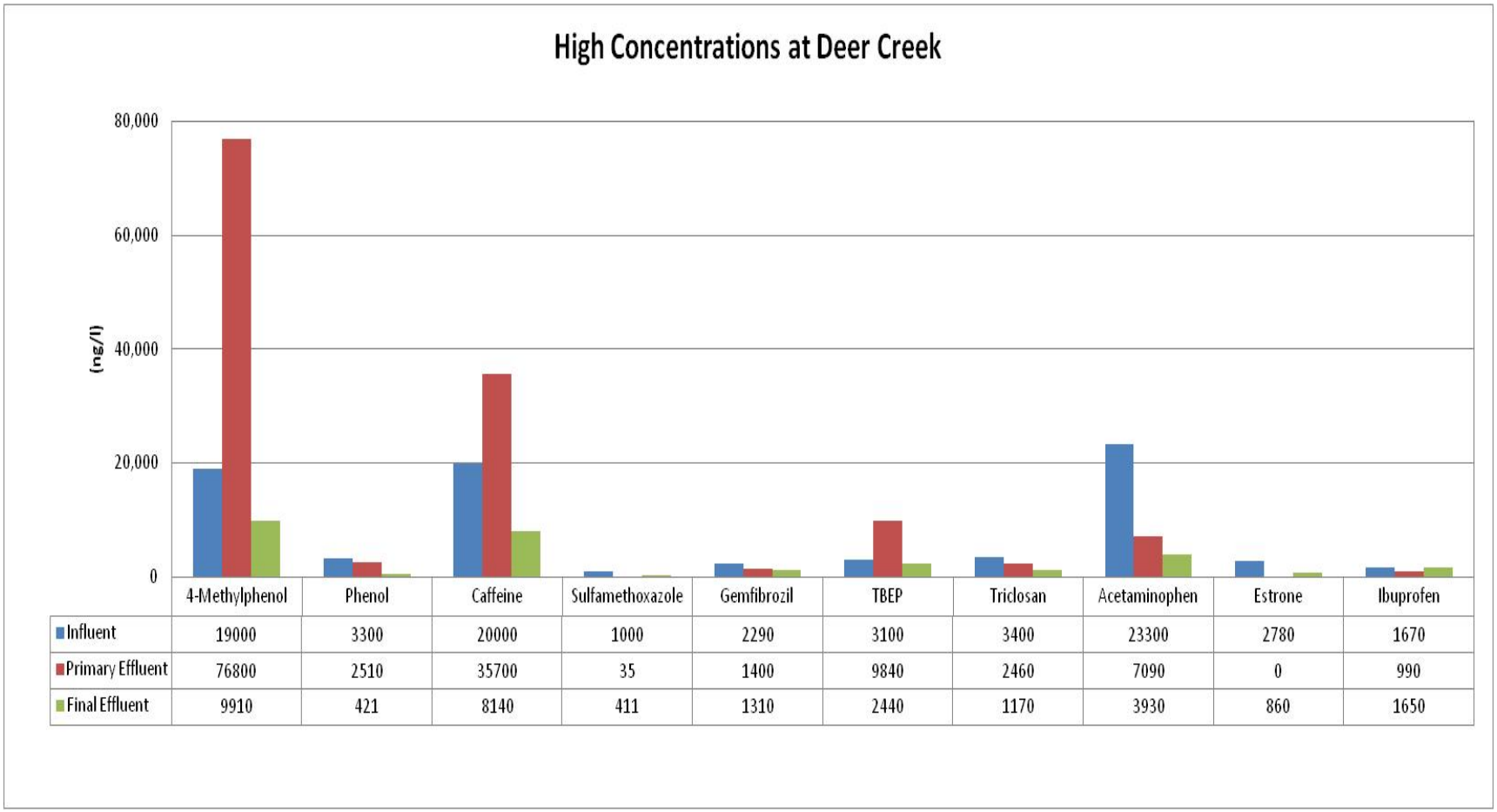


FIGURE 4 – 6: Low Concentrations at Deer Creek



	4-Methylphenol	Phenol	Caffeine	Sulfamethoxazole	Gemfibrozil	TBEP	Triclosan	Acetaminophen	Estrone	Ibuprofen
Influent	19000	3300	20000	1000	2290	3100	3400	23300	2780	1670
Primary Effluent	76800	2510	35700	35	1400	9840	2460	7090	0	990
Final Effluent	9910	421	8140	411	1310	2440	1170	3930	860	1650

FIGURE 4 – 7: High Concentrations at Deer Creek

As shown in Figure 4-6, progesterone is the only compound that was predominantly removed through the biological treatment at the Deer Creek WWTP with a concentration of 8.1 ng/l in the final effluent. The removal of progesterone is consistent with the Suidan et al., 2004, study.

Also in Figure 4-8 only one compound, ibuprofen, remained approximately at the same level. Whereas, at the North Canadian WWTP, ibuprofen was completely removed. Deer Creek WWTP has a longer sludge retention time than the North Canadian WWTP. This may account for the difference between the plants.

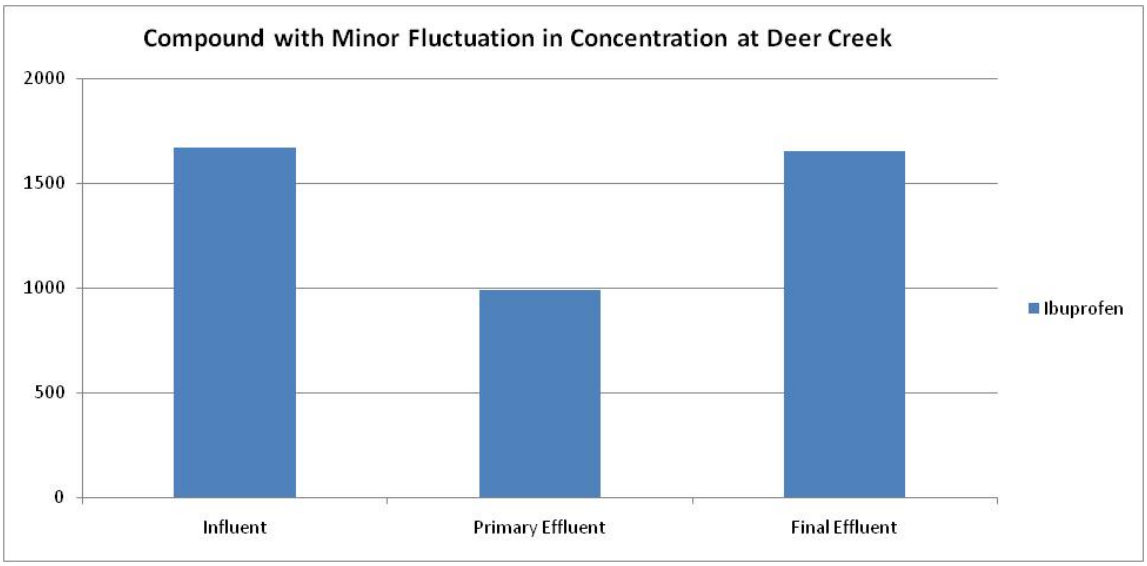


FIGURE 4–8: Compound with Minor Fluctuation in Concentration at Deer Creek

Seven compounds increased in concentration through the treatment process as demonstrated in Figure 4-9. Again, a possible reason for the increase could be due to the chemical makeup of these compounds. Iopromide and TDCPP are halogenated compounds. Triclosan is an antimicrobial and DEET is an insect repellant. Triclosan also increased through treatment at the North Canadian WWTP. However, DEET was

completely removed. A possible difference could be due to the time of day the samples were taken.

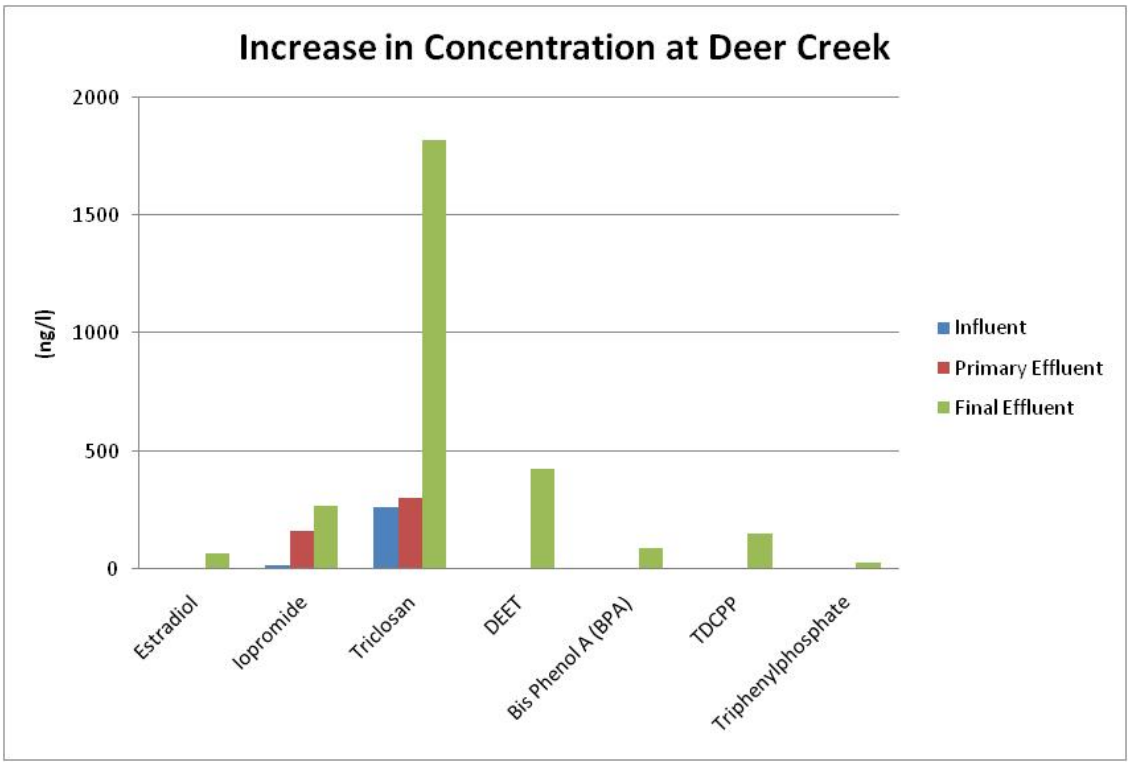


FIGURE 4 – 9: Increase in Concentration at Deer Creek

Caffeine had the largest concentration detected in the effluent at 96,800 ng/l. and had the largest increase between the influent flow and the primary effluent at 13.5 %. Fluoxetine, estradiol, ethinyl estradiol, and tris (2-chloroethyl) phosphate were not found at detectable levels at the Deer Creek WWTP, along with the compounds listed in Table 4-2.

The thirteen remaining compounds were reduced through the biological treatment unit process. The removal of these compounds is illustrated in Figure 4-10. Caffeine and 4-methylphenol shows the greatest amount removed through treatment. This is consistent

with the results from the North Canadian WWTP as well as other studies (Phillips et al., 2003; Boyd et al., 2003; Soliman et al., 2004; Miao et al., 2002, Thomas and Foster, 2004).

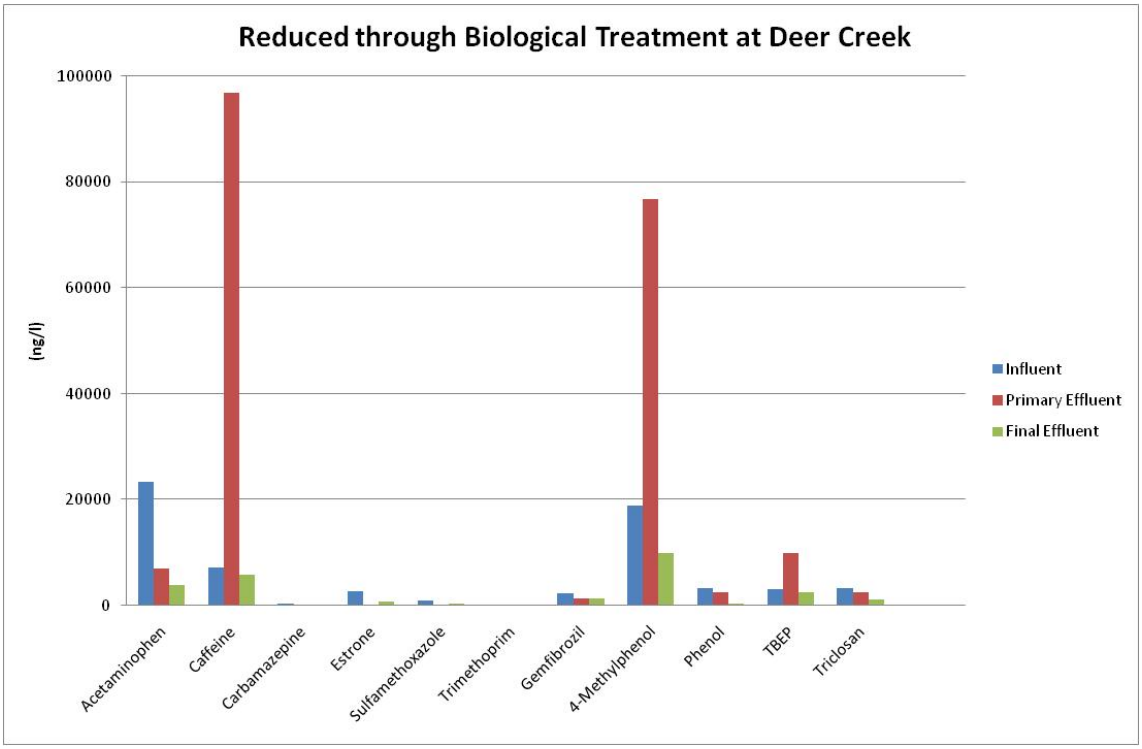


FIGURE 4 – 10: Reduced through Biological Treatment at Deer Creek

Singer et al. (2002) established that triclosan is mainly degraded by biological treatment which is consistent with the Deer Creek WWTP. A reduction was reported in the Hartig et al., 1999, for sulfamethoxazole from the primary effluent of a German WWTP of 2.4 ug/l to the secondary treated sewage of 1.5 ug/l which is consistent with this study.

Heberer, 2002 found carbamazepine to be resistant to biological treatment which is not consistent with this study. However, only a relatively small amount was found at

the Deer Creek WWTP in comparison to the North Canadian and Chisholm Creek WWTPs.

Figure 4-11 illustrates the concentration of constituents in the final plant effluent sample only. This graph demonstrates the magnitude of the concentrations ranging from 96,800 ppt down to less than 10 ppt. Figure 4-11 clearly shows that multiple EDC/PPCPs are present in final plant effluent.

Although there is no definite answer if any of the compounds in Figure 4-11 effect human health, it has been determined that hormones at very low levels adversely affect various aquatic life (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al., 2000).

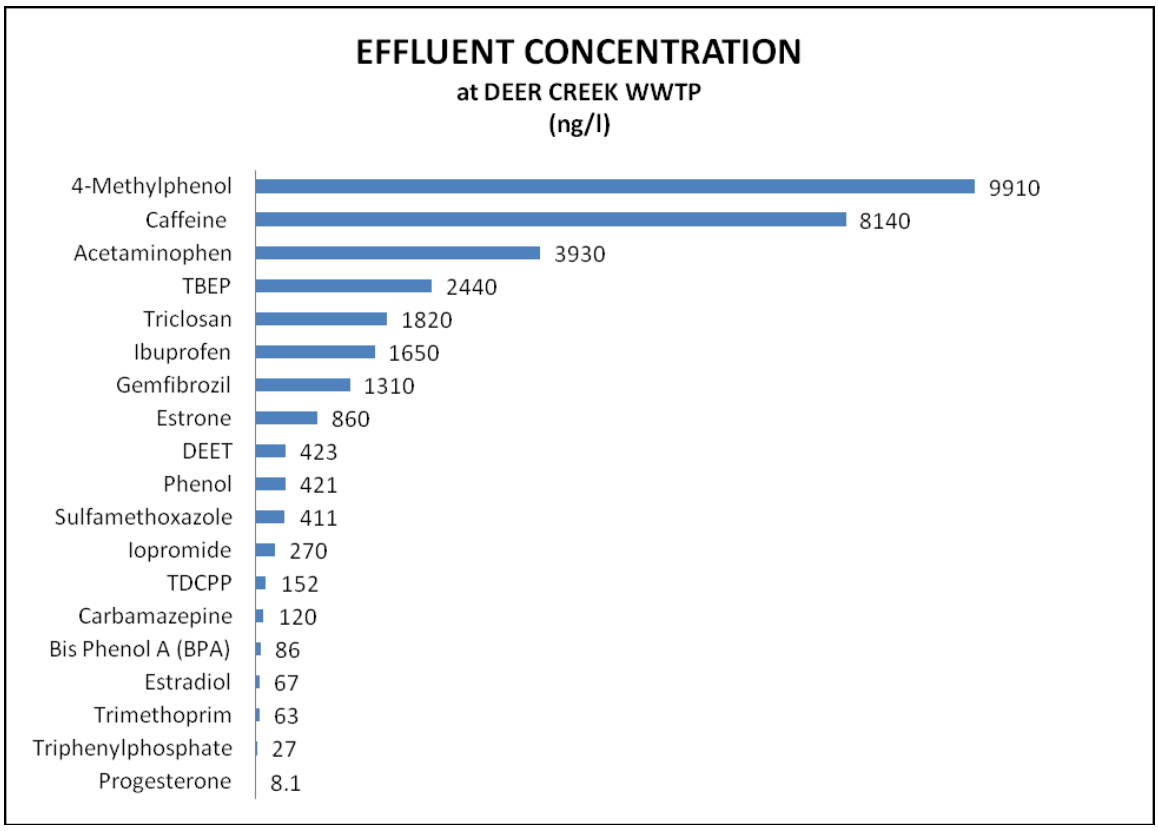


FIGURE 4 – 11: Effluent Concentration at Deer Creek

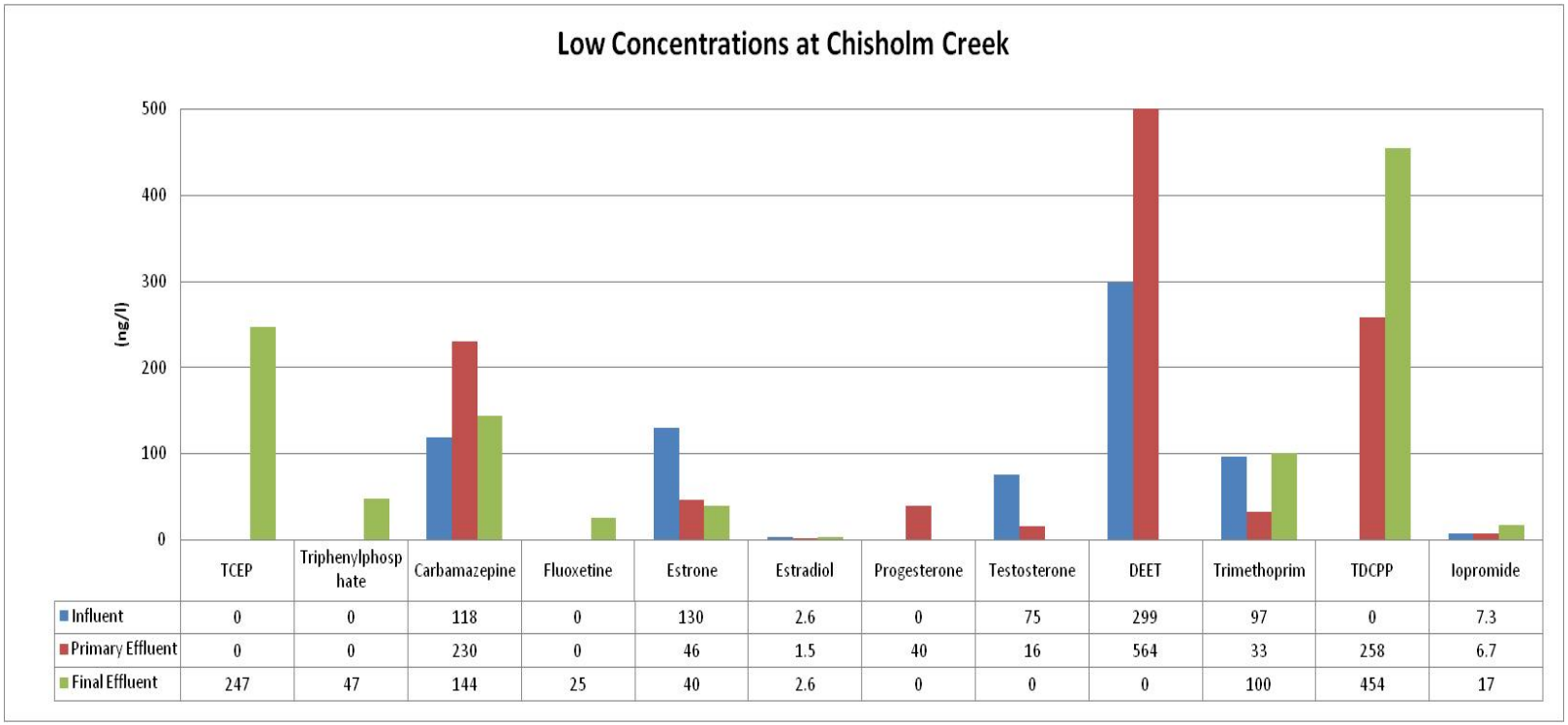
Table 4-8 lists the effluent concentration in parts per billion (ppb) by the application. Antibiotics detected include sulfamethoxazole, trimethoprim, and triclosan at 2.30 ppb. The psychoactive compounds detected were caffeine and carbamazepine at 8.25 ppb. Detected hormones include estrone, progesterone and estradiol at 0.86 ppb. The flame retardants detected were TBEP, triphenylphosphate and TDCPP at 2.62 ppb. The detected analgesics/heart medicines were acetaminophen, ibuprofen, and gemfibrozil at 6.89 ppb. Iopromide, the contrast media, was detected at 0.27 ppb. Phenolics detected were phenol and bis phenol A at 10.4 ppb. DEET, a pesticide, was detected at 0.42 ppb.

Phenolics had the highest concentration at 10.4 ppb. Contrast media had the lowest concentration at 0.27 ppb. Again, these numbers could change dramatically for pesticides and insecticides if testing is continued in the summer months when insecticides and pesticides are applied frequently. The high numbers per pound of psychoactive and contrast media is most likely due to the fact that the Deer Creek sewershed basin has a large hospital as a contributor.

TABLE 4-8 EFFLUENT CONCENTRATION BY APPLICATION AT DEER CREEK	
Application	***Final Effluent (ppb)***
Antibiotics	2.30
Psychoactive	8.25
Hormones	0.86
Flame Retardants	2.62
Analgesics/Heart Medicine	6.89
Contrast Media	0.27
Phenolics	10.4
Pesticides/Insecticides	0.42
TOTAL =	**21.5 ppb**

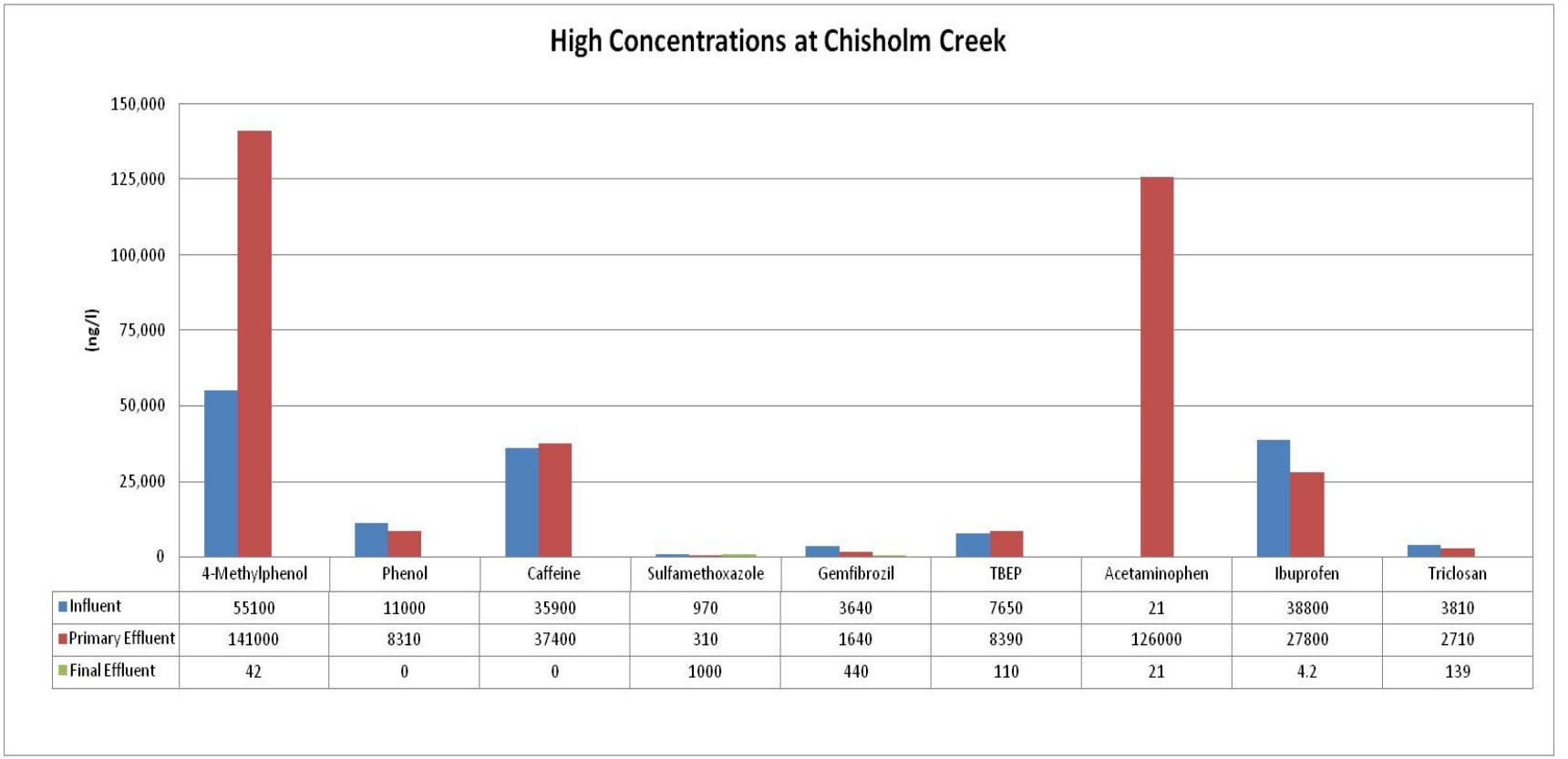
4.5 Chisholm Creek

The Chisholm Creek WWTP had the same seven EDC compounds with results greater than 3,000 ng/l in the influent as North Canadian WWTP and the Deer Creek WWTP. However, two additional compounds (Ibuprofen and Gemfibrozil) were found at these levels. The compound with the highest concentration detected at this plant was 4-Methylphenol at 141,000 ng/l in the primary effluent. The concentration of 4-Methylphenol in the Chisholm Creek sewershed basin should be investigated further. This basin is predominantly residential and concentrations are higher than the North Canadian sewershed basin which has most of Oklahoma City's industrial facilities. Figure 4-12 and Figure 4-13 show the low and high concentrations at Chisholm Creek respectively.



	TCEP	Triphenylphosphate	Carbamazepine	Fluoxetine	Estrone	Estradiol	Progesterone	Testosterone	DEET	Trimethoprim	TDCPP	Iopromide
Influent	0	0	118	0	130	2.6	0	75	299	97	0	7.3
Primary Effluent	0	0	230	0	46	1.5	40	16	564	33	258	6.7
Final Effluent	247	47	144	25	40	2.6	0	0	0	100	454	17

FIGURE 4 – 12: Low Concentrations at Chisholm Creek



	4-Methylphenol	Phenol	Caffeine	Sulfamethoxazole	Gemfibrozil	TBEP	Acetaminophen	Ibuprofen	Triclosan
Influent	55100	11000	35900	970	3640	7650	21	38800	3810
Primary Effluent	141000	8310	37400	310	1640	8390	126000	27800	2710
Final Effluent	42	0	0	1000	440	110	21	4.2	139

FIGURE 4 – 13: High Concentrations at Chisholm Creek

Ibuprofen, progesterone, testosterone, 4-methylphenol, phenol, DEET, tris (2-butoxyethyl) phosphate, and triclosan were predominantly removed by the biological treatment processes at the Chisholm Creek WWTP. Four EDC compounds (progesterone, testosterone, phenol, DEET) were completely removed by the wastewater treatment process at the Chisholm Creek WWTP. Progesterone, phenol, and DEET were removed from the North Canadian WWTP but none of the four were removed from the Deer Creek WWTP.

The largest increase between treatment processes was observed with the compound acetaminophen with a 60-fold (or 600 %) increase between the influent flow and the primary effluent. Ethinyl estradiol and Bisphenol A were not found in detectable levels at the Deer Creek WWTP along with the compounds listed in Table 4-2.

Four compounds remained at a constant concentration through all phases of treatment. These compounds were acetaminophen, carbamazepine, estradiol, and trimethoprim as shown in Figure 4-14.

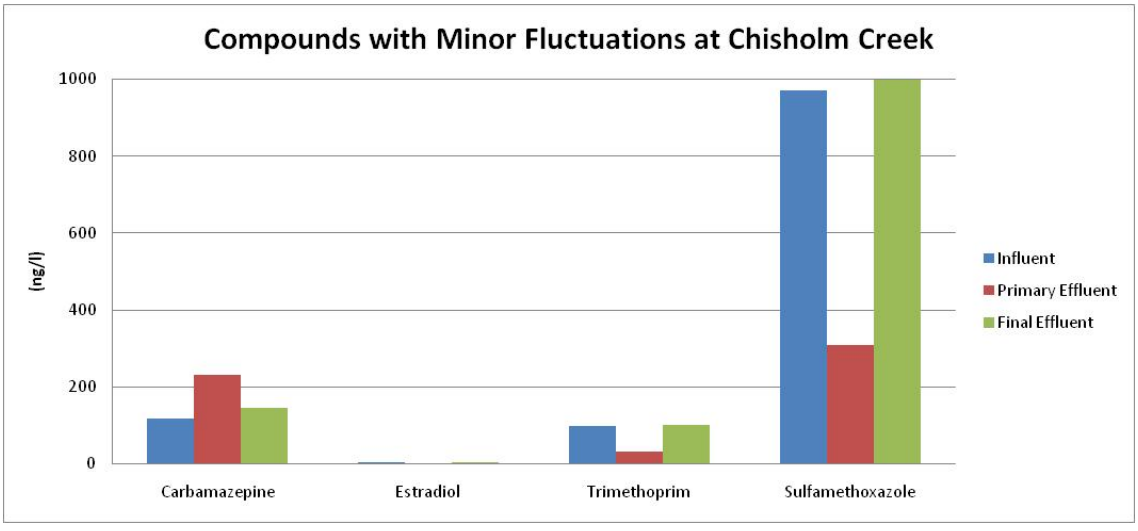


FIGURE 4 – 14: Compounds with Minor Fluctuations at Chisholm Creek

The five compounds shown in Figure 4-15 are the EDCs that increased as they progressed through the plant. Fluoxetine, iopromide, TDCPP, and TCEP are halogenated structures as shown in Chapter 2, Figure 2-1: Chemical Structures. As stated earlier, the stability of halogenated compounds is what makes them hard to degrade **(**Howard et al., 2007; Aarestrup, 2005; Jones and Mitchell, 1998). This may be one possible reason why we see an increase in the concentration of these chemicals due to the accumulation at each stage of treatment over time. Triphenylphosphate is a refractory compound and is not easily removed by biological degradation. This is another observation that should be explored further.

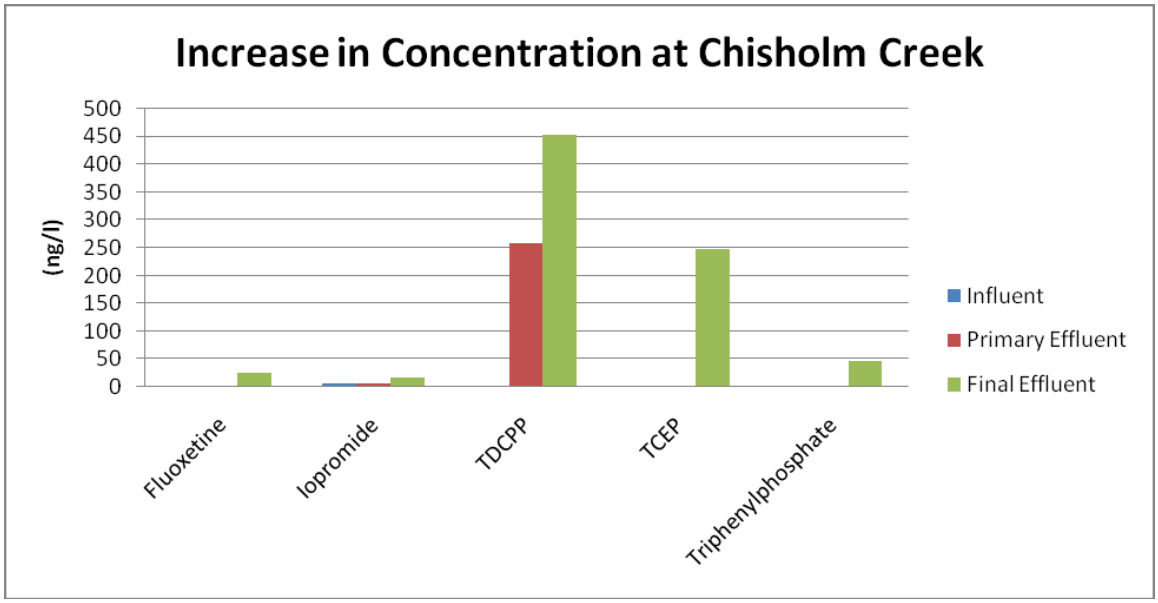


FIGURE 4 – 15: Increase in Concentration at Chisholm Creek

Estrone, gemfibrozil, triclosan and caffeine were reduced by the treatment plant processes as shown in Figure 4-16.

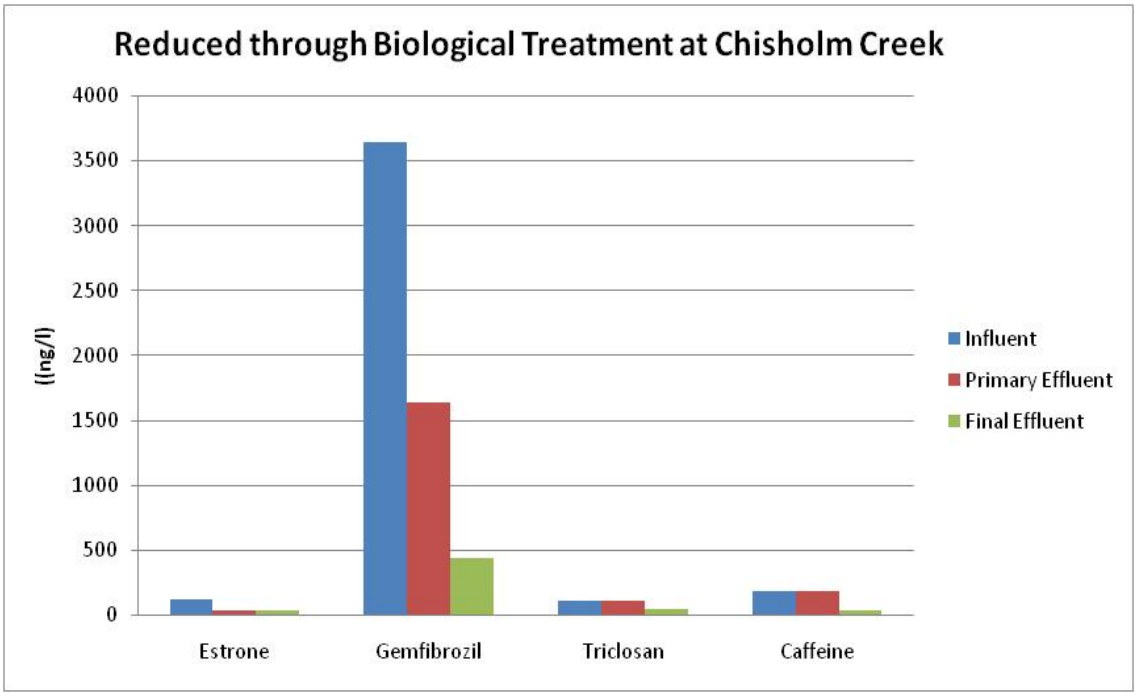


FIGURE 4 – 16: Reduced through Biological Treatment at Chisholm Creek

EDC/PPCP compounds were present at detectable levels in the final treated effluent from the Chisholm Creek WWTP. Figure 4-17 illustrates the concentration of constituents in the final plant effluent sample only. This graph demonstrates the magnitude of the concentrations of the compounds screened - ranging from 126,000 ppt down to less than 10 ppt.

It has been determined that hormones at very low levels adversely affect various aquatic life (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al. 2000) although there are no studies that say these compounds affect human health.

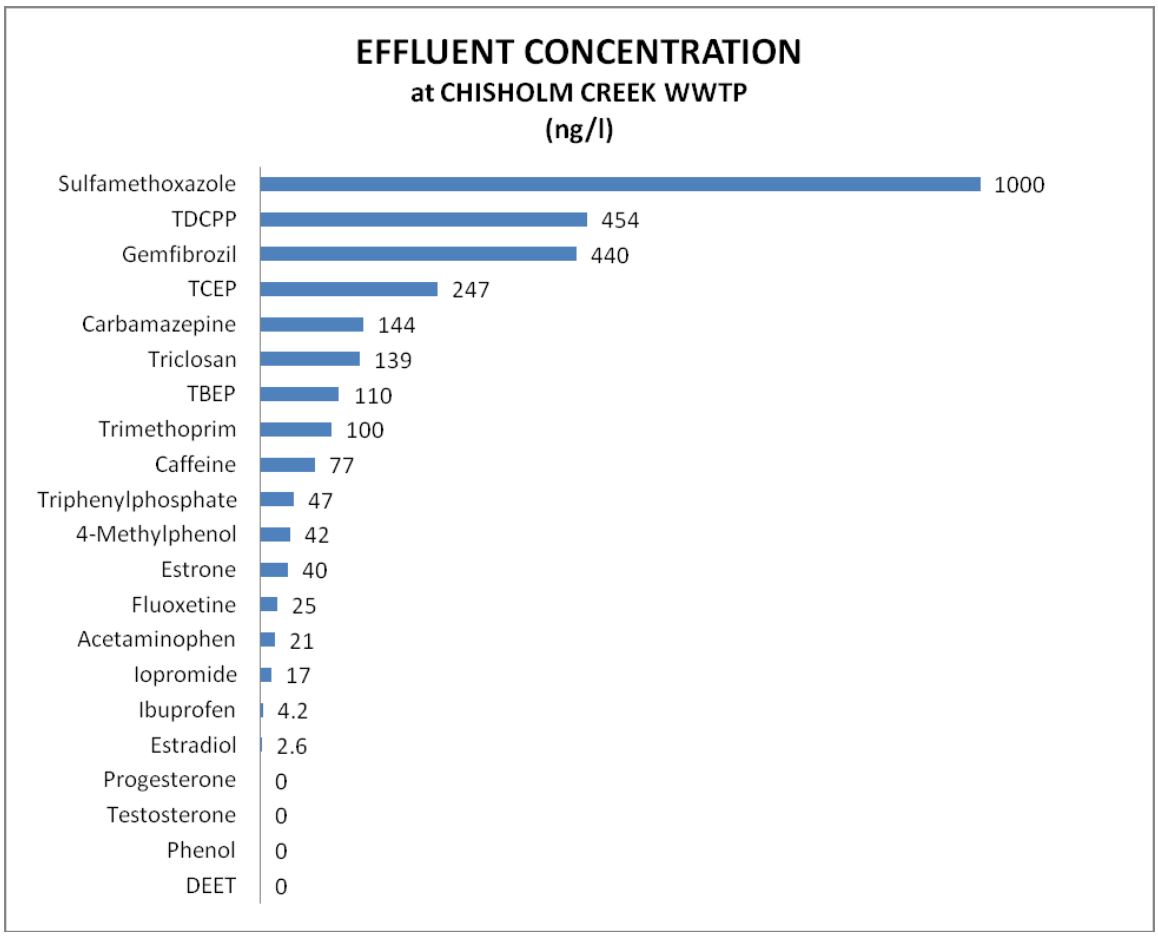


FIGURE 4 – 17: Effluent Concentration at Chisholm Creek

Table 4-9 lists the effluent concentration in parts per billion (ppb) by the application. Antibiotics detected include sulfamethoxazole, trimethoprim, and triclosan at 1.24 ppb. The psychoactive compounds detected were carbamazepine, caffeine and fluoxetine at 0.25 ppb. Detected hormones include estrone and estradiol at 0.04 ppb. The flame retardants detected were TCEP, TBEP and TDCPP at 0.80 ppb. Gemfibrozil ibuprofen and acetaminophen, analgesics/heart medicines, were detected at 0.47 ppb. Iopromide and 4-methylphenol were the only detected analgesics contrast media and phenolic at 0.02 and 0.04 respectively.

Antibiotics had the highest concentration at 1.24 ppb and pesticides were not detected at this plant. These numbers could change for pesticides and insecticides if testing is continued in the summer months when insecticides and pesticides are applied frequently.

TABLE 4-9

EFFLUENT CONCENTRATION BY APPLICATION AT CHISHOLM CREEK

Application	***Final Effluent (ppb)***
Antibiotics	1.24
Psychoactive	0.25
Hormones	0.04
Flame Retardants	0.80
Analgesics/Heart Medicine	0.47
Contrast Media	0.02
Phenolics	0.04
Pesticides/Insecticides	ND
TOTAL =	**2.86 ppb**

4.6 Discussion

Implications to human health from prolonged (i.e. over a lifetime) exposure via water comsuption, bathing or other activities to EDCs is still unknown. Whereas, studies have demonstrated that relevant levels of potent estrogens do induce biomarker changes in aquatic organisms (Ormerod et al. 2000, Hayes et al. 2003, Reeder et al, 2005, and Willingham et al. 2000). New research indicates that there are over 200 species with known or suspected adverse reactions to endocrine disruptors (McCann, 2004).

However, affects between aquatic life and human health is difficult to compare because aquatic life is exposed continuously through a lifetime.

Figure 4-18 shows the concentrations at each plant for each class of compounds. Deer Creek WWTP has considerably higher concentrations of all the classes compared to North Canadian and Chisholm Creek. One reason could be that the Deer Creek Basin is not very developed in relationship to its size, however, one of the largest hospitals discharges to this basin. Therefore, the population to commercial ratio is greater.

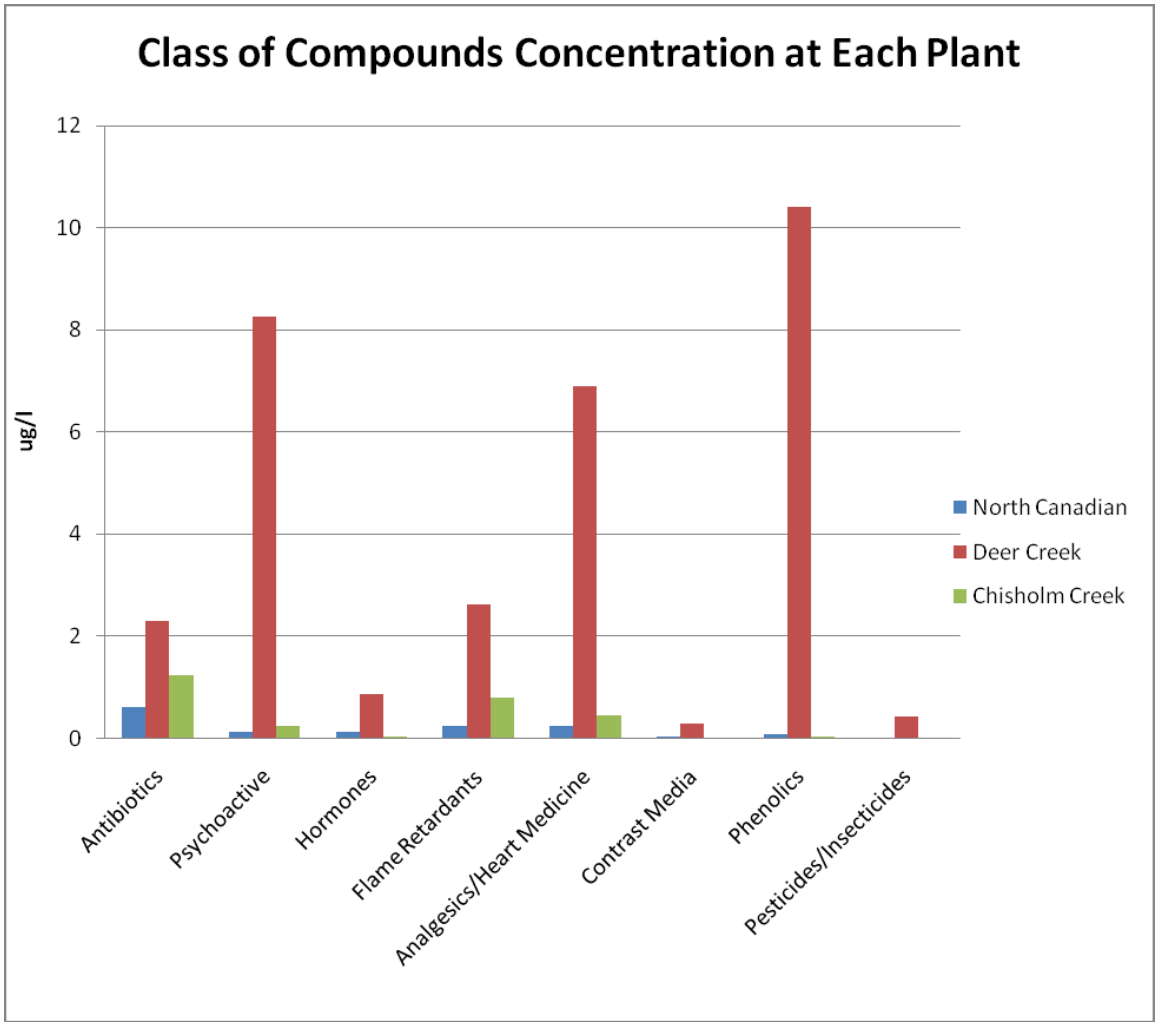


FIGURE 4 – 18: Class of Compound Concentration at Each Plant

Figure 4-19 shows the total concentration for each plant. Again, Deer Creek's total concentration effluent is seven times greater than the other two WWTPs. Additional sampling is needed to verify the difference in the concentrations remains constant year round.

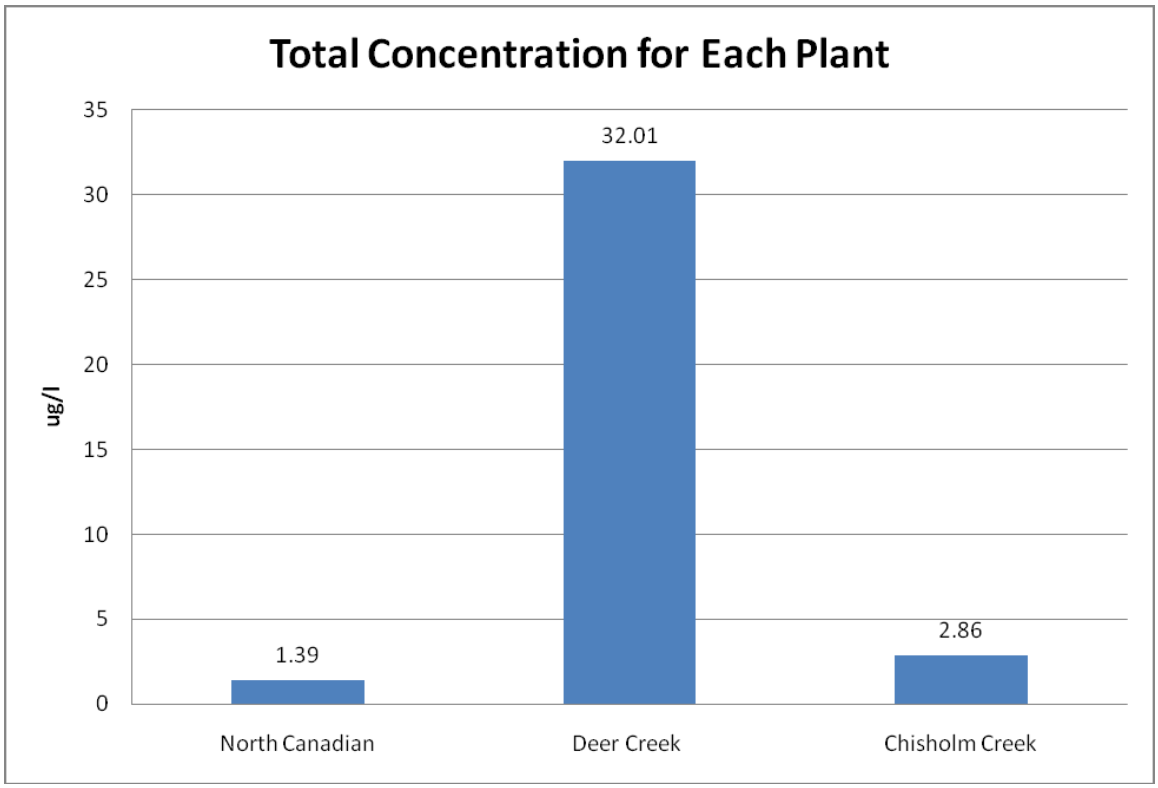


FIGURE 4 – 19: Total Concentration for Each Plant

Based on flows the day of the sampling events at Deer Creek, Chisholm Creek and North Canadian, 10.21 mgd, 4.49 mgd and 42.1 mgd respectively the mass loading was calculated and shown in Table 4-10. Deer Creek has approximately five times more pounds per day then the North Canadian WWTP. Again, the North Canadian basin contains the majority of industries for the City of Oklahoma City. Therefore, the loadings in the Deer Creek plant are not consistant with what you would be expected.

TABLE 4-10 MASS LOADING	
Plant	***Mass Loading (lbs/day)***
Deer Creek	2.73
Chisholm Creek	0.11
North Canadian	0.49

Tanka et al., 2003b, discovered twenty five percent (25%) of male carp in Japan were found to have been feminized and seventeen percent (17%) had adnormal testes when exposed to estrogenic compounds at levels around 0.1 µg/l. North Canadian and Deer Creek both have concentrations above 0.1 ug/l of estrogenic compounds.

Anitbiotics concentrations have been previously reported ranging from 0.01 to 1.5 µg/l (Hirsch et al., 1999; Andreozzi et al., 2003; Metcalf et al., 2003). Deer Creek WWTP effluent detected higher concentrations than the studies previously mentioned. Both the Chisholm Creek WWTP and the North Canadian WWTP were within this range.

Antipsychotic compounds carbamazepine and fluoxetine have been detected between 0.08 and 10 µg/l (Brun et al., 2006; Tixier et al., 2003; Reemtsma et al., 2006). All three Oklahoma City WWTPs are with this range of the concentrations detected by previous researchers.

The only pesticide, DEET, was detected at the Deer Creek WWTP during this single sampling event during November and December. Occurrence of these compounds

is more likely to be found during months when residential and agricultural users are applying pesticides and fertilizers. Concentrations at all three plants are lower than seen in other studies (Snyder et al., 2003; Oppenheimer, et al., 2004). However, Hayes et al., 2002, found hermaphroditism in African clawed frogs at concentrations of 0.1 µg/l.

However, DEET found during this sampling event is unusual since the compound is mainly used for insect repellant. A possible explanation of this occurrence may be due to the fact that a large portion of the Deer Creek basin is agricultural and that the weather was still fairly warm in the November sampling event.

Ternes and Hirsch, 2000, published X-ray observed no degradation of iopromide contrast media through biological treatment with a median concentration of 0.75 µg/l. Again, all the Oklahoma City WWTPs tested were below this concentration level. However, the detection of iopromide in the Chisholm Creek basin was not expected because there are no major hospitals within this basin. Possible reasons could be that after procedures are completed patients return to their residence and continue to excrete this compound into the wastewater stream.

Caffeine and 4-Methlyphenol were the two compounds detected at all three wastewater treatment plants with the highest influent concentrations. Table 4-11 shows influent concentrations, final effluent concentrations and percent removal for each plant. Both the Chisholm Creek WWTP and the North Canadian WWTP detection limits are comparable to other studies such as Thomas and Foster, 2005, Miao et al., 2005, and Ghasempur et al., 2007).

TABLE 4-11

PERCENT REMOVAL FOR EACH PLANT

Compound	*Influent (ng/l)*	*Primary Effluent (ng/l)*	*Percent Removal (%)*
Deer Creek			
Caffeine	20,000	8,140	59.3%
4-Methylphenol	19,000	9,910	47.8%
Chisholm Creek			
Caffeine	35,900	0	100%
4-Methylphenol	55,100	42	99.9%
North Canadian			
Caffeine	11,000	0	100%
4-Methylphenol	17,000	67	99.6%

Table 4-12 lists associated studies and the range of concentrations found at other wastewater treatment plants. All of these were used in comparison for this Oklahoma City study. Most class of compounds found at the City of Oklahoma City were within the range of concentrations listed in other studies.

TABLE 4 - 12

Comparison Study

Group	Range of Concentration	Associated Study	Treatment
Antibiotics	0.01 - 1.5 ug/l	Hirsch et al., 1999;	Biological Treatment
		Andreozzi et al., 2003	Biological Treatment
		Metcalf et al., 2003	Biological Treatment
	8-17 ng/l	Gobel, et al., 2004	Biological Treatment
	4 - 9 ng/l	Gobel, et al., 2004	Biological Treatment
	ND - 1.7 ug/l	Gross et al, 2007	Biological Treatment
	0.03 - 0.25 ug/l	Waltman et al., 2006	Biological Treatment
	0.24 - 2.7 ug/l	Reiss, et al., 2002	Biological Treatment
	0.01 - 0.324 ug/l	Lishman, et al., 2006	Biological Treatment
	0.3 - 2 ug/l	Scruggs et al., 2004	Biological Treatment
	0.08 - 0.53 ug/l	Batt et al., 2006	Activated Sludge
Psychoactive	0.08 - 10 ug/l	Brun et al., 2006	Biological Treatment
	0.01 - 0.95 ug/l	Tixier et al., 2003	Biological Treatment
	0.06 - 7.2 ug/l	Phillips et al., 2005	Biological Treatment
	0.03 - 9.5 ug/l	Burege, et al., 2003	Biological Treatment
	0.25 ug/l	Miao et al.; 2005	Biological Treatment
	ND - 0.97 ug/l	Han et al., 2006	Biological Treatment
	2.3 - 8.1 ug/l	Verenitch et al., 2006	Biological Treatment
	0.5 - 8 ug/l	Scruggs et al., 2004	Biological Treatment
	1 - 10 ug/l	Reemtsma et al., 2006	Biological Treatment
	ND - 5 ug/l	Oppenheimer, et al., 2004	MBR
	ND - 0.04 ug/l	Suidan et al., 2004	Biological Treatment
	ND - 0.04 ug/l	Lishman, et al., 2006	Biological Treatment
	0.2 - 7.0 ng/l	Desbrow et al., 1998	Biological Treatment
	1.8 - 17 ng/l	Servos et al., 2005	Biological Treatment
	ND - 0.24 ug/l	Brun et al., 2006	Biological Treatment
	ND - 2.9 ng/l	Spring et al., 2007	Biological Treatment
	ND - 1.6 ng/l	Spring et al., 2007	MBR
Flame Retardants	0.29 - 30 ug/l	Marklund et al., 2005	Biological Treatment
	ND - 17 ug/l	Phillips et al., 2005	Biological Treatment
	0.1 - 1 ug/l	Reemtsma et al., 2006	Biological Treatment
Analgesics/ Heart Medicine	ND - 40 ng/l	Gross et al, 2007	Biological Treatment
	0.4 - 0.8 ug/l	Lishman, et al., 2006	Biological Treatment
	ND - 0.31 ug/l	Han et al., 2006	Biological Treatment
	12 ug/l	Scruggs et al., 2004	Biological Treatment
	0.01 - 2.6 ug/l	Tixier et al., 2003	Biological Treatment
	0.04 - 22 ug/l	Brun et al., 2006	Biological Treatment
Contrast Media	0.75 - XX ug/l	Ternes and Hirsch, 2000	Biological Treatment
	0.10 - 0.27 ug/l	Batt et al., 2006	Activated Sludge
Phenolics	3.5 - 15.8 ng/l	Spring et al., 2007	Biological Treatment
	2.5 - 12.6 ng/l	Spring et al., 2007	MBR
Pesticides/Insecticides	0.1 ug/l	Snyder et al., 2003	Biological Treatment
	ND - 1.5 ug/l	Phillips et al., 2005	Biological Treatment
	5 - 45 ug/l	Oppenheimer, et al., 2004	MBR
	ND - 1 ug/l	Scruggs et al., 2004	Biological Treatment

CHAPTER V

CONCLUSIONS AND RECOMENDATIONS

5.0 Conclusions

North Canadian WWTP

Figure 4-1 and Figure 4-2 show the concentrations of detected constituents at the North Canadian WWTP. Data is presented in the form of a bar graph with each constituent grouped to illustrate influent, primary effluent, and final plant effluent concentrations, respectively. Phenol, caffeine, and 4-methylphenol were all detected in the influent at greater than 10,000 ppt. Triclosan and TBEP were both present in the influent at or very near 5000 ppt.

Figure 4-3 illustrates the concentration of constituents in the final plant effluent sample only. This graph is somewhat easier to interpret since the magnitudes of the concentrations are much more comparable than the data in Figure 1, which range from 25,000 ppt down to less than 10 ppt.

Deer Creek WWTP

Plant profile data for selected constituents detected in the process streams at the Deer Creek WWTP are presented in Figure 4-6 and Figure 4-7. Acetaminophen (23300 ppt) and caffeine (7180 ppt) were both detected at levels exceeding 5000 ppt in the plant influent. Estrone (2780 ppt), gemfibrozil (2290 ppt), ibuprofen (1670 ppt), and sulfamethoxazole (1000 ppt) were all detected at levels above 1000 ppt in the plant influent.

Figure 4-11 illustrates the plant effluent concentrations for any constituent detected at some point in the WWTP. Several notable findings (summarized in Table 1) include 4-Methylphenol (9910 ppt), acetaminophen (5858 ppt), TCEP (2440 ppt), triclosan (1820 ppt), gemfibrozil (1310 ppt), estrone (860 ppt), sulfamethoxazole (411 ppt), iopromide (270 ppt), carbamazepine (120 ppt).

Chisholm Creek WWTP

Figure 4-12 and Figure 4-13 presents selected constituent concentrations detected at influent, primary effluent, and final plant effluent locations. As in North Canadian and Deer Creek, a few constituents (i.e. 4-methylphenol and caffeine) were detected at concentrations that were orders of magnitude higher than others. Data is presented in this format to illustrate the disparity in detected concentrations and to display removal (in the cases that removal actually occurred). 4-Methylphenol (55100 ppt), Caffeine (35900

ppt), and phenol (11000 ppt) were all detected at concentrations exceeding 10,000 ppt. Triclosan and TBEP were detected in the 3500-10,000 ppt range.

Figure 4-17 illustrates the final effluent concentrations of constituents that were detected at some point in the treatment process at Chisholm Creek WWTP. Sulfamethoxazole (1000 ppt), TDCPP (454 ppt), gemfibrozil (440 ppt), TCEP (247 ppt), carbamazepine (144 ppt), and trimethoprim (100 ppt) are a few of the more notable findings in the plant effluent.

Conclusion

Although only a snapshot of possible EDCs were tested for at the Oklahoma City WWTPs, three facts are known. First, endocrine disrupting compounds were detected at all three Oklahoma City WWTPs. Second, concentrations of hormones and pesticides were found at levels known to affect aquatic life. Third, the majority of effluent EDCs detected at the plants are consistent with other WWTPs throughout the world.

5.1 Recommendations

The data presented in this report represent a single sampling event, or snapshot, of WWTP water quality. The findings are from a single point in time and do not include influence from factors such as seasonal variation of flow in to the WWTP, changes in treatment (i.e. chlorination/de-chlorination), and application of pesticides, fertilizers, etc. by both residential and agricultural users. Concentrations in the plant effluent imply the

need for further work to more fully characterize seasonal variability. Few conclusions can be reliably formed other than some chemicals do appear to pass-through the treatment process at some level, and that more work needs to be performed to gain a better understanding of the potential impacts to Oklahoma City source waters and natural waters of the state.

Although the City's WWTPs do not discharge to any of the City's drinking water sources, additional work should be conducted to determine potential impact from upstream activities on the North Canadian River. This includes sampling Lake Hefner, Lake Overholser, and Lake Stanley Draper in addition to profiling water quality up the North Canadian River. This would include monitoring to Lake Canton and beyond to determine impact from agricultural operations and Concentrated Animal Feeding Operations (CAFOs). Also of interest is the water quality from Lake Atoka and McGee Creek reservoir, since these sources are used to keep Draper at acceptable levels.

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APPENDIX A

MWH Laboratories
750 Royal Oaks Drive, Monrovia, CA 91016
PHONE: 626-386-1100/FAX: 626-386-1101

ACKNOWLEDGMENT OF SAMPLES RECEIVED

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City, OK 73120
Attn: Todd Brewer
Phone: (405) 749-3070

Customer Code: OKCITY-LHEF
PO#: CHISHOLM CREEK
Group#: 224318
Project#: EDC
Proj Mgr: Allen Glover
Phone: (916) 374-8030

The following samples were received from you on **12/06/07**. They have been scheduled for the tests listed beside each sample. If this information is incorrect, please contact your service representative. Thank you for using MWH Laboratories.

Sample#	Sample Id	Matrix	Sample Date
	Tests Scheduled		
2712060444	CHISHOLM CREEK PRIMARY	Water	04-dec-2007 09:45:00
	@EDC4SCR		
2712060445	CHISHOLM CREEK SECONDARY	Water	04-dec-2007 10:00:00
	@EDC2SCR @EDC4SCR		

Test Acronym Description

Test Acronym	Description
@EDC2SCR	EDC screen by LC-MS-MS
@EDC4SCR	EDC-Phenols-waste indic screen

MWH Laboratories
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Monrovia, California 91016-3629
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Fax: 626 386 1101
1 800 566 LABS (1 800 566 5227)

Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

DATE OF ISSUE
FEB 07 2008
MWH LABORATORIES

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 224318
Project: EDC
PO#: CHISHOLM CRE

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Comments,QC Report,QC Summary,Data Report,Hits Report, totaling 12 page[s].

MWH Laboratories

MONTGOMERY WATSON HARZA

750 Royal Oaks, Suite 100
Monrovia, California 91016
Phone: (626) 386-1100
(800) 566-5227
Fax: (626) 386-1101

CHAIN OF CUSTODY RECORD

224318

MWH LABS USE ONLY:

LOGIN COMMENTS:

SAMPLES CHECKED AGAINST COC BY:

SAMPLES LOGGED IN BY: MLD

SAMPLE TEMP WHEN REC'D AT LAB: 4°C (Compliance: 6°C or Below)

SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

CONDITION OF BLUE ICE: FROZEN ☒ PARTIALLY FROZEN ☐ THAWED

TO BE COMPLETED BY SAMPLER:

COMPANY, UTILITY or PROJECT: Lake Hefner WTP

SYSTEM #: N/A

COMPLIANCE SAMPLES (check for yes) ☐
- Requires state forms

NON-COMPLIANCE SAMPLES (check for yes) ☒

REGULATION INVOLVED:

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

MWH LABS CLIENT CODE: OKCITY-LHEF

P.O.# / JOB # / PROJECT: Chisholm Creek

SEE ATTACHED BOTTLE ORDER FOR ANALYSES ☐ (check for yes), OR

LIST ANALYSES REQUIRED BELOW (enter number of bottles sent for each test for each sample):

SAMPLER PRINTED NAME AND SIGNATURE: Morris Williams Morris Williams

TAT requested: rush by adv notice only
STD ___ 1 week ___ 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	STATION # or LOCATION	SITE NAME OR SAMPLE I.D.	MATRIX *	GRAB	COMP	EDC2	EDC4	SAMPLER COMMENTS
12/4/07	945	Chisholm Creek	Primary	WW	X			3	
12/4/07	1000	Chisholm Creek	Secondary	WW	X		3	3	

SCANNED

Date 12/05/07 FedEx Tracking Number 863402789910

Sender's name TODD BREWER Phone 405 297-2622

Company OKC CITY WATER UTILITY TRUST

Address 420 W MAIN ST STE 900

City OKLAHOMA CITY State OK ZIP 73102

our Internal Billing Reference

* MATRIX TYPES: RSW = Raw Surface Water; RGW = Raw Ground Water; CFW = Chlor(am)inated Finished Water; FW = Other Finished Water; CWW = Chlorinated Waste Water; WW = Other Waste Water; BW = Bottled Water; SW = Storm Water; SO = Soil; SL = Sludge

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	Lucas Berry	Lucas Berry	City of OKC Lab Tech	12/4/07	1100
RECEIVED BY:	Fed Ex				
RELINQUISHED BY:					
RECEIVED BY:					
RELINQUISHED BY:					
RECEIVED BY:					

Page 1

C-O-C# _____

PAGE ____ OF ____

MWH Laboratories, a Division of MWH Americas, Inc.
750 Royal Oaks Drive Suite 100
Monrovia CA 91016 (626) 386-1100 FAX (626) 386-1124

Bottle Order for Oklahoma City - EDC Testing

Group #
Date Sampled
Date Received

Allen Glover — Your MWL Project Manager
(915) 374-8030 — Direct Phone/Voice Mail

Client Code OKCITY-LHEF
Project Code EDC
PO# / Job# PG W0360003962

ProjectName

BO# 43667

Sampler: please return this paper with your samples

Created by MAG

Order Date 11/13/07

Date Needed by Client **11/16/07**

Date Samples to Arrive at MWL

Ship Sample Kits to
Lake Hefner WTP
3827 West Hefner Road
Oklahoma City, OK 73120

ATTN: Todd Brewer
PHONE: (405) 749-3070

Send Report to
Lake Hefner WTP
3827 West Hefner Road
Oklahoma City, OK 73120

ATTN: Todd Brewer
PHONE: (405) 749-3070
FAX: (405) 749-3099

Billing Address
City of Oklahoma City
Procurement Services
100 N. Walker, Suite 201
Oklahoma City, OK 73102

# of Samples	Tests	Qteline#	Bottles-Qty for each sample, type & preservative if any	UN DOT #	Comments
3	@EDC2SCR		3: 2 x 1L silanized amb gls + 0.5g ascorbic + 0.5g CuSO4*5H2O xls + 1x 1L		
3	@EDC4SCR		3: 2 x 1L silanized amb gls + 0.5g ascorbic + 0.5g CuSO4*5H2O xls + 1x 1L		

Code | Status | Date Shipped | Via | Tracking # | # of Coolers | Prepared By

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ACKNOWLEDGMENT OF SAMPLES RECEIVED

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City, OK 73120
Attn: Todd Brewer
Phone: (405) 749-3070

Customer Code: OKCITY-LHEP
PO#: CHISHOLM CREEK
Group#: 224318
Project#: EDC
Proj Mgr: Allen Glover
Phone: (916) 374-8030

The following samples were received from you on **12/06/07.** They have been scheduled for the tests listed beside each sample. If this information is incorrect, please contact your service representative. Thank you for using MWH Laboratories.

Sample#	Sample Id	Matrix	Sample Date
	Tests Scheduled		
2712060444	CHISHOLM CREEK PRIMARY	Water	04-dec-2007 09:45:00
	@EDC4SCR		
2712060445	CHISHOLM CREEK SECONDARY	Water	04-dec-2007 10:00:00
	@EDC2SCR @EDC4SCR		

Test Acronym Description

Test Acronym	Description
@EDC2SCR	EDC screen by LC-MS-MS
@EDC4SCR	EDC-Phenols-waste indic screen

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Report
Comments
#224318

Group Comments

Surrogate recovery was above laboratory and method acceptance limits for Caffeine.

(QC Ref#: 2712060444)
Test: EDC-Phenols-waste indic screen (USGS4MOD)

S7 - Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.

(QC Ref#: 2712060445)
Test: EDC-Phenols-waste indic screen (USGS4MOD)

S7 - Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.

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Laboratory
Hits Report
#224318

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:08:42

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060444	**CHISHOLM CREEK PRIMARY**				
12/11/07	4-Methylphenol		141000		ng/l	7500
12/11/07	Caffeine by GCMS LLE		37400		ng/l	2500
12/11/07	DEET		564		ng/l	250
12/11/07	Phenol		8310		ng/l	2000
12/11/07	TDCPP		258		ng/l	250
12/11/07	Triclosan		2710		ng/l	500
12/11/07	Tris (2-butoxyethyl) phosphate		8390		ng/l	2000
	2712060445	**CHISHOLM CREEK SECONDARY**				
12/16/07	Acetaminophen		21		ng/l	1.0
12/16/07	Caffeine		77		ng/l	1.0
12/16/07	Carbamazepine		144		ng/l	5.0
12/16/07	Esterone		40		ng/l	1.0
12/16/07	Estradiol		2.6		ng/l	1.0
12/16/07	Fluoxetine		25		ng/l	1.0
12/16/07	Gemfibrozil		440		ng/l	1.0
12/16/07	Ibuprofen		4.2		ng/l	1.0
12/16/07	Iopromide		17		ng/l	5.0
12/16/07	Sulfamethoxazole		1000		ng/l	1.0
12/16/07	Triclosan		52		ng/l	5.0
12/16/07	Trimethoprim		100		ng/l	1.0
12/11/07	4-Methylphenol		42		ng/l	25
12/11/07	TDCPP		454		ng/l	25
12/11/07	Triclosan		139		ng/l	50
12/11/07	Triphenylphosphate		47		ng/l	25
12/11/07	Tris (2-butoxyethyl) phosphate		110		ng/l	100
12/11/07	Tris (2-chloroethyl) phosphate		247		ng/l	25

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Hits Report
#224318

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:08:42

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060445	CHISHOLM CREEK SECONDARY				

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#224318

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

12/06/07

Prepared	Analyzed	QC Batch	Method	Analyte	Result	Units	MRL	Dilution
CHISHOLM CREEK PRIMARY (2712060444) Sampled on 12/04/07 09:45								
				EDC-Phenols-waste indic screen				
12/07/07	12/11/07 00:00	402231	USGS4MOD	2,6-di-tert-butylphenol	ND(S7)	ng/l	100	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	4-Methylphenol	141000(S7)	ng/l	7500	300
12/07/07	12/11/07 00:00	402231	USGS4MOD	4-Nonyl Phenol	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Alpha Chlordane	ND(S7)	ng/l	100	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Bis Phenol A (BPA)	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Caffeine by GCMS LLB	37460(S7)	ng/l	2500	100
12/07/07	12/11/07 00:00	402231	USGS4MOD	Carbaryl	ND(S7)	ng/l	500	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Chlorpyrifos	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	DEET	564(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Diazinon	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Dieldrin	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Methyl Parathion	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Phenol	8310(S7)	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	USGS4MOD	TDCPP	256(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Tris (2-butoxyethyl) phosphate	8390(S7)	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	USGS4MOD	Tris (2-chloroethyl) phosphate	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Triphenylphosphate	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	USGS4MOD	Triclosan	2710(S7)	ng/l	500	10
			USGS4MOD	BR7-d21(70-130)	22(S7)	% Rec		
			USGS4MOD	Caffeine-C13(70-130)	138(S7)	% Rec		
CHISHOLM CREEK SECONDARY (2712060445) Sampled on 12/04/07 10:00								
				EDC screen by LC-MS-MS				
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Acetaminophen	21	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Caffeine	77	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Carbamazepine	144	ng/l	5.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Fluorene	40	ng/l	1.0	1

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Laboratory
Data Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analysed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Estradiol	2.6	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Fluoxetine	25	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Gemfibrozil	440	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Ibuprofen	4.2	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Iopromide	17	ng/l	5.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Progesterone	ND	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Sulfamethoxazole	1000	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Testosterone	ND	ng/l	1.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Triclosan	52	ng/l	5.0	1
12/11/07	12/16/07 10:15	410492	LC-MS-MS	Trimethoprim	106	ng/l	1.0	1
			LC-MS-MS	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
12/07/07	12/11/07 00:00	402231	USGS4MOD	2,6-di-tert-butylphenol	ND(S7)	ng/l	10	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	4-Methylphenol	42(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	4-Nonyl Phenol	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Alpha Chlordane	ND(S7)	ng/l	10	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Bis Phenol A (BPA)	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Caffeine by GCMS LLE	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Carbaryl	ND(S7)	ng/l	50	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Chlorpyrifos	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	DEET	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Diazinon	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Dieldrin	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Methyl Parathion	ND(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Phenol	ND(S7)	ng/l	100	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	TDCPP	454(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Tris (2-butoxyethyl) phosphate	110(S7)	ng/l	100	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Tris (2-chloroethyl) phosphate	247(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Triphenylphosphate	47(S7)	ng/l	25	1
12/07/07	12/11/07 00:00	402231	USGS4MOD	Triclosan	139(S7)	ng/l	50	1
			USGS4MOD	Caffeine-C13(70-130)	177(S7)	% Rec		
			USGS4MOD	BHT-d21(70-130)	42(S7)	% Rec		

MWH Laboratories
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Laboratory
QC Summary
#224318

City of Oklahoma City EDC
Monitoring

QC Ref #402231 - EDC-Phenols-waste indic screenAnalysis Date: 12/11/2007

2712060444	CHISHOLM CREEK PRIMARY	Analyzed by: jwc
2712060445	CHISHOLM CREEK SECONDARY	Analyzed by: jwc

QC Ref #410492 - EDC screen by LC-MS-MS Analysis Date: 12/16/2007

2712060445	CHISHOLM CREEK SECONDARY	Analyzed by: ali

MWH Laboratories
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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring

QC Ref #402231 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	76.6	NGL	76.6	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	78.1	NGL	78.1	(50-150)	
MSD	2,6-di-tert-butylphenol	100	66.0	NGL	66.0	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	78.100	66.000	NGL	16.8	(0-20)	
LCS1	4-Methylphenol	100	71.6	NGL	71.6	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	75.2	NGL	75.2	(50-150)	
MSD	4-Methylphenol	100	59.8	NGL	59.8	(50-150)	
RPD_MS	4-Methylphenol	75.200	59.800	NGL	22.8	(0-20)	
LCS1	4-Nonyl Phenol	100	93.8	NGL	93.8	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	93.3	NGL	93.3	(50-150)	
MSD	4-Nonyl Phenol	100	81.3	NGL	81.3	(50-150)	
RPD_MS	4-Nonyl Phenol	93.300	81.300	NGL	13.7	(0-20)	
MS	Spiked sample	Lab # 27	12070025	NONE		(0-0)	
LCS1	Alpha Chlordane	100	98.5	NGL	98.5	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	92.5	NGL	92.5	(50-150)	
MSD	Alpha Chlordane	100	80.0	NGL	80.0	(50-150)	
RPD_MS	Alpha Chlordane	92.500	80.000	NGL	14.5	(0-20)	
LCS1	Bis Phenol A (BPA)	100	71.5	NGL	71.5	(50-150)	
MBLK	Bis Phenol A (BPA)	ND	<25	NGL			
MS	Bis Phenol A (BPA)	100	79.9	NGL	79.9	(50-150)	
MSD	Bis Phenol A (BPA)	100	69.7	NGL	69.7	(50-150)	
RPD_MS	Bis Phenol A (BPA)	79.900	69.700	NGL	13.6	(0-20)	
LCS1	Caffeine by GCMS LLE	100	76.3	NGL	76.3	(50-150)	
MBLK	Caffeine by GCMS LLE	ND	<25	NGL			
MS	Caffeine by GCMS LLE	100	73.2	NGL	73.2	(50-150)	
MSD	Caffeine by GCMS LLE	100	79.4	NGL	79.4	(50-150)	
RPD_MS	Caffeine by GCMS LLE	73.200	79.400	NGL	8.1	(0-20)	
LCS1	Carbaryl	100	111	NGL	111.0	(50-150)	

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	98.4	NGL	98.4	(50-150)
MSD	Carbaryl	100	84.7	NGL	84.7	(50-150)
RPD_MS	Carbaryl	98.400	84.700	NGL	15.0	(0-20)
LCS1	Chlorpyrifos	100	112	NGL	112.0	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	99.3	NGL	99.3	(50-150)
MSD	Chlorpyrifos	100	86.1	NGL	86.1	(50-150)
RPD_MS	Chlorpyrifos	99.300	86.100	NGL	14.2	(0-20)
LCS1	DEET	100	101	NGL	101.0	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	91.1	NGL	91.1	(50-150)
MSD	DEET	100	77.4	NGL	77.4	(50-150)
RPD_MS	DEET	91.100	77.400	NGL	16.1	(0-20)
LCS1	Diazinon	100	102	NGL	102.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	87.9	NGL	87.9	(50-150)
MSD	Diazinon	100	72.6	NGL	72.6	(50-150)
RPD_MS	Diazinon	87.900	72.600	NGL	19.1	(0-20)
LCS1	Dieldrin	100	103	NGL	103.0	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	90.6	NGL	90.6	(50-150)
MSD	Dieldrin	100	81.2	NGL	81.2	(50-150)
RPD_MS	Dieldrin	90.600	81.200	NGL	10.9	(0-20)
LCS1	Methyl Parathion	100	128	NGL	128.0	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	128	NGL	128.0	(50-150)
MSD	Methyl Parathion	100	117	NGL	117.0	(50-150)
RPD_MS	Methyl Parathion	128.000	117.000	NGL	9.0	(0-20)
LCS1	Phenol	100	76.0	NGL	76.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	71.5	NGL	71.5	(50-150)
MSD	Phenol	100	54.5	NGL	54.5	(50-150)
RPD_MS	Phenol	71.500	54.500	NGL	27.0	(0-20)
LCS1	SMT-421	100	64	%R	64.0	(50-150)

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

MBLK	BHT-d21	100	82	%R	82.0	
MS	BHT-d21	100	68	%R	68.0	(50-150)
MSD	BHT-d21	100	63	%R	63.0	(50-150)
LCS1	Caffeine-C13	100	74	%R	74.0	(50-150)
MBLK	Caffeine-C13	100	90	%R	90.0	
MS	Caffeine-C13	100	68	%R	68.0	(50-150)
MSD	Caffeine-C13	100	55	%R	55.0	(50-150)
LCS1	TDCPP	100	116	NGL	116.0	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	110	NGL	110.0	(50-150)
MSD	TDCPP	100	96.5	NGL	96.5	(50-150)
RPD_MS	TDCPP	110.000	95.500	NGL	14.1	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	101	NGL	101.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	Nb	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	162	NGL	162.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	125	NGL	125.0	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	162.000	125.000	NGL	25.8	(0-20)
LCS1	Tris (2-enloroethyl) phosphate	100	114	NGL	114.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	101	NGL	101.0	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	86.4	NGL	86.4	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	101.000	86.400	NGL	15.6	(0-20)
LCS1	Triphenylphosphate	100	113	NGL	113.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		
MS	Triphenylphosphate	100	106	NGL	106.0	(50-150)
MSD	Triphenylphosphate	100	81.0	NGL	81.0	(50-150)
RPD_MS	Triphenylphosphate	106.000	81.000	NGL	26.7	(0-20)
LCS1	Triclosan	100	101	NGL	101.0	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	121	NGL	121.0	(50-150)
MSD	Triclosan	100	97.5	NGL	97.5	(50-150)
RPD_MS	Triclosan	121.000	97.500	NGL	21.5	(0-20)

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

QC Ref #410492 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	12060445	NONE		(0-0)	
LCS1	Acetaminophen	50	42.6	NGL	85.2	(70-130)	
LCS2	Acetaminophen	50	37.0	NGL	74.0	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	45.7	NGL	91.4	(70-130)	
MSD	Acetaminophen	50	53	NGL	106.0	(70-130)	
LCS1	Caffeine	50	58.0	NGL	116.0	(70-130)	
LCS2	Caffeine	50	55.8	NGL	111.6	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	40	NGL	80.0	(70-130)	
MSD	Caffeine	50	34.2	NGL	68.4	(70-130)	
LCS1	Carbamazepine	50	51.0	NGL	102.0	(70-130)	
LCS2	Carbamazepine	50	52.2	NGL	104.4	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	46.0	NGL	92.0	(70-130)	
MSD	Carbamazepine	50	39.0	NGL	78.0	(70-130)	
LCS1	Esterone	50	56.0	NGL	112.0	(70-130)	
LCS2	Esterone	50	51.9	NGL	103.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	32.6	NGL	65.2	(70-130)	
MSD	Esterone	50	38.2	NGL	76.4	(70-130)	
LCS1	Estradiol	50	49.5	NGL	99.0	(70-130)	
LCS2	Estradiol	50	54.4	NGL	108.8	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.9	NGL	103.8	(70-130)	
MSD	Estradiol	50	45	NGL	90.0	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	48.6	NGL	97.2	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	50.5	NGL	101.0	(70-130)	

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

MSD	Ethinyl Estradiol -17 alpha	50	45.8	NGL	99.6	(70-130)
LCS1	Fluoxetine	50	45.4	NGL	90.8	(70-130)
LCS2	Fluoxetine	50	43.4	NGL	86.8	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	50	60.4	NGL	120.8	(70-130)
MSD	Fluoxetine	50	43.0	NGL	86.0	(70-130)
LCS1	Gemfibrozil	50	51.0	NGL	102.0	(70-130)
LCS2	Gemfibrozil	50	50.4	NGL	100.8	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	50	129	NGL	258.0	(70-130)
MSD	Gemfibrozil	50	62	NGL	124.0	(70-130)
LCS1	Ibuprofen	50	52.5	NGL	105.0	(70-130)
LCS2	Ibuprofen	50	51.8	NGL	103.6	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	50	41.8	NGL	83.6	(70-130)
MSD	Ibuprofen	50	46.5	NGL	93.0	(70-130)
LCS1	Iopromide	50	39.5	NGL	79.0	(70-130)
LCS2	Iopromide	50	53.6	NGL	107.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	50	65	NGL	130.0	(70-130)
MSD	Iopromide	50	64	NGL	128.0	(70-130)
LCS1	Progesterone	50	62.2	NGL	124.4	(70-130)
LCS2	Progesterone	50	50.0	NGL	100.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	50	47.0	NGL	94.0	(70-130)
MSD	Progesterone	50	57.9	NGL	115.8	(70-130)
LCS1	Sulfamethoxazole	50	57.6	NGL	115.2	(70-130)
LCS2	Sulfamethoxazole	50	55.9	NGL	111.8	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
LCS1	Testosterone	50	52.6	NGL	105.2	(70-130)
LCS2	Testosterone	50	56.5	NGL	113.0	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	50	56.4	NGL	112.8	(70-130)
MSD	Testosterone	50	59.1	NGL	118.2	(70-130)
LCS1	Triclosan	50	44.4	NGL	88.8	(70-130)

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Triclosan	50	44.6	NGL	89.6	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	58.1	NGL	116.2	(70-130)
MSD	Triclosan	50	41	NGL	82.0	(70-130)
LCS1	Trimethoprim	50	39.2	NGL	78.4	(70-130)
LCS2	Trimethoprim	50	38.2	NGL	76.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	56.5	NGL	113.0	(70-130)
MSD	Trimethoprim	50	58.9	NGL	117.8	(70-130)

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MWH Laboratories
750 Royal Oaks Drive, Monrovia, CA 91016
PHONE: 626-386-1100/FAX: 626-386-1101

ACKNOWLEDGMENT OF SAMPLES RECEIVED

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City, OK 73120
Attn: Todd Brewer
Phone: (405) 749-3070

Customer Code: OKCITY-LHEF
PO#: CHISHOLM CREEK
Group#: 224320
Project#: EDC
Proj Mgr: Allen Glover
Phone: (916) 374-8030

The following samples were received from you on **12/06/07**. They have been scheduled for the tests listed beside each sample. If this information is incorrect, please contact your service representative. Thank you for using MWH Laboratories.

Sample#	Sample Id	Matrix	Sample Date
	Tests Scheduled		
2712060447	CHISHOLM CREEK INFLUENT	Water	04-dec-2007 09:30:00
	@EDC2SCR @EDC4SCR		
2712060448	CHISHOLM CREEK PRIMARY	Water	04-dec-2007 09:45:00
	@EDC2SCR		

Test Acronym Description

Test Acronym	Description
@EDC2SCR	EDC screen by LC-MS-MS
@EDC4SCR	EDC-Phenols-waste indic screen

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

DATE OF ISSUE
FEB 07 2008
MWH LABORATORIES

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 224320
Project: EDC
PO#: CHISHOLM CRE

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Comments,QC Report,QC Summary,Data Report,Hits Report, totaling 12 page[s].

MWH Laboratories

MONTGOMERY WATSON HARZA

750 Royal Oaks, Suite 100
Monrovia, California 91016
Phone: (626) 386-1100
(800) 566-5227
Fax: (626) 386-1101

CHAIN OF CUSTODY RECORD

724326

MWH LABS USE ONLY:

LOGIN COMMENTS:

SAMPLES CHECKED AGAINST COC BY:

SAMPLES LOGGED IN BY:

SAMPLE TEMP WHEN REC'D AT LAB: (Compliance 6°C or Below)

SAMPLES REC'D DAY OF COLLECTION? (check for yes)

CONDITION OF BLUE ICE: FROZEN PARTIALLY FROZEN THAWED

TO BE COMPLETED BY SAMPLER

COMPANY, UTILITY or PROJECT: Lake Hefner WTP

SYSTEM #: N/A

COMPLIANCE SAMPLES (check for yes) - Requires state forms

NON-COMPLIANCE SAMPLES (check for yes) REGULATION INVOLVED:

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (ie. SDWA, Phase V, NPDES, FDA,)

MWH LABS CLIENT CODE: OKCity-LHEF

P.O.# / JOB # / PROJECT: Chisholm Creek

SEE ATTACHED BOTTLE ORDER FOR ANALYSES (check for yes), OR

LIST ANALYSES REQUIRED BELOW (enter number of bottles sent for each test for each sample)

SAMPLER PRINTED NAME AND SIGNATURE: Morris Williams Morris Williams

TAT requested: rush by adv notice only

STD ___ 1 week ___ 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	STATION # or LOCATION	SITE NAME OR SAMPLE I.D.	MATRIX *	GRAB	COMP	EDC6	EDC4	SAMPLER COMMENTS
12/4/07	930	Chisholm Creek	Influent	WW	X		3	3	
12/4/07	945	Chisholm Creek	Primary	WW	X		3		

Job 12/5/07 FedEx Tracking Number 863402789920

Order's name TODD BREWER Phone 405 297-3422

Company OKC CITY WATER UTILITY (MUB)

Address 420 W MAIN ST STE 500

City OKLAHOMA CITY State OK ZIP 73102

Your Internal Billing Reference

* MATRIX TYPES:

RSW = Raw Surface Water
RGW = Raw Ground Water
CFW = Chlor(am)inated Finished Water
FW = Other Finished Water
CWW = Chlorinated Waste Water
WW = Other Waste Water
BW = Bottled Water
SW = Storm Water
SO = Soil
SL = Sludge

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	Lucas Berry	Lucas Berry	City of OKC Lab Tech.	12/4/07	1100
RECEIVED BY:	FedEx				
RELINQUISHED BY:					
RECEIVED BY:					
RELINQUISHED BY:					
RECEIVED BY:					

Page 1

C-O-C# _____

PAGE ___ OF ___

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750 Royal Oaks Drive Suite 100
Monrovia CA 91016 (626) 386-1100 FAX (626) 386-1124

Bottle Order for Oklahoma City - EDC Testing

Group #
Date Sampled
Date Received

Allen Glover — Your MWL Project Manager
(916) 374-8030 — Direct Phone/Voice Mail

Client Code OKCITY-LHEF
Project Code EDC
PO# / Job# PG W0360003952

ProjectName

BO# 43667

Sampler: please return this paper with your samples

Created by MAG

Order Date
11/13/07

Date Needed by Client
11/16/07

Date Samples to Arrive at MWL

Ship Sample Kits to
Lake Hefner WTP
3827 West Hefner Road
Oklahoma City, OK 73120

ATTN: Todd Brewer
PHONE: (405) 749-3070

Send Report to
Lake Hefner WTP
3827 West Hefner Road
Oklahoma City, OK 73120

ATTN: Todd Brewer
PHONE: (405) 749-3070
FAX: (405) 749-3099

Billing Address
City of Oklahoma City
Procurement Services
100 N. Walker, Suite 201
Oklahoma City, OK 73102

# of Samples	Tests	Qteline#	Bottles-Qty for each sample, type & preservative if any	UN DOT #	Comments
3	@EDC2SCR		3: 2 x 1L silanized amb gls + 0.5g ascorbic + 0.5g CuSO4*5H2O xls + 1x 1L		
3	@EDC4SCR		3: 2 x 1L silanized amb gls + 0.5g ascorbic + 0.5g CuSO4*5H2O xls + 1x 1L		

CANCELLED

Code | Status | Date Shipped | Via | Tracking # | # of Coolers | Prepared By

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PHONE: 626-386-1100/FAX: 626-386-1101

ACKNOWLEDGMENT OF SAMPLES RECEIVED

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City, OK 73120
Attn: Todd Brewer
Phone: (405) 749-3070

Customer Code: OKCITY-LHEP
PO#: CHISHOLM CREEK
Group#: 224320
Project#: EDC
Proj Mgr: Allen Glover
Phone: (916) 374-8030

The following samples were received from you on **12/06/07**. They have been scheduled for the tests listed beside each sample. If this information is incorrect, please contact your service representative. Thank you for using MWH Laboratories.

Sample#	Sample Id	Matrix	Sample Date
	Tests Scheduled		
2712060447	CHISHOLM CREEK INFLUENT	Water	04-dec-2007 09:30:00
	@EDC2SCR @EDC4SCR		
2712060448	CHISHOLM CREEK PRIMARY	Water	04-dec-2007 09:45:00
	@EDC2SCR		

Test Acronym Description

Test Acronym	Description
@EDC2SCR	EDC screen by LC-MS-MS
@EDC4SCR	EDC-Phenols-waste indic screen

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Report
Comments
#224320

Group Comments

Surrogate recovery was above laboratory and method acceptance limits for Caffeine.

(QC Ref#: 2712060447)

Test: EDC-Phenols-waste indic screen (USGS4MOD)

S7 - Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.

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Laboratory
Hits Report
#224320

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:11:54

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060447	CHISHOLM CREEK INFLUENT				
12/16/07	Acetaminophen		21		ng/l	1.0
12/16/07	Caffeine		4760		ng/l	100
12/16/07	Carbamazepine		118		ng/l	5.0
12/16/07	Esterone		130		ng/l	1.0
12/16/07	Estradiol		2.6		ng/l	1.0
12/16/07	Gemfibrozil		3640		ng/l	1.0
12/16/07	Ibuprofen		38800		ng/l	100
12/16/07	Iopromide		7.3		ng/l	5.0
12/16/07	Sulfamethoxazole		970		ng/l	1.0
12/16/07	Testosterone		75		ng/l	1.0
12/16/07	Triclosan		116		ng/l	5.0
12/16/07	Trimethoprim		97		ng/l	1.0
12/11/07	4-Methylphenol		55100		ng/l	7500
12/11/07	Caffeine by GCMS LLE		35900		ng/l	2500
12/11/07	DEET		299		ng/l	250
12/11/07	Phenol		11000		ng/l	10000
12/11/07	Triclosan		3810		ng/l	500
12/11/07	Tris (2-butoxyethyl) phosphate		7650		ng/l	2000
	2712060448	CHISHOLM CREEK PRIMARY				
12/16/07	Acetaminophen		126000		ng/l	100
12/16/07	Caffeine		7320		ng/l	100
12/16/07	Carbamazepine		230		ng/l	5.0
12/16/07	Esterone		46		ng/l	1.0
12/16/07	Estradiol		1.5		ng/l	1.0
12/16/07	Gemfibrozil		1640		ng/l	100
12/16/07	Ibuprofen		27800		ng/l	100

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Laboratory
Hits Report
#224320

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:11:54

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060448	CHISHOLM CREEK PRIMARY				
12/16/07	Iopromide		6.7		ng/l	5.0
12/16/07	Progesterone		40		ng/l	1.0
12/16/07	Sulfamethoxazole		310		ng/l	1.0
12/16/07	Testosterone		16		ng/l	1.0
12/16/07	Triclosan		121		ng/l	5.0
12/16/07	Trimethoprim		33		ng/l	1.0

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#224320

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

12/06/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
CHISHOLM CREEK INFLUENT (2712060447) Sampled on 12/04/07 09:30								
				EDC screen by LC-MS-MS				
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Acetaminophen	21	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Caffeine	4760	ng/l	100	100
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Carbamazepine	118	ng/l	5.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Esterone	110	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Estradiol	2.6	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Fluoxetine	ND	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Gemfibrozil	3640	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Ibuprofen	38800	ng/l	100	100
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Iopromide	7.3	ng/l	5.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Progesterone	ND	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Sulfamethoxazole	970	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Testosterone	75	ng/l	1.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Triclosan	116	ng/l	5.0	1
12/11/07	12/16/07 10:46	410492	LC-MS-MS	Trimethoprim	97	ng/l	1.0	1
			LC-MS-MS	Caffeine C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
12/07/07	12/11/07 00:00	402231	GCGC4MOD	2,6-di-tert butylphenol	ND(S7)	ng/l	100	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	4-Methylphenol	55100(S7)	ng/l	7500	100
12/07/07	12/11/07 00:00	402231	GCGC4MOD	4-Nonyl Phenol	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Alpha Chlordane	ND(S7)	ng/l	100	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Bis Phenol A (BPA)	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Caffeine by GCMS LLS	35900(S7)	ng/l	2500	100
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Carbaryl	ND(S7)	ng/l	500	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Chlorpyrifos	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	DEET	299(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	GCGC4MOD	Diazinon	ND(S7)	ng/l	250	10

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City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Dieldrin	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Methyl Parathion	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Phenol	11000(S7)	ng/l	10000	100
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) TDCPP	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	7650(S7)	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-chloroethyl) phosphate	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triphenylphosphate	ND(S7)	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triclosan	3810(S7)	ng/l	500	10
			(USGS4MOD	) BHT-d21(70-130)	14(S7)	% Rec		
			(USGS4MOD	) Caffeine-C13(70-130)	194(S7)	% Rec		

CHISHOLM CREEK PRIMARY (2712060448) Sampled on 12/04/07 09:45

EDC screen by LC-MS-MS

12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Acetaminophen	126000	ng/l	100	100
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Caffeine	7320	ng/l	100	100
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Carbamazepine	230	ng/l	5.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Esterone	46	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Estradiol	1.5	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Fluoxetine	ND	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Gemfibrozil	1640	ng/l	100	100
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Ibuprofen	27800	ng/l	100	100
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Iopromide	6.7	ng/l	5.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Progesterone	40	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Sulfamethoxazole	310	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Testosterone	16	ng/l	1.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Triclosan	121	ng/l	5.0	1
12/11/07	12/16/07 10:53	410492	(LC-MS-MS	) Trimethoprim	33	ng/l	1.0	1
			(LC-MS-MS	) Caffeine-C13(70-130)	NA	% Rec		

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Laboratory
QC Summary
#224320

City of Oklahoma City EDC
Monitoring

QC Ref #402231 - EDC-Phenols-waste indic screenAnalysis Date: 12/11/2007

2712060447	CHISHOLM CREEK INFLUENT	Analyzed by: jwc

QC Ref #410492 - EDC screen by LC-MS-MS Analysis Date: 12/16/2007

2712060447	CHISHOLM CREEK INFLUENT	Analyzed by: ali
2712060448	CHISHOLM CREEK PRIMARY	Analyzed by: ali

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Laboratory
QC Report
#224320

City of Oklahoma City EDC
Monitoring

QC Ref #402231 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	76.6	NGL	76.6	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	78.1	NGL	78.1	(50-150)	
MSD	2,6-di-tert-butylphenol	100	66.0	NGL	66.0	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	78.100	66.000	NGL	16.8	(0-20)	
LCS1	4-Methylphenol	100	71.6	NGL	71.6	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	75.2	NGL	75.2	(50-150)	
MSD	4-Methylphenol	100	59.8	NGL	59.8	(50-150)	
RPD_MS	4-Methylphenol	75.200	59.800	NGL	22.8	(0-20)	
LCS1	4-Nonyl Phenol	100	93.8	NGL	93.8	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	93.3	NGL	93.3	(50-150)	
MSD	4-Nonyl Phenol	100	81.3	NGL	81.3	(50-150)	
RPD_MS	4-Nonyl Phenol	93.300	81.300	NGL	13.7	(0-20)	
MS	Spiked sample	Lab # 27	12070025	NONE		(0-0)	
LCS1	Alpha Chlordane	100	98.5	NGL	98.5	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	92.5	NGL	92.5	(50-150)	
MSD	Alpha Chlordane	100	80.0	NGL	80.0	(50-150)	
RPD_MS	Alpha Chlordane	92.500	80.000	NGL	14.5	(0-20)	
LCS1	Bis Phenol A (BPA)	100	71.5	NGL	71.5	(50-150)	
MBLK	Bis Phenol A (BPA)	ND	<25	NGL			
MS	Bis Phenol A (BPA)	100	79.9	NGL	79.9	(50-150)	
MSD	Bis Phenol A (BPA)	100	69.7	NGL	69.7	(50-150)	
RPD_MS	Bis Phenol A (BPA)	79.900	69.700	NGL	13.6	(0-20)	
LCS1	Caffeine by GCMS LLE	100	76.3	NGL	76.3	(50-150)	
MBLK	Caffeine by GCMS LLE	ND	<25	NGL			
MS	Caffeine by GCMS LLE	100	73.2	NGL	73.2	(50-150)	
MSD	Caffeine by GCMS LLE	100	79.4	NGL	79.4	(50-150)	
RPD_MS	Caffeine by GCMS LLE	73.200	79.400	NGL	8.1	(0-20)	
LCS1	Carbaryl	100	111	NGL	111.0	(50-150)	

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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	98.4	NGL	98.4	(50-150)
MSD	Carbaryl	100	84.7	NGL	84.7	(50-150)
RPD_MS	Carbaryl	98.400	84.700	NGL	15.0	(0-20)
LCS1	Chlorpyrifos	100	112	NGL	112.0	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	99.3	NGL	99.3	(50-150)
MSD	Chlorpyrifos	100	86.1	NGL	86.1	(50-150)
RPD_MS	Chlorpyrifos	99.300	86.100	NGL	14.2	(0-20)
LCS1	DEET	100	101	NGL	101.0	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	91.1	NGL	91.1	(50-150)
MSD	DEET	100	77.4	NGL	77.4	(50-150)
RPD_MS	DEET	91.100	77.400	NGL	16.3	(0-20)
LCS1	Diazinon	100	102	NGL	102.6	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	87.9	NGL	87.9	(50-150)
MSD	Diazinon	100	72.6	NGL	72.6	(50-150)
RPD_MS	Diazinon	87.900	72.600	NGL	19.1	(0-20)
LCS1	Dieldrin	100	103	NGL	103.6	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	90.6	NGL	90.6	(50-150)
MSD	Dieldrin	100	81.2	NGL	81.2	(50-150)
RPD_MS	Dieldrin	90.600	81.200	NGL	10.9	(0-20)
LCS1	Methyl Parathion	100	128	NGL	128.0	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	124	NGL	124.0	(50-150)
MSD	Methyl Parathion	100	117	NGL	117.0	(50-150)
RPD_MS	Methyl Parathion	124.000	117.000	NGL	5.8	(0-20)
LCS1	Phenol	100	76.0	NGL	76.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	71.5	NGL	71.5	(50-150)
MSD	Phenol	100	54.5	NGL	54.5	(50-150)
RPD_MS	Phenol	71.500	54.500	NGL	27.0	(0-20)
LCS1	BHT-d21	100	64	%R	64.0	(50-150)

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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	BHT-d21	100	82	%R	82.0	
MS	BHT-d21	100	68	%R	68.0	(50-150)
MSD	BHT-d21	100	63	%R	63.0	(50-150)
LCS1	Caffeine-C13	100	74	%R	74.0	(50-150)
MBLK	Caffeine-C13	100	90	%R	90.0	
MS	Caffeine-C13	100	68	%R	68.0	(50-150)
MSD	Caffeine-C13	100	55	%R	55.0	(50-150)
LCS1	TDCPP	100	116	NGL	116.0	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	110	NGL	110.0	(50-150)
MSD	TDCPP	100	95.5	NGL	95.5	(50-150)
RPD_MS	TDCPP	110.000	95.500	NGL	14.1	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	101	NGL	101.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	162	NGL	162.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	125	NGL	125.0	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	162.000	125.000	NGL	25.8	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	114	NGL	114.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	101	NGL	101.0	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	86.4	NGL	86.4	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	101.000	86.400	NGL	15.6	(0-20)
LCS1	Triphenylphosphate	100	113	NGL	113.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		
MS	Triphenylphosphate	100	106	NGL	106.0	(50-150)
MSD	Triphenylphosphate	100	81.0	NGL	81.0	(50-150)
RPD_MS	Triphenylphosphate	106.000	81.000	NGL	26.7	(0-20)
LCS1	Triclosan	100	101	NGL	101.0	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	121	NGL	121.0	(50-150)
MSD	Triclosan	100	97.5	NGL	97.5	(50-150)
RPD_MS	Triclosan	121.000	97.500	NGL	21.5	(0-20)

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City of Oklahoma City EDC
Monitoring
(continued)

QC Ref #410492 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	12060445	NONE		(0-0)	
LCS1	Acetaminophen	50	42.6	NGL	85.2	(70-130)	
LCS2	Acetaminophen	50	37.0	NGL	74.0	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	45.7	NGL	91.4	(70-130)	
MSD	Acetaminophen	50	53	NGL	106.0	(70-130)	
LCS1	Caffeine	50	58.0	NGL	116.0	(70-130)	
LCS2	Caffeine	50	55.8	NGL	111.6	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	40	NGL	80.0	(70-130)	
MSD	Caffeine	50	34.2	NGL	68.4	(70-130)	
LCS1	Carbamazepine	50	51.0	NGL	102.0	(70-130)	
LCS2	Carbamazepine	50	52.2	NGL	104.4	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	46.0	NGL	92.0	(70-130)	
MSD	Carbamazepine	50	39.0	NGL	78.0	(70-130)	
LCS1	Esterone	50	56.0	NGL	112.0	(70-130)	
LCS2	Esterone	50	51.9	NGL	103.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	32.6	NGL	65.2	(70-130)	
MSD	Esterone	50	38.2	NGL	76.4	(70-130)	
LCS1	Estradiol	50	49.5	NGL	99.0	(70-130)	
LCS2	Estradiol	50	54.4	NGL	108.8	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.9	NGL	103.8	(70-130)	
MSD	Estradiol	50	45	NGL	90.0	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	48.6	NGL	97.2	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	50.5	NGL	101.0	(70-130)	

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Laboratory
QC Report
#224320

City of Oklahoma City EDC
Monitoring
(continued)

MSD	Ethinyl Estradiol -17 alpha	50	49.8	NGL	99.6	(70-130)
LCS1	Fluoxetine	50	45.4	NGL	90.8	(70-130)
LCS2	Fluoxetine	50	43.4	NGL	86.8	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	50	60.4	NGL	120.8	(70-130)
MSD	Fluoxetine	50	43.0	NGL	86.0	(70-130)
LCS1	Gemfibrozil	50	51.0	NGL	102.0	(70-130)
LCS2	Gemfibrozil	50	50.4	NGL	100.8	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	50	129	NGL	258.0	(70-130)
MSD	Gemfibrozil	50	62	NGL	124.0	(70-130)
LCS1	Ibuprofen	50	52.5	NGL	105.0	(70-130)
LCS2	Ibuprofen	50	51.8	NGL	103.6	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	50	41.8	NGL	83.6	(70-130)
MSD	Ibuprofen	50	46.5	NGL	93.0	(70-130)
LCS1	Iopromide	50	39.9	NGL	79.8	(70-130)
LCS2	Iopromide	50	53.6	NGL	107.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	50	65	NGL	130.0	(70-130)
MSD	Iopromide	50	64	NGL	128.0	(70-130)
LCS1	Progesterone	50	62.2	NGL	124.4	(70-130)
LCS2	Progesterone	50	50.0	NGL	100.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	50	47.0	NGL	94.0	(70-130)
MSD	Progesterone	50	57.9	NGL	115.8	(70-130)
LCS1	Sulfamethoxazole	50	57.6	NGL	115.2	(70-130)
LCS2	Sulfamethoxazole	50	55.9	NGL	111.8	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
LCS1	Testosterone	50	52.6	NGL	105.2	(70-130)
LCS2	Testosterone	50	56.5	NGL	113.0	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	50	56.4	NGL	112.8	(70-130)
MSD	Testosterone	50	59.1	NGL	118.2	(70-130)
LCS1	Triclosan	50	44.4	NGL	88.8	(70-130)

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Triclosan	50	44.8	NGL	89.6	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	58.1	NGL	116.2	(70-130)
MSD	Triclosan	50	41	NGL	82.0	(70-130)
LCS1	Trimethoprim	50	39.2	NGL	78.4	(70-130)
LCS2	Trimethoprim	50	38.2	NGL	76.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	56.5	NGL	113.0	(70-130)
MSD	Trimethoprim	50	58.9	NGL	117.8	(70-130)

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 224320
Project: EDC
PO#: CHISHOLM CRE

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 7 page[s].

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Laboratory
Hits Report
#224320

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:11:54

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060447	CHISHOLM CREEK INFLUENT				
12/11/07	4-Methylphenol		55079		ng/l	7500
12/11/07	Caffeine by GCMS LLE		35917		ng/l	2500
12/11/07	DEET		299		ng/l	250
12/11/07	Phenol		10991		ng/l	10000
12/11/07	Triclosan		3808		ng/l	500
12/11/07	Tris (2-butoxyethyl) phosphate		7650		ng/l	2000

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#224320

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

12/06/07

CHISHOLM CREEK INFLUENT (2712060447) Sampled on 12/04/07 09:30

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
EDC screen by LC-MS-MS								
12/11/07			(LC-MS-MS)	Acetaminophen		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Caffeine		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Carbamazepine		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Esterone		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Estradiol		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Ethinyl Estradiol -17 alpha		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Fluoxetine		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Gemfibrozil		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Ibuprofen		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Iopromide		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Progesterone		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Sulfamethoxazole		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Testosterone		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Triclosan		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Trimethoprim		ng/l	1.0	1
EDC-Phenols-waste indic screen								
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	2,6-di-tert-butylphenol	ND	ng/l	100	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	4-Methylphenol	55079	ng/l	7500	300
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	4-Nonyl Phenol	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Alpha Chlordane	ND	ng/l	100	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Bis Phenol A (BPA)	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Caffeine by GCMS LLE	35917	ng/l	2500	100
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Carbaryl	ND	ng/l	500	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Chlorpyrifos	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	DEET	299	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Diazinon	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Dieldrin	ND	ng/l	250	10

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City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Methyl Parathion	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Phenol	10991	ng/l	10000	100
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) TDCPP	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	7650	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-chloroethyl) phosphate	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triphenylphosphate	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triclosan	3808	ng/l	500	10
			(USGS4MOD	) Caffeine-C13(70-130)	194	% Rec		
			(USGS4MOD	) BHT-d21(70-130)	14	% Rec		

CHISHOLM CREEK PRIMARY (2712060448) Sampled on 12/04/07 09:45

EDC screen by LC-MS-MS

12/11/07	(LC-MS-MS	) Acetaminophen	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Caffeine	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Carbamazepine	ng/l	5.0	1
12/11/07	(LC-MS-MS	) Esterone	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Estradiol	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Ethinyl Estradiol -17 alpha	ng/l	5.0	1
12/11/07	(LC-MS-MS	) Fluoxetine	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Gemfibrozil	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Ibuprofen	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Iopromide	ng/l	5.0	1
12/11/07	(LC-MS-MS	) Progesterone	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Sulfamethoxazole	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Testosterone	ng/l	1.0	1
12/11/07	(LC-MS-MS	) Triclosan	ng/l	5.0	1
12/11/07	(LC-MS-MS	) Trimethoprim	ng/l	1.0	1

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Laboratory
QC Summary
#224320

City of Oklahoma City EDC
Monitoring

QC Ref #402231 - EDC-Phenols-waste indic screenAnalysis Date: 12/11/2007

2712060447 CHISHOLM CREEK INFLUENT

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QC Report
#224320

City of Oklahoma City EDC
Monitoring

QC Ref #402231 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	76.6	NGL	76.6	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	78.1	NGL	78.1	(50-150)	
MSD	2,6-di-tert-butylphenol	100	66.0	NGL	66.0	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	78.100	66.000	NGL	16.8	(0-20)	
LCS1	4-Methylphenol	100	71.6	NGL	71.6	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	75.2	NGL	75.2	(50-150)	
MSD	4-Methylphenol	100	59.8	NGL	59.8	(50-150)	
RPD_MS	4-Methylphenol	75.200	59.800	NGL	22.8	(0-20)	
LCS1	4-Nonyl Phenol	100	93.8	NGL	93.8	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	93.3	NGL	93.3	(50-150)	
MSD	4-Nonyl Phenol	100	81.3	NGL	81.3	(50-150)	
RPD_MS	4-Nonyl Phenol	93.300	81.300	NGL	13.7	(0-20)	
MS	Spiked sample	Lab # 27	12070025	NONE		(0-0)	
LCS1	Alpha Chlordane	100	98.5	NGL	98.5	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	92.5	NGL	92.5	(50-150)	
MSD	Alpha Chlordane	100	80.0	NGL	80.0	(50-150)	
RPD_MS	Alpha Chlordane	92.500	80.000	NGL	14.5	(0-20)	
LCS1	Bis Phenol A (BPA)	100	71.5	NGL	71.5	(50-150)	
MBLK	Bis Phenol A (BPA)	ND	<25	NGL			
MS	Bis Phenol A (BPA)	100	79.9	NGL	79.9	(50-150)	
MSD	Bis Phenol A (BPA)	100	69.7	NGL	69.7	(50-150)	
RPD_MS	Bis Phenol A (BPA)	79.900	69.700	NGL	13.6	(0-20)	
LCS1	Caffeine by GCMS LLE	100	76.3	NGL	76.3	(50-150)	
MBLK	Caffeine by GCMS LLE	ND	<25	NGL			
MS	Caffeine by GCMS LLE	100	73.2	NGL	73.2	(50-150)	
MSD	Caffeine by GCMS LLE	100	79.4	NGL	79.4	(50-150)	
RPD_MS	Caffeine by GCMS LLE	73.200	79.400	NGL	8.1	(0-20)	
LCS1	Carbaryl	100	111	NGL	111.0	(50-150)	

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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	98.4	NGL	98.4	(50-150)
MSD	Carbaryl	100	84.7	NGL	84.7	(50-150)
RPD_MS	Carbaryl	98.400	84.700	NGL	15.0	(0-20)
LCS1	Chlorpyrifos	100	112	NGL	112.0	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	99.3	NGL	99.3	(50-150)
MSD	Chlorpyrifos	100	86.1	NGL	86.1	(50-150)
RPD_MS	Chlorpyrifos	99.300	86.100	NGL	14.2	(0-20)
LCS1	DEET	100	101	NGL	101.0	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	91.1	NGL	91.1	(50-150)
MSD	DEET	100	77.4	NGL	77.4	(50-150)
RPD_MS	DEET	91.100	77.400	NGL	16.3	(0-20)
LCS1	Diazinon	100	102	NGL	102.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	87.9	NGL	87.9	(50-150)
MSD	Diazinon	100	72.6	NGL	72.6	(50-150)
RPD_MS	Diazinon	87.900	72.600	NGL	19.1	(0-20)
LCS1	Dieldrin	100	103	NGL	103.0	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	90.6	NGL	90.6	(50-150)
MSD	Dieldrin	100	81.2	NGL	81.2	(50-150)
RPD_MS	Dieldrin	90.600	81.200	NGL	10.9	(0-20)
LCS1	Methyl Parathion	100	128	NGL	128.0	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	128	NGL	128.0	(50-150)
MSD	Methyl Parathion	100	117	NGL	117.0	(50-150)
RPD_MS	Methyl Parathion	128.000	117.000	NGL	9.0	(0-20)
LCS1	Phenol	100	76.0	NGL	76.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	71.5	NGL	71.5	(50-150)
MSD	Phenol	100	54.5	NGL	54.5	(50-150)
RPD_MS	Phenol	71.500	54.500	NGL	27.0	(0-20)
LCS1	BHT-d21	100	64	%R	64.0	(50-150)

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Laboratory
QC Report
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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	BHT-d21	100	82	%R	82.0	
MS	BHT-d21	100	68	%R	68.0	(50-150)
MSD	BHT-d21	100	63	%R	63.0	(50-150)
LCS1	Caffeine-C13	100	74	%R	74.0	(50-150)
MBLK	Caffeine-C13	100	90	%R	90.0	
MS	Caffeine-C13	100	68	%R	68.0	(50-150)
MSD	Caffeine-C13	100	55	%R	55.0	(50-150)
LCS1	TDCPP	100	116	NGL	116.0	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	110	NGL	110.0	(50-150)
MSD	TDCPP	100	95.5	NGL	95.5	(50-150)
RPD_MS	TDCPP	110.000	95.500	NGL	14.1	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	101	NGL	101.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	162	NGL	162.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	125	NGL	125.0	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	162.000	125.000	NGL	25.8	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	114	NGL	114.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	101	NGL	101.0	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	86.4	NGL	86.4	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	101.000	86.400	NGL	15.6	(0-20)
LCS1	Triphenylphosphate	100	113	NGL	113.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		
MS	Triphenylphosphate	100	106	NGL	106.0	(50-150)
MSD	Triphenylphosphate	100	81.0	NGL	81.0	(50-150)
RPD_MS	Triphenylphosphate	106.000	81.000	NGL	26.7	(0-20)
LCS1	Triclosan	100	101	NGL	101.0	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	121	NGL	121.0	(50-150)
MSD	Triclosan	100	97.5	NGL	97.5	(50-150)
RPD_MS	Triclosan	121.000	97.500	NGL	21.5	(0-20)

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 222640
Project: EDC

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Laboratory
Hits Report
#222640

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received
15-nov-2007 17:32:23

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150476	NC-PRIMARY EFF				
11/27/07	Acetaminophen		9870		ng/l	10
11/27/07	Caffeine		9530		ng/l	10
11/27/07	Carbamazepine		110		ng/l	5.0
11/27/07	Esterone		1410		ng/l	1.0
11/27/07	Estradiol		74		ng/l	1.0
11/27/07	Ethinyl Estradiol -17 alpha		220		ng/l	5.0
11/27/07	Fluoxetine		2.2		ng/l	1.0
11/27/07	Gemfibrozil		1220		ng/l	10
11/27/07	Ibuprofen		1470		ng/l	10
11/27/07	Progesterone		63		ng/l	1.0
11/27/07	Sulfamethoxazole		22		ng/l	1.0
11/27/07	Triclosan		64		ng/l	5.0
11/27/07	Trimethoprim		44		ng/l	1.0
	2711150477	NC-FINAL EFF				
11/27/07	Caffeine		35		ng/l	1.0
11/27/07	Carbamazepine		67		ng/l	5.0
11/27/07	Esterone		98		ng/l	1.0
11/27/07	Estradiol		8.3		ng/l	1.0
11/27/07	Ethinyl Estradiol -17 alpha		12.6		ng/l	5.0
11/27/07	Fluoxetine		10		ng/l	1.0
11/27/07	Gemfibrozil		230		ng/l	1.0
11/27/07	Iopromide		29		ng/l	5.0
11/27/07	Sulfamethoxazole		420		ng/l	1.0
11/27/07	Triclosan		90		ng/l	5.0
11/27/07	Trimethoprim		53		ng/l	1.0
11/21/07	4-Methylphenol		67		ng/l	25

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Laboratory
Hits Report
#222640

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

15-nov-2007 17:32:23

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150477	NC-FINAL EFF				
11/21/07	TDCPP		141		ng/l	25
11/21/07	Triclosan		109		ng/l	50
11/21/07	Tris (2-chloroethyl) phosphate		98		ng/l	25

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#222640

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

11/15/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
NC-PRIMARY EFF (2711150476) Sampled on 11/13/07 13:16								
				EDC screen by LC-MS-MS				
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Acetaminophen	9870	ng/l	10	10
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Caffeine	9530	ng/l	10	10
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Carbamazepine	110	ng/l	5.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Esterone	1410	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Estradiol	74	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	220	ng/l	5.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Fluoxetine	2.2	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Gemfibrozil	1220	ng/l	10	10
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Ibuprofen	1470	ng/l	10	10
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Iopromide	ND	ng/l	5.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Progesterone	63	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Sulfamethoxazole	22	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Triclosan	64	ng/l	5.0	1
11/20/07	11/27/07 13:32	400001	(LC-MS-MS)	Trimethoprim	44	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
11/16/07			(USGS4MOD)	2,6-di-tert-butylphenol		ng/l	10	1
11/16/07			(USGS4MOD)	4-Methylphenol		ng/l	25	1
11/16/07			(USGS4MOD)	4-Nonyl Phenol		ng/l	25	1
11/16/07			(USGS4MOD)	Alpha Chlordane		ng/l	10	1
11/16/07			(USGS4MOD)	Bis Phenol A (BPA)		ng/l	25	1
11/16/07			(USGS4MOD)	Caffeine by GCMS LLE		ng/l	25	1
11/16/07			(USGS4MOD)	Carbaryl		ng/l	50	1
11/16/07			(USGS4MOD)	Chlorpyrifos		ng/l	25	1
11/16/07			(USGS4MOD)	DEET		ng/l	25	1
11/16/07			(USGS4MOD)	Diazinon		ng/l	25	1

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City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
11/16/07			(USGS4MOD)	Dieldrin		ng/l	25	1
11/16/07			(USGS4MOD)	Methyl Parathion		ng/l	25	1
11/16/07			(USGS4MOD)	Phenol		ng/l	100	1
11/16/07			(USGS4MOD)	TDCPP		ng/l	25	1
11/16/07			(USGS4MOD)	Tris (2-butoxyethyl) phosphate		ng/l	100	1
11/16/07			(USGS4MOD)	Tris (2-chloroethyl) phosphate		ng/l	25	1
11/16/07			(USGS4MOD)	Triphenylphosphate		ng/l	25	1
11/16/07			(USGS4MOD)	Triclosan		ng/l	50	1
NC-FINAL EFF (2711150477)			**Sampled on**	**11/13/07 13:36**				
				EDC screen by LC-MS-MS				
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Acetaminophen	ND	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Caffeine	35	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Carbamazepine	67	ng/l	5.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Esterone	98	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Estradiol	8.3	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	12.6	ng/l	5.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Fluoxetine	10	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Gemfibrozil	230	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Ibuprofen	ND	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Iopromide	29	ng/l	5.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Progesterone	ND	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Sulfamethoxazole	420	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Triclosan	90	ng/l	5.0	1
11/19/07	11/27/07 09:58	400001	(LC-MS-MS)	Trimethoprim	53	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	2,6-di-tert-butylphenol	ND	ng/l	10	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	4-Methylphenol	67	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	4-Nonyl Phenol	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Alpha Chlordane	ND	ng/l	10	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Bis Phenol A (BPA)	ND	ng/l	25	1

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City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Caffeine by GCMS LLE	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Carbaryl	ND	ng/l	50	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Chlorpyrifos	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) DEET	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Diazinon	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Dieldrin	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Methyl Parathion	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Phenol	ND	ng/l	100	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) TDCPP	141	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	ND	ng/l	100	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) Tris (2-chloroethyl) phosphate	98	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Triphenylphosphate	ND	ng/l	25	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) Triclosan	109	ng/l	50	1
			(USGS4MOD	) BHT-d21(70-130)	12	% Rec		
			(USGS4MOD	) Caffeine-C13(70-130)	39	% Rec		

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QC Summary
#222640

City of Oklahoma City EDC
Monitoring

QC Ref #400001 - EDC screen by LC-MS-MS Analysis Date: 11/27/2007

2711150476	NC-PRIMARY EFF
2711150477	NC-FINAL EFF

QC Ref #402227 - EDC-Phenols-waste indic screenAnalysis Date: 11/21/2007

2711150477	NC-FINAL EFF
2711150477	NC-FINAL EFF

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Laboratory
QC Report
#222640

City of Oklahoma City EDC
Monitoring

QC Ref #400001 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	11090521	NONE		(0-0)	
LCS1	Acetaminophen	50	60.5	NGL	121.0	(70-130)	
LCS2	Acetaminophen	50	35.1	NGL	70.2	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	46.7	NGL	93.4	(70-130)	
MSD	Acetaminophen	50	51.0	NGL	102.0	(70-130)	
LCS1	Caffeine	50	46.3	NGL	92.6	(70-130)	
LCS2	Caffeine	50	50.6	NGL	101.2	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	49.0	NGL	98.0	(70-130)	
MSD	Caffeine	50	48.2	NGL	96.4	(70-130)	
LCS1	Carbamazepine	50	50.4	NGL	100.8	(70-130)	
LCS2	Carbamazepine	50	52.6	NGL	105.2	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	51.3	NGL	102.6	(70-130)	
MSD	Carbamazepine	50	50.8	NGL	101.6	(70-130)	
LCS1	Esterone	50	49.9	NGL	99.8	(70-130)	
LCS2	Esterone	50	47.4	NGL	94.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	53.5	NGL	107.0	(70-130)	
MSD	Esterone	50	51.7	NGL	103.4	(70-130)	
LCS1	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS2	Estradiol	50	47.5	NGL	95.0	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.2	NGL	102.4	(70-130)	
MSD	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	48.4	NGL	96.8	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	49.9	NGL	99.8	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
MSD	Ethinyl Estradiol -17 alpha	50	52.3	NGL	104.6	(70-130)	
LCS1	Fluoxetine	50	61.2	NGL	122.4	(70-130)	

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Fluoxetine	SO	54.8	NGL	109.6	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	SO	56.9	NGL	113.8	(70-130)
MSD	Fluoxetine	SO	62.8	NGL	125.6	(70-130)
LCS1	Gemfibrozil	SO	48.8	NGL	97.6	(70-130)
LCS2	Gemfibrozil	SO	49.6	NGL	99.2	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	SO	51.0	NGL	102.0	(70-130)
MSD	Gemfibrozil	SO	53.4	NGL	106.8	(70-130)
LCS1	Ibuprofen	SO	39	NGL	78.0	(70-130)
LCS2	Ibuprofen	SO	56.5	NGL	113.0	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	SO	60.8	NGL	121.6	(70-130)
MSD	Ibuprofen	SO	40.7	NGL	81.4	(70-130)
LCS1	Iopromide	SO	47.5	NGL	95.0	(70-130)
LCS2	Iopromide	SO	43.6	NGL	87.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	SO	56.8	NGL	113.6	(70-130)
MSD	Iopromide	SO	55.9	NGL	111.8	(70-130)
LCS1	Progesterone	SO	56.2	NGL	112.4	(70-130)
LCS2	Progesterone	SO	55.5	NGL	111.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	SO	50.8	NGL	101.6	(70-130)
MSD	Progesterone	SO	49.1	NGL	98.2	(70-130)
LCS1	Sulfamethoxazole	SO	49.4	NGL	98.8	(70-130)
LCS2	Sulfamethoxazole	SO	48.2	NGL	96.4	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
MS	Sulfamethoxazole	SO	46.9	NGL	93.8	(70-130)
MSD	Sulfamethoxazole	SO	60.2	NGL	120.4	(70-130)
LCS1	Testosterone	SO	52.2	NGL	104.4	(70-130)
LCS2	Testosterone	SO	51.9	NGL	103.8	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	SO	51.0	NGL	102.0	(70-130)
MSD	Testosterone	SO	52.4	NGL	104.8	(70-130)
LCS1	Triclosan	SO	55.1	NGL	110.2	(70-130)

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Triclosan	50	58.1	NGL	116.2	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	62.2	NGL	124.4	(70-130)
MSD	Triclosan	50	67.3	NGL	134.6	(70-130)
LCS1	Trimethoprim	50	44.1	NGL	88.2	(70-130)
LCS2	Trimethoprim	50	52.7	NGL	105.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	37.6	NGL	75.2	(70-130)
MSD	Trimethoprim	50	46.6	NGL	93.2	(70-130)

QC Ref #402227 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	67.8	NGL	67.8	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	57.0	NGL	57.0	(50-150)	
MSD	2,6-di-tert-butylphenol	100	56.2	NGL	56.2	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	57.000	56.200	NGL	1.4	(0-20)	
LCS1	4-Methylphenol	100	51.0	NGL	51.0	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	44.1	NGL	44.1	(50-150)	
MSD	4-Methylphenol	100	38.0	NGL	38.0	(50-150)	
RPD_MS	4-Methylphenol	44.100	38.000	NGL	14.9	(0-20)	
LCS1	4-Nonyl Phenol	100	59.6	NGL	59.6	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	55.0	NGL	55.0	(50-150)	
MSD	4-Nonyl Phenol	100	47.3	NGL	47.3	(50-150)	
RPD_MS	4-Nonyl Phenol	55.000	47.300	NGL	15.1	(0-20)	
MS	Spiked sample	Lab # 27	11160574	NONE		(0-0)	
LCS1	Alpha Chlordane	100	85.7	NGL	85.7	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	66.6	NGL	66.6	(50-150)	
MSD	Alpha Chlordane	100	64.8	NGL	64.8	(50-150)	
RPD_MS	Alpha Chlordane	66.600	64.800	NGL	2.7	(0-20)	

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City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Bis Phenol A (BPA)	100	47.9	NGL	47.9	(50-150)
MBLK	Bis Phenol A (BPA)	ND	<25	NGL		
MS	Bis Phenol A (BPA)	100	48.8	NGL	48.8	(50-150)
MSD	Bis Phenol A (BPA)	100	39.8	NGL	39.8	(50-150)
RPD_MS	Bis Phenol A (BPA)	48.800	39.800	NGL	20.3	(0-20)
LCS1	Caffeine by GCMS LLE	100	67.5	NGL	67.5	(50-150)
MBLK	Caffeine by GCMS LLE	ND	<25	NGL		
MS	Caffeine by GCMS LLE	100	52.4	NGL	52.4	(50-150)
MSD	Caffeine by GCMS LLE	100	52.1	NGL	52.1	(50-150)
RPD_MS	Caffeine by GCMS LLE	52.400	52.100	NGL	0.6	(0-20)
LCS1	Carbaryl	100	115	NGL	115.0	(50-150)
MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	93.1	NGL	93.1	(50-150)
MSD	Carbaryl	100	95.1	NGL	95.1	(50-150)
RPD_MS	Carbaryl	93.100	95.100	NGL	2.1	(0-20)
LCS1	Chlorpyrifos	100	93.5	NGL	93.5	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	73.8	NGL	73.8	(50-150)
MSD	Chlorpyrifos	100	70.6	NGL	70.6	(50-150)
RPD_MS	Chlorpyrifos	73.800	70.600	NGL	4.4	(0-20)
LCS1	DEET	100	89.6	NGL	89.6	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	72.3	NGL	72.3	(50-150)
MSD	DEET	100	69.0	NGL	69.0	(50-150)
RPD_MS	DEET	72.300	69.000	NGL	4.7	(0-20)
LCS1	Diazinon	100	92.0	NGL	92.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	75.7	NGL	75.7	(50-150)
MSD	Diazinon	100	68.5	NGL	68.5	(50-150)
RPD_MS	Diazinon	75.700	68.500	NGL	10.0	(0-20)
LCS1	Dieldrin	100	88.4	NGL	88.4	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	68.1	NGL	68.1	(50-150)
MSD	Dieldrin	100	67.6	NGL	67.6	(50-150)
RPD_MS	Dieldrin	68.100	67.600	NGL	0.7	(0-20)

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Laboratory
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#222640

City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Methyl Parathion	100	95.8	NGL	95.8	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	83.6	NGL	83.6	(50-150)
MSD	Methyl Parathion	100	102	NGL	102.0	(50-150)
RPD_MS	Methyl Parathion	83.600	102.000	NGL	19.8	(0-20)
LCS1	Phenol	100	75.0	NGL	75.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	465	NGL	465.0	(50-150)
MSD	Phenol	100	87.1	NGL	87.1	(50-150)
RPD_MS	Phenol	465.000	87.100	NGL	136.9	(0-20)
LCS1	BHT-d21	100	59	%R	59.0	(50-150)
MBLK	BHT-d21	100	86	%R	86.0	
MS	BHT-d21	100	53	%R	53.0	(50-150)
MSD	BHT-d21	100	57	%R	57.0	(50-150)
LCS1	Caffeine-C13	100	71	%R	71.0	(50-150)
MBLK	Caffeine-C13	100	79	%R	79.0	
MS	Caffeine-C13	100	53	%R	53.0	(50-150)
MSD	Caffeine-C13	100	49	%R	49.0	(50-150)
LCS1	TDCPP	100	98.6	NGL	98.6	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	79.4	NGL	79.4	(50-150)
MSD	TDCPP	100	83.9	NGL	83.9	(50-150)
RPD_MS	TDCPP	79.400	83.900	NGL	5.5	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	136	NGL	136.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	160	NGL	160.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	96.4	NGL	96.4	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	160.000	96.400	NGL	49.6	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	102	NGL	102.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	78.8	NGL	78.8	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	79.0	NGL	79.0	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	78.800	79.000	NGL	0.3	(0-20)
LCS1	Triphenylphosphate	100	102	NGL	102.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		

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Laboratory
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#222640

City of Oklahoma City EDC
Monitoring
(continued)

MS	Triphenylphosphate	100	75.3	NGL	75.3	(50-150)
MSD	Triphenylphosphate	100	67.4	NGL	67.4	(50-150)
RPD_MS	Triphenylphosphate	75.300	67.400	NGL	11.1	(0-20)
LCS1	Triclosan	100	91.8	NGL	91.8	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	89.0	NGL	89.0	(50-150)
MSD	Triclosan	100	72.1	NGL	72.1	(50-150)
RPD_MS	Triclosan	89.000	72.100	NGL	21.0	(0-20)

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 224318
Project: EDC
PO#: CHISHOLM CRE

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 7 page[s].

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Laboratory
Hits Report
#224318

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

06-dec-2007 17:08:42

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2712060444	CHISHOLM CREEK PRIMARY				
12/11/07	4-Methylphenol		141054		ng/l	7500
12/11/07	Caffeine by GCMS LLE		37447		ng/l	2500
12/11/07	DEET		564		ng/l	250
12/11/07	Phenol		8310		ng/l	2000
12/11/07	TDCPP		258		ng/l	250
12/11/07	Triclosan		2707		ng/l	500
12/11/07	Tris (2-butoxyethyl) phosphate		8388		ng/l	2000
	2712060445	CHISHOLM CREEK SECONDARY				
12/11/07	4-Methylphenol		42		ng/l	25
12/11/07	TDCPP		454		ng/l	25
12/11/07	Triclosan		139		ng/l	50
12/11/07	Triphenylphosphate		47		ng/l	25
12/11/07	Tris (2-butoxyethyl) phosphate		110		ng/l	100
12/11/07	Tris (2-chloroethyl) phosphate		247		ng/l	25

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#224318

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

12/06/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
CHISHOLM CREEK PRIMARY (2712060444) Sampled on 12/04/07 09:45								
				EDC-Phenols-waste indic screen				
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) 2,6-di-tert-butylphenol	ND	ng/l	100	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) 4-Methylphenol	141054	ng/l	7500	300
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) 4-Nonyl Phenol	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Alpha Chlordane	ND	ng/l	100	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Bis Phenol A (BPA)	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Caffeine by GCMS LLE	37447	ng/l	2500	100
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Carbaryl	ND	ng/l	500	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Chlorpyrifos	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) DEET	564	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Diazinon	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Dieldrin	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Methyl Parathion	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Phenol	8310	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) TDCPP	258	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	8388	ng/l	2000	20
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Tris (2-chloroethyl) phosphate	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triphenylphosphate	ND	ng/l	250	10
12/07/07	12/11/07 00:00	402231	(USGS4MOD	) Triclosan	2707	ng/l	500	10
			(USGS4MOD	) BHT-d21(70-130)	22	% Rec		
			(USGS4MOD	) Caffeine-C13(70-130)	188	% Rec		
CHISHOLM CREEK SECONDARY (2712060445) Sampled on 12/04/07 10:00								
				EDC screen by LC-MS-MS				
12/11/07			(LC-MS-MS	) Acetaminophen		ng/l	1.0	1
12/11/07			(LC-MS-MS	) Caffeine		ng/l	1.0	1
12/11/07			(LC-MS-MS	) Carbamazepine		ng/l	5.0	1
12/11/07			(LC-MS-MS	) Estrone		ng/l	1.0	1

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Laboratory
Data Report
#224318

City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
12/11/07			(LC-MS-MS)	Estradiol		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Ethinyl Estradiol -17 alpha		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Fluoxetine		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Gemfibrozil		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Ibuprofen		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Iopromide		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Progesterone		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Sulfamethoxazole		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Testosterone		ng/l	1.0	1
12/11/07			(LC-MS-MS)	Triclosan		ng/l	5.0	1
12/11/07			(LC-MS-MS)	Trimethoprim		ng/l	1.0	1
				EDC-Phenols-waste indic screen				
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	2,6-di-tert-butylphenol	ND	ng/l	10	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	4-Methylphenol	42	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	4-Nonyl Phenol	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Alpha Chlordane	ND	ng/l	10	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Bis Phenol A (BPA)	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Caffeine by GCMS LLE	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Carbaryl	ND	ng/l	50	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Chlorpyrifos	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	DEET	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Diazinon	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Dieldrin	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Methyl Parathion	ND	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Phenol	ND	ng/l	100	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	TDCPP	454	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Tris (2-butoxyethyl) phosphate	110	ng/l	100	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Tris (2-chloroethyl) phosphate	247	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Triphenylphosphate	47	ng/l	25	1
12/07/07	12/11/07 00:00	402231	(USGS4MOD)	Triclosan	139	ng/l	50	1
			(USGS4MOD)	Caffeine-C13(70-130)	177	% Rec		
			(USGS4MOD)	BHT-d21(70-130)	42	% Rec		

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Laboratory
QC Summary
#224318

City of Oklahoma City EDC
Monitoring

QC Ref #402231 - EDC-Phenols-waste indic screenAnalysis Date: 12/11/2007

2712060444	CHISHOLM CREEK PRIMARY
2712060445	CHISHOLM CREEK SECONDARY

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Laboratory
QC Report
#224318

City of Oklahoma City EDC
Monitoring

QC Ref #402231 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	76.6	NGL	76.6	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	78.1	NGL	78.1	(50-150)	
MSD	2,6-di-tert-butylphenol	100	66.0	NGL	66.0	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	78.100	66.000	NGL	16.8	(0-20)	
LCS1	4-Methylphenol	100	71.6	NGL	71.6	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	75.2	NGL	75.2	(50-150)	
MSD	4-Methylphenol	100	59.8	NGL	59.8	(50-150)	
RPD_MS	4-Methylphenol	75.200	59.800	NGL	22.8	(0-20)	
LCS1	4-Nonyl Phenol	100	93.8	NGL	93.8	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	93.3	NGL	93.3	(50-150)	
MSD	4-Nonyl Phenol	100	81.3	NGL	81.3	(50-150)	
RPD_MS	4-Nonyl Phenol	93.300	81.300	NGL	13.7	(0-20)	
MS	Spiked sample	Lab # 27	12070025	NONE		(0-0)	
LCS1	Alpha Chlordane	100	98.5	NGL	98.5	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	92.5	NGL	92.5	(50-150)	
MSD	Alpha Chlordane	100	80.0	NGL	80.0	(50-150)	
RPD_MS	Alpha Chlordane	92.500	80.000	NGL	14.5	(0-20)	
LCS1	Bis Phenol A (BPA)	100	71.5	NGL	71.5	(50-150)	
MBLK	Bis Phenol A (BPA)	ND	<25	NGL			
MS	Bis Phenol A (BPA)	100	79.9	NGL	79.9	(50-150)	
MSD	Bis Phenol A (BPA)	100	69.7	NGL	69.7	(50-150)	
RPD_MS	Bis Phenol A (BPA)	79.900	69.700	NGL	13.6	(0-20)	
LCS1	Caffeine by GCMS LLE	100	76.3	NGL	76.3	(50-150)	
MBLK	Caffeine by GCMS LLE	ND	<25	NGL			
MS	Caffeine by GCMS LLE	100	73.2	NGL	73.2	(50-150)	
MSD	Caffeine by GCMS LLE	100	79.4	NGL	79.4	(50-150)	
RPD_MS	Caffeine by GCMS LLE	73.200	79.400	NGL	8.1	(0-20)	
LCS1	Carbaryl	100	111	NGL	111.0	(50-150)	

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Laboratory
QC Report
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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	98.4	NGL	98.4	(50-150)
MSD	Carbaryl	100	84.7	NGL	84.7	(50-150)
RPD_MS	Carbaryl	98.400	84.700	NGL	15.0	(0-20)
LCS1	Chlorpyrifos	100	112	NGL	112.0	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	99.3	NGL	99.3	(50-150)
MSD	Chlorpyrifos	100	86.1	NGL	86.1	(50-150)
RPD_MS	Chlorpyrifos	99.300	86.100	NGL	14.2	(0-20)
LCS1	DEET	100	101	NGL	101.0	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	91.1	NGL	91.1	(50-150)
MSD	DEET	100	77.4	NGL	77.4	(50-150)
RPD_MS	DEET	91.100	77.400	NGL	16.3	(0-20)
LCS1	Diazinon	100	102	NGL	102.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	87.9	NGL	87.9	(50-150)
MSD	Diazinon	100	72.6	NGL	72.6	(50-150)
RPD_MS	Diazinon	87.900	72.600	NGL	19.1	(0-20)
LCS1	Dieldrin	100	103	NGL	103.0	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	90.6	NGL	90.6	(50-150)
MSD	Dieldrin	100	81.2	NGL	81.2	(50-150)
RPD_MS	Dieldrin	90.600	81.200	NGL	10.9	(0-20)
LCS1	Methyl Parathion	100	128	NGL	128.0	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	128	NGL	128.0	(50-150)
MSD	Methyl Parathion	100	117	NGL	117.0	(50-150)
RPD_MS	Methyl Parathion	128.000	117.000	NGL	9.0	(0-20)
LCS1	Phenol	100	76.0	NGL	76.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	71.5	NGL	71.5	(50-150)
MSD	Phenol	100	54.5	NGL	54.5	(50-150)
RPD_MS	Phenol	71.500	54.500	NGL	27.0	(0-20)
LCS1	BHT-d21	100	64	%R	64.0	(50-150)

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City of Oklahoma City EDC
Monitoring
(continued)

MBLK	BHT-d21	100	82	%R	82.0	
MS	BHT-d21	100	68	%R	68.0	(50-150)
MSD	BHT-d21	100	63	%R	63.0	(50-150)
LCS1	Caffeine-C13	100	74	%R	74.0	(50-150)
MBLK	Caffeine-C13	100	90	%R	90.0	
MS	Caffeine-C13	100	68	%R	68.0	(50-150)
MSD	Caffeine-C13	100	55	%R	55.0	(50-150)
LCS1	TDCPP	100	116	NGL	116.0	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	110	NGL	110.0	(50-150)
MSD	TDCPP	100	95.5	NGL	95.5	(50-150)
RPD_MS	TDCPP	110.000	95.500	NGL	14.1	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	101	NGL	101.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	162	NGL	162.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	125	NGL	125.0	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	162.000	125.000	NGL	25.8	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	114	NGL	114.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	101	NGL	101.0	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	86.4	NGL	86.4	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	101.000	86.400	NGL	15.6	(0-20)
LCS1	Triphenylphosphate	100	113	NGL	113.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		
MS	Triphenylphosphate	100	106	NGL	106.0	(50-150)
MSD	Triphenylphosphate	100	81.0	NGL	81.0	(50-150)
RPD_MS	Triphenylphosphate	106.000	81.000	NGL	26.7	(0-20)
LCS1	Triclosan	100	101	NGL	101.0	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	121	NGL	121.0	(50-150)
MSD	Triclosan	100	97.5	NGL	97.5	(50-150)
RPD_MS	Triclosan	121.000	97.500	NGL	21.5	(0-20)

Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and DUP are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 222610
Project: EDC

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 11 page[s].

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Laboratory
Hits Report
#222610

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

15-nov-2007 15:00:30

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150356	DC-INFLUENT				
11/27/07	Acetaminophen		23300		ng/l	10
11/27/07	Caffeine		7180		ng/l	10
11/27/07	Carbamazepine		304		ng/l	5.0
11/27/07	Esterone		2780		ng/l	1.0
11/27/07	Gemfibrozil		2290		ng/l	10
11/27/07	Ibuprofen		1670		ng/l	10
11/27/07	Iopromide		15		ng/l	5.0
11/27/07	Progesterone		300		ng/l	1.0
11/27/07	Sulfamethoxazole		1000		ng/l	10
11/27/07	Triclosan		260		ng/l	5.0
11/27/07	Trimethoprim		100		ng/l	1.0
	2711150357	DC-2ND EFFLUENT				
11/27/07	Acetaminophen		3930		ng/l	10
11/27/07	Caffeine		5850		ng/l	10
11/27/07	Carbamazepine		120		ng/l	5.0
11/27/07	Esterone		860		ng/l	1.0
11/27/07	Estradiol		67		ng/l	1.0
11/27/07	Gemfibrozil		1310		ng/l	10
11/27/07	Ibuprofen		1650		ng/l	10
11/27/07	Iopromide		270		ng/l	5.0
11/27/07	Progesterone		8.1		ng/l	1.0
11/27/07	Sulfamethoxazole		411		ng/l	1.0
11/27/07	Triclosan		1820		ng/l	50
11/27/07	Trimethoprim		63		ng/l	1.0
11/30/07	4-Methylphenol		9910		ng/l	1250
11/21/07	Bis Phenol A (BPA)		86		ng/l	25

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Hits Report
#222610

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

15-nov-2007 15:00:30

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150357	DC-2ND EFFLUENT				
11/30/07	Caffeine by GCMS LLE		8140		ng/l	1250
11/21/07	DEET		423		ng/l	25
11/21/07	Phenol		421		ng/l	100
11/21/07	TDCPP		152		ng/l	25
11/30/07	Triclosan		1170		ng/l	500
11/21/07	Triphenylphosphate		27		ng/l	25
11/30/07	Tris (2-butoxyethyl) phosphate		2440		ng/l	1000

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#222610

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

11/15/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
DC-INFLUENT (2711150356) Sampled on 11/13/07 11:36								
				EDC screen by LC-MS-MS				
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Acetaminophen	23300	ng/l	10	10
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Caffeine	7180	ng/l	10	10
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Carbamazepine	304	ng/l	5.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Esterone	2780	ng/l	1.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Estradiol	ND	ng/l	1.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Fluoxetine	ND	ng/l	1.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Gemfibrozil	2290	ng/l	10	10
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Ibuprofen	1670	ng/l	10	10
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Iopromide	15	ng/l	5.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Progesterone	300	ng/l	1.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Sulfamethoxazole	1000	ng/l	10	10
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Triclosan	260	ng/l	5.0	1
11/20/07	11/27/07 12:53	400001	(LC-MS-MS)	Trimethoprim	100	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
DC-2ND EFFLUENT (2711150357) Sampled on 11/13/07 11:50								
				EDC screen by LC-MS-MS				
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Acetaminophen	3930	ng/l	10	10
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Caffeine	5850	ng/l	10	10
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Carbamazepine	120	ng/l	5.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Esterone	860	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Estradiol	67	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Fluoxetine	ND	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Gemfibrozil	1310	ng/l	10	10

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Laboratory
Data Report
#222610

City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Ibuprofen	1650	ng/l	10	10
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Iopromide	270	ng/l	5.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Progesterone	8.1	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Sulfamethoxazole	411	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Triclosan	1820	ng/l	50	10
11/20/07	11/27/07 13:23	400001	(LC-MS-MS)	Trimethoprim	63	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	2,6-di-tert-butylphenol	ND	ng/l	10	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	4-Methylphenol	9910	ng/l	1250	50
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	4-Nonyl Phenol	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Alpha Chlordane	ND	ng/l	10	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	Bis Phenol A (BPA)	86	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Caffeine by GCMS LLE	8140	ng/l	1250	50
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Carbaryl	ND	ng/l	50	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Chlorpyrifos	ND	ng/l	25	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	DEET	423	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Diazinon	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Dieldrin	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Methyl Parathion	ND	ng/l	25	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	Phenol	421	ng/l	100	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	TDCPP	152	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Tris (2-butoxyethyl) phosphate	2440	ng/l	1000	10
11/16/07	11/22/07 00:00	402227	(USGS4MOD)	Tris (2-chloroethyl) phosphate	ND	ng/l	25	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD)	Triphenylphosphate	27	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Triclosan	1170	ng/l	500	10
			(USGS4MOD)	BHT-d21(70-130)	10	% Rec		
			(USGS4MOD)	Caffeine-C13(70-130)	50	% Rec		

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Laboratory
QC Summary
#222610

City of Oklahoma City EDC
Monitoring

QC Ref #400001 - EDC screen by LC-MS-MS Analysis Date: 11/27/2007

2711150356	DC-INFLUENT
2711150357	DC-2ND EFFLUENT

QC Ref #402227 - EDC-Phenols-waste indic screen Analysis Date: 11/21/2007

2711150357	DC-2ND EFFLUENT
2711150357	DC-2ND EFFLUENT
2711150357	DC-2ND EFFLUENT

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Laboratory
QC Report
#222610

City of Oklahoma City EDC
Monitoring

QC Ref #400001 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	11090521	NONE		(0-0)	
LCS1	Acetaminophen	50	60.5	NGL	121.0	(70-130)	
LCS2	Acetaminophen	50	35.1	NGL	70.2	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	46.7	NGL	93.4	(70-130)	
MSD	Acetaminophen	50	51.0	NGL	102.0	(70-130)	
LCS1	Caffeine	50	46.3	NGL	92.6	(70-130)	
LCS2	Caffeine	50	50.6	NGL	101.2	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	49.0	NGL	98.0	(70-130)	
MSD	Caffeine	50	48.2	NGL	96.4	(70-130)	
LCS1	Carbamazepine	50	50.4	NGL	100.8	(70-130)	
LCS2	Carbamazepine	50	52.6	NGL	105.2	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	51.3	NGL	102.6	(70-130)	
MSD	Carbamazepine	50	50.8	NGL	101.6	(70-130)	
LCS1	Esterone	50	49.9	NGL	99.8	(70-130)	
LCS2	Esterone	50	47.4	NGL	94.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	53.5	NGL	107.0	(70-130)	
MSD	Esterone	50	51.7	NGL	103.4	(70-130)	
LCS1	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS2	Estradiol	50	47.5	NGL	95.0	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.2	NGL	102.4	(70-130)	
MSD	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	48.4	NGL	96.8	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	49.9	NGL	99.8	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
MSD	Ethinyl Estradiol -17 alpha	50	52.3	NGL	104.6	(70-130)	
LCS1	Fluoxetine	50	61.2	NGL	122.4	(70-130)	

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Fluoxetine	50	54.8	NGL	109.6	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	50	56.9	NGL	113.8	(70-130)
MSD	Fluoxetine	50	62.8	NGL	125.6	(70-130)
LCS1	Gemfibrozil	50	48.8	NGL	97.6	(70-130)
LCS2	Gemfibrozil	50	49.6	NGL	99.2	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	50	51.0	NGL	102.0	(70-130)
MSD	Gemfibrozil	50	53.4	NGL	106.8	(70-130)
LCS1	Ibuprofen	50	39	NGL	78.0	(70-130)
LCS2	Ibuprofen	50	56.5	NGL	113.0	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	50	60.8	NGL	121.6	(70-130)
MSD	Ibuprofen	50	40.7	NGL	81.4	(70-130)
LCS1	Iopromide	50	47.5	NGL	95.0	(70-130)
LCS2	Iopromide	50	43.6	NGL	87.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	50	56.8	NGL	113.6	(70-130)
MSD	Iopromide	50	55.9	NGL	111.8	(70-130)
LCS1	Progesterone	50	56.2	NGL	112.4	(70-130)
LCS2	Progesterone	50	55.5	NGL	111.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	50	50.8	NGL	101.6	(70-130)
MSD	Progesterone	50	49.1	NGL	98.2	(70-130)
LCS1	Sulfamethoxazole	50	49.4	NGL	98.8	(70-130)
LCS2	Sulfamethoxazole	50	48.2	NGL	96.4	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
MS	Sulfamethoxazole	50	46.9	NGL	93.8	(70-130)
MSD	Sulfamethoxazole	50	60.2	NGL	120.4	(70-130)
LCS1	Testosterone	50	52.2	NGL	104.4	(70-130)
LCS2	Testosterone	50	51.9	NGL	103.8	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	50	51.0	NGL	102.0	(70-130)
MSD	Testosterone	50	52.4	NGL	104.8	(70-130)
LCS1	Triclosan	50	55.1	NGL	110.2	(70-130)

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Laboratory
QC Report
#222610

City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Triclosan	50	58.1	NGL	116.2	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	62.2	NGL	124.4	(70-130)
MSD	Triclosan	50	67.3	NGL	134.6	(70-130)
LCS1	Trimethoprim	50	44.1	NGL	88.2	(70-130)
LCS2	Trimethoprim	50	52.7	NGL	105.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	37.6	NGL	75.2	(70-130)
MSD	Trimethoprim	50	46.6	NGL	93.2	(70-130)

QC Ref #402227 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	67.8	NGL	67.8	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	57.0	NGL	57.0	(50-150)	
MSD	2,6-di-tert-butylphenol	100	56.2	NGL	56.2	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	57.000	56.200	NGL	1.4	(0-20)	
LCS1	4-Methylphenol	100	51.0	NGL	51.0	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	44.1	NGL	44.1	(50-150)	
MSD	4-Methylphenol	100	38.0	NGL	38.0	(50-150)	
RPD_MS	4-Methylphenol	44.100	38.000	NGL	14.9	(0-20)	
LCS1	4-Nonyl Phenol	100	59.6	NGL	59.6	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	55.0	NGL	55.0	(50-150)	
MSD	4-Nonyl Phenol	100	47.3	NGL	47.3	(50-150)	
RPD_MS	4-Nonyl Phenol	55.000	47.300	NGL	15.1	(0-20)	
MS	Spiked sample	Lab # 27	11160574	NONE		(0-0)	
LCS1	Alpha Chlordane	100	85.7	NGL	85.7	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	66.6	NGL	66.6	(50-150)	
MSD	Alpha Chlordane	100	64.8	NGL	64.8	(50-150)	
RPD_MS	Alpha Chlordane	66.600	64.800	NGL	2.7	(0-20)	

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Laboratory
QC Report
#222610

City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Bis Phenol A (BPA)	100	47.9	NGL	47.9	(50-150)
MBLK	Bis Phenol A (BPA)	ND	<25	NGL		
MS	Bis Phenol A (BPA)	100	48.8	NGL	48.8	(50-150)
MSD	Bis Phenol A (BPA)	100	39.8	NGL	39.8	(50-150)
RPD_MS	Bis Phenol A (BPA)	48.800	39.800	NGL	20.3	(0-20)
LCS1	Caffeine by GCMS LLE	100	67.5	NGL	67.5	(50-150)
MBLK	Caffeine by GCMS LLE	ND	<25	NGL		
MS	Caffeine by GCMS LLE	100	52.4	NGL	52.4	(50-150)
MSD	Caffeine by GCMS LLE	100	52.1	NGL	52.1	(50-150)
RPD_MS	Caffeine by GCMS LLE	52.400	52.100	NGL	0.6	(0-20)
LCS1	Carbaryl	100	115	NGL	115.0	(50-150)
MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	93.1	NGL	93.1	(50-150)
MSD	Carbaryl	100	95.1	NGL	95.1	(50-150)
RPD_MS	Carbaryl	93.100	95.100	NGL	2.1	(0-20)
LCS1	Chlorpyrifos	100	93.5	NGL	93.5	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	73.8	NGL	73.8	(50-150)
MSD	Chlorpyrifos	100	70.6	NGL	70.6	(50-150)
RPD_MS	Chlorpyrifos	73.800	70.600	NGL	4.4	(0-20)
LCS1	DEET	100	89.6	NGL	89.6	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	72.3	NGL	72.3	(50-150)
MSD	DEET	100	69.0	NGL	69.0	(50-150)
RPD_MS	DEET	72.300	69.000	NGL	4.7	(0-20)
LCS1	Diazinon	100	92.0	NGL	92.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	75.7	NGL	75.7	(50-150)
MSD	Diazinon	100	68.5	NGL	68.5	(50-150)
RPD_MS	Diazinon	75.700	68.500	NGL	10.0	(0-20)
LCS1	Dieldrin	100	88.4	NGL	88.4	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	68.1	NGL	68.1	(50-150)
MSD	Dieldrin	100	67.6	NGL	67.6	(50-150)
RPD_MS	Dieldrin	68.100	67.600	NGL	0.7	(0-20)

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City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Methyl Parathion	100	95.8	NGL	95.8	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	83.6	NGL	83.6	(50-150)
MSD	Methyl Parathion	100	102	NGL	102.0	(50-150)
RPD_MS	Methyl Parathion	83.600	102.000	NGL	19.8	(0-20)
LCS1	Phenol	100	75.0	NGL	75.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	465	NGL	465.0	(50-150)
MSD	Phenol	100	87.1	NGL	87.1	(50-150)
RPD_MS	Phenol	465.000	87.100	NGL	136.9	(0-20)
LCS1	BHT-d21	100	59	%R	59.0	(50-150)
MBLK	BHT-d21	100	86	%R	86.0	
MS	BHT-d21	100	53	%R	53.0	(50-150)
MSD	BHT-d21	100	57	%R	57.0	(50-150)
LCS1	Caffeine-C13	100	71	%R	71.0	(50-150)
MBLK	Caffeine-C13	100	79	%R	79.0	
MS	Caffeine-C13	100	53	%R	53.0	(50-150)
MSD	Caffeine-C13	100	49	%R	49.0	(50-150)
LCS1	TDCPP	100	98.6	NGL	98.6	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	79.4	NGL	79.4	(50-150)
MSD	TDCPP	100	83.9	NGL	83.9	(50-150)
RPD_MS	TDCPP	79.400	83.900	NGL	5.5	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	136	NGL	136.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	160	NGL	160.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	96.4	NGL	96.4	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	160.000	96.400	NGL	49.6	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	102	NGL	102.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	78.8	NGL	78.8	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	79.0	NGL	79.0	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	78.800	79.000	NGL	0.3	(0-20)
LCS1	Triphenylphosphate	100	102	NGL	102.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		

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Laboratory
QC Report
#222610

City of Oklahoma City EDC
Monitoring
(continued)

MS	Triphenylphosphate	100	75.3	NGL	75.3	(50-150)
MSD	Triphenylphosphate	100	67.4	NGL	67.4	(50-150)
RPD_MS	Triphenylphosphate	75.300	67.400	NGL	11.1	(0-20)
LCS1	Triclosan	100	91.8	NGL	91.8	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	89.0	NGL	89.0	(50-150)
MSD	Triclosan	100	72.1	NGL	72.1	(50-150)
RPD_MS	Triclosan	89.000	72.100	NGL	21.0	(0-20)

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 222594
Project: EDC

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 10 page[s].

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Laboratory
Hits Report
#222594

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

15-nov-2007 13:55:12

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150270	NC-INFLUENT				
11/27/07	Acetaminophen		5030		ng/l	10
11/27/07	Caffeine		5460		ng/l	10
11/27/07	Carbamazepine		99		ng/l	5.0
11/27/07	Esterone		420		ng/l	1.0
11/27/07	Estradiol		96		ng/l	1.0
11/27/07	Gemfibrozil		107		ng/l	1.0
11/27/07	Ibuprofen		880		ng/l	10
11/27/07	Triclosan		66		ng/l	5.0
11/27/07	Trimethoprim		54		ng/l	1.0
	2711150273	NC-FINAL EFFLUENT				
11/21/07	Bis Phenol A (BPA)		32		ng/l	25
11/21/07	TDCPP		144		ng/l	25
11/21/07	Triclosan		96		ng/l	50
11/21/07	Tris (2-chloroethyl) phosphate		95		ng/l	25

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#222594

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

11/15/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
NC-INFLUENT (2711150270)			**Sampled on 11/13/07 12:53**					
				EDC screen by LC-MS-MS				
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Acetaminophen	5030	ng/l	10	10
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Caffeine	5460	ng/l	10	10
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Carbamazepine	99	ng/l	5.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Esterone	420	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Estradiol	96	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Fluoxetine	ND	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Gemfibrozil	107	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Ibuprofen	880	ng/l	10	10
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Iopromide	ND	ng/l	5.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Progesterone	ND	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Sulfamethoxazole	ND	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Triclosan	66	ng/l	5.0	1
11/20/07	11/27/07 21:08	400001	(LC-MS-MS)	Trimethoprim	54	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
11/16/07			(USGS4MOD)	2,6-di-tert-butylphenol		ng/l	10	1
11/16/07			(USGS4MOD)	4-Methylphenol		ng/l	25	1
11/16/07			(USGS4MOD)	4-Nonyl Phenol		ng/l	25	1
11/16/07			(USGS4MOD)	Alpha Chlordane		ng/l	10	1
11/16/07			(USGS4MOD)	Bis Phenol A (BPA)		ng/l	25	1
11/16/07			(USGS4MOD)	Caffeine by GCMS LLE		ng/l	25	1
11/16/07			(USGS4MOD)	Carbaryl		ng/l	50	1
11/16/07			(USGS4MOD)	Chlorpyrifos		ng/l	25	1
11/16/07			(USGS4MOD)	DEET		ng/l	25	1
11/16/07			(USGS4MOD)	Diazinon		ng/l	25	1

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Data Report
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City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
11/16/07			(USGS4MOD	) Dieldrin		ng/l	25	1
11/16/07			(USGS4MOD	) Methyl Parathion		ng/l	25	1
11/16/07			(USGS4MOD	) Phenol		ng/l	100	1
11/16/07			(USGS4MOD	) TDCPP		ng/l	25	1
11/16/07			(USGS4MOD	) Tris (2-butoxyethyl) phosphate		ng/l	100	1
11/16/07			(USGS4MOD	) Tris (2-chloroethyl) phosphate		ng/l	25	1
11/16/07			(USGS4MOD	) Triphenylphosphate		ng/l	25	1
11/16/07			(USGS4MOD	) Triclosan		ng/l	50	1

NC-FINAL EFFLUENT (2711150273) Sampled on 11/13/07 13:40

EDC-Phenols-waste indic screen

11/16/07	11/22/07 00:00	402227	(USGS4MOD	) 2,6-di-tert-butylphenol	ND	ng/l	10	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) 4-Methylphenol	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) 4-Nonyl Phenol	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Alpha Chlordane	ND	ng/l	10	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) Bis Phenol A (BPA)	32	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Caffeine by GCMS LLE	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Carbaryl	ND	ng/l	50	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Chlorpyrifos	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) DEET	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Diazinon	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Dieldrin	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Methyl Parathion	ND	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Phenol	ND	ng/l	100	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) TDCPP	144	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	ND	ng/l	100	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) Tris (2-chloroethyl) phosphate	95	ng/l	25	1
11/16/07	11/22/07 00:00	402227	(USGS4MOD	) Triphenylphosphate	ND	ng/l	25	1
11/16/07	11/21/07 00:00	402227	(USGS4MOD	) Triclosan	96	ng/l	50	1
			(USGS4MOD	) BHT-d21(70-130)	18	% Rec		
			(USGS4MOD	) Caffeine-C13(70-130)	42	% Rec		

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Laboratory
QC Summary
#222594

City of Oklahoma City EDC
Monitoring

QC Ref #400001 - EDC screen by LC-MS-MS Analysis Date: 11/27/2007

2711150270	NC-INFLUENT

QC Ref #402227 - EDC-Phenols-waste indic screen Analysis Date: 11/21/2007

2711150273	NC-FINAL EFFLUENT
2711150273	NC-FINAL EFFLUENT

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QC Report
#222594

City of Oklahoma City EDC
Monitoring

QC Ref #400001 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	11090521	NONE		(0-0)	
LCS1	Acetaminophen	50	60.5	NGL	121.0	(70-130)	
LCS2	Acetaminophen	50	35.1	NGL	70.2	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	46.7	NGL	93.4	(70-130)	
MSD	Acetaminophen	50	51.0	NGL	102.0	(70-130)	
LCS1	Caffeine	50	46.3	NGL	92.6	(70-130)	
LCS2	Caffeine	50	50.6	NGL	101.2	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	49.0	NGL	98.0	(70-130)	
MSD	Caffeine	50	48.2	NGL	96.4	(70-130)	
LCS1	Carbamazepine	50	50.4	NGL	100.8	(70-130)	
LCS2	Carbamazepine	50	52.6	NGL	105.2	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	51.3	NGL	102.6	(70-130)	
MSD	Carbamazepine	50	50.8	NGL	101.6	(70-130)	
LCS1	Esterone	50	49.9	NGL	99.8	(70-130)	
LCS2	Esterone	50	47.4	NGL	94.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	53.5	NGL	107.0	(70-130)	
MSD	Esterone	50	51.7	NGL	103.4	(70-130)	
LCS1	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS2	Estradiol	50	47.5	NGL	95.0	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.2	NGL	102.4	(70-130)	
MSD	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	48.4	NGL	96.8	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	49.9	NGL	99.8	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
MSD	Ethinyl Estradiol -17 alpha	50	52.3	NGL	104.6	(70-130)	
LCS1	Fluoxetine	50	61.2	NGL	122.4	(70-130)	

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Fluoxetine	SO	54.8	NGL	109.6	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	SO	56.9	NGL	113.8	(70-130)
MSD	Fluoxetine	SO	62.8	NGL	125.6	(70-130)
LCS1	Gemfibrozil	SO	48.8	NGL	97.6	(70-130)
LCS2	Gemfibrozil	SO	49.6	NGL	99.2	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	SO	51.0	NGL	102.0	(70-130)
MSD	Gemfibrozil	SO	53.4	NGL	106.8	(70-130)
LCS1	Ibuprofen	SO	39	NGL	78.0	(70-130)
LCS2	Ibuprofen	SO	56.5	NGL	113.0	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	SO	60.8	NGL	121.6	(70-130)
MSD	Ibuprofen	SO	40.7	NGL	81.4	(70-130)
LCS1	Iopromide	SO	47.5	NGL	95.0	(70-130)
LCS2	Iopromide	SO	43.6	NGL	87.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	SO	56.8	NGL	113.6	(70-130)
MSD	Iopromide	SO	55.9	NGL	111.8	(70-130)
LCS1	Progesterone	SO	56.2	NGL	112.4	(70-130)
LCS2	Progesterone	SO	55.5	NGL	111.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	SO	50.8	NGL	101.6	(70-130)
MSD	Progesterone	SO	49.1	NGL	98.2	(70-130)
LCS1	Sulfamethoxazole	SO	49.4	NGL	98.8	(70-130)
LCS2	Sulfamethoxazole	SO	48.2	NGL	96.4	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
MS	Sulfamethoxazole	SO	46.9	NGL	93.8	(70-130)
MSD	Sulfamethoxazole	SO	60.2	NGL	120.4	(70-130)
LCS1	Testosterone	SO	52.2	NGL	104.4	(70-130)
LCS2	Testosterone	SO	51.9	NGL	103.8	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	SO	51.0	NGL	102.0	(70-130)
MSD	Testosterone	SO	52.4	NGL	104.8	(70-130)
LCS1	Triclosan	SO	55.1	NGL	110.2	(70-130)

Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and DUP are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.

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City of Oklahoma City EDC
Monitoring
(continued)

LCS2	Triclosan	50	58.1	NGL	116.2	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	62.2	NGL	124.4	(70-130)
MSD	Triclosan	50	67.3	NGL	134.6	(70-130)
LCS1	Trimethoprim	50	44.1	NGL	88.2	(70-130)
LCS2	Trimethoprim	50	52.7	NGL	105.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	37.6	NGL	75.2	(70-130)
MSD	Trimethoprim	50	46.6	NGL	93.2	(70-130)

QC Ref #402227 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	67.8	NGL	67.8	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	57.0	NGL	57.0	(50-150)	
MSD	2,6-di-tert-butylphenol	100	56.2	NGL	56.2	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	57.000	56.200	NGL	1.4	(0-20)	
LCS1	4-Methylphenol	100	51.0	NGL	51.0	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	44.1	NGL	44.1	(50-150)	
MSD	4-Methylphenol	100	38.0	NGL	38.0	(50-150)	
RPD_MS	4-Methylphenol	44.100	38.000	NGL	14.9	(0-20)	
LCS1	4-Nonyl Phenol	100	59.6	NGL	59.6	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	55.0	NGL	55.0	(50-150)	
MSD	4-Nonyl Phenol	100	47.3	NGL	47.3	(50-150)	
RPD_MS	4-Nonyl Phenol	55.000	47.300	NGL	15.1	(0-20)	
MS	Spiked sample	Lab # 27	11160574	NONE		(0-0)	
LCS1	Alpha Chlordane	100	85.7	NGL	85.7	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	66.6	NGL	66.6	(50-150)	
MSD	Alpha Chlordane	100	64.8	NGL	64.8	(50-150)	
RPD_MS	Alpha Chlordane	66.600	64.800	NGL	2.7	(0-20)	

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Criteria for MS and DUP are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.

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Laboratory
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City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Bis Phenol A (BPA)	100	47.9	NGL	47.9	(50-150)
MBLK	Bis Phenol A (BPA)	ND	<25	NGL		
MS	Bis Phenol A (BPA)	100	48.8	NGL	48.8	(50-150)
MSD	Bis Phenol A (BPA)	100	39.8	NGL	39.8	(50-150)
RPD_MS	Bis Phenol A (BPA)	48.800	39.800	NGL	20.3	(0-20)
LCS1	Caffeine by GCMS LLE	100	67.5	NGL	67.5	(50-150)
MBLK	Caffeine by GCMS LLE	ND	<25	NGL		
MS	Caffeine by GCMS LLE	100	52.4	NGL	52.4	(50-150)
MSD	Caffeine by GCMS LLE	100	52.1	NGL	52.1	(50-150)
RPD_MS	Caffeine by GCMS LLE	52.400	52.100	NGL	0.6	(0-20)
LCS1	Carbaryl	100	115	NGL	115.0	(50-150)
MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	93.1	NGL	93.1	(50-150)
MSD	Carbaryl	100	95.1	NGL	95.1	(50-150)
RPD_MS	Carbaryl	93.100	95.100	NGL	2.1	(0-20)
LCS1	Chlorpyrifos	100	93.5	NGL	93.5	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	73.8	NGL	73.8	(50-150)
MSD	Chlorpyrifos	100	70.6	NGL	70.6	(50-150)
RPD_MS	Chlorpyrifos	73.800	70.600	NGL	4.4	(0-20)
LCS1	DEET	100	89.6	NGL	89.6	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	72.3	NGL	72.3	(50-150)
MSD	DEET	100	69.0	NGL	69.0	(50-150)
RPD_MS	DEET	72.300	69.000	NGL	4.7	(0-20)
LCS1	Diazinon	100	92.0	NGL	92.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	75.7	NGL	75.7	(50-150)
MSD	Diazinon	100	68.5	NGL	68.5	(50-150)
RPD_MS	Diazinon	75.700	68.500	NGL	10.0	(0-20)
LCS1	Dieldrin	100	88.4	NGL	88.4	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	68.1	NGL	68.1	(50-150)
MSD	Dieldrin	100	67.6	NGL	67.6	(50-150)
RPD_MS	Dieldrin	68.100	67.600	NGL	0.7	(0-20)

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City of Oklahoma City EDC
Monitoring
(continued)

LCS1	Methyl Parathion	100	95.8	NGL	95.8	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	83.6	NGL	83.6	(50-150)
MSD	Methyl Parathion	100	102	NGL	102.0	(50-150)
RPD_MS	Methyl Parathion	83.600	102.000	NGL	19.8	(0-20)
LCS1	Phenol	100	75.0	NGL	75.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	465	NGL	465.0	(50-150)
MSD	Phenol	100	87.1	NGL	87.1	(50-150)
RPD_MS	Phenol	465.000	87.100	NGL	136.9	(0-20)
LCS1	BHT-d21	100	59	%R	59.0	(50-150)
MBLK	BHT-d21	100	86	%R	86.0	
MS	BHT-d21	100	53	%R	53.0	(50-150)
MSD	BHT-d21	100	57	%R	57.0	(50-150)
LCS1	Caffeine-C13	100	71	%R	71.0	(50-150)
MBLK	Caffeine-C13	100	79	%R	79.0	
MS	Caffeine-C13	100	53	%R	53.0	(50-150)
MSD	Caffeine-C13	100	49	%R	49.0	(50-150)
LCS1	TDCPP	100	98.6	NGL	98.6	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	79.4	NGL	79.4	(50-150)
MSD	TDCPP	100	83.9	NGL	83.9	(50-150)
RPD_MS	TDCPP	79.400	83.900	NGL	5.5	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	136	NGL	136.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	160	NGL	160.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	96.4	NGL	96.4	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	160.000	96.400	NGL	49.6	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	102	NGL	102.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	78.8	NGL	78.8	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	79.0	NGL	79.0	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	78.800	79.000	NGL	0.3	(0-20)
LCS1	Triphenylphosphate	100	102	NGL	102.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		

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Laboratory
QC Report
#222594

City of Oklahoma City EDC
Monitoring
(continued)

MS	Triphenylphosphate	100	75.3	NGL	75.3	(50-150)
MSD	Triphenylphosphate	100	67.4	NGL	67.4	(50-150)
RPD_MS	Triphenylphosphate	75.300	67.400	NGL	11.1	(0-20)
LCS1	Triclosan	100	91.8	NGL	91.8	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	89.0	NGL	89.0	(50-150)
MSD	Triclosan	100	72.1	NGL	72.1	(50-150)
RPD_MS	Triclosan	89.000	72.100	NGL	21.0	(0-20)

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Laboratory Report

for

City of Oklahoma City EDC Monitoring
Lake Hefner Water TP

3827 West Hefner Road

Oklahoma City , OK 73120

Attention: Todd Brewer
Fax: (405) 749-3099

ACCREDITED IN ACCORDANCE WITH nelac 01114CA

MAG Matthew Allen Glover
Project Manager

Report#: 222621
Project: EDC

Laboratory certifies that the test results meet all **NELAC** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 10 page[s].

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Laboratory
Hits Report
#222621

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

15-nov-2007 15:53:48

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2711150406	DC-PRIMARY EFF				
11/27/07	Acetaminophen		7090		ng/l	10
11/27/07	Caffeine		96800		ng/l	10
11/27/07	Carbamazepine		206		ng/l	5.0
11/27/07	Gemfibrozil		1400		ng/l	10
11/27/07	Ibuprofen		990		ng/l	1.0
11/27/07	Iopromide		164		ng/l	5.0
11/27/07	Progesterone		60		ng/l	1.0
11/27/07	Sulfamethoxazole		35		ng/l	10
11/27/07	Triclosan		300		ng/l	50
11/27/07	Trimethoprim		86		ng/l	1.0
11/30/07	4-Methylphenol		76800		ng/l	2500
11/30/07	Caffeine by GCMS LLE		35700		ng/l	2500
11/30/07	Phenol		2510		ng/l	2000
11/30/07	Triclosan		2460		ng/l	1000
11/30/07	Tris (2-butoxyethyl) phosphate		9840		ng/l	2000

SUMMARY OF POSITIVE DATA ONLY.

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Laboratory
Data Report
#222621

City of Oklahoma City EDC
Monitoring
Todd Brewer
Lake Hefner Water TP
3827 West Hefner Road
Oklahoma City , OK 73120

Samples Received

11/15/07

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
DC-PRIMARY EFF (2711150406) Sampled on 11/13/07 11:22								
				EDC screen by LC-MS-MS				
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Acetaminophen	7090	ng/l	10	10
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Caffeine	96800	ng/l	10	10
11/19/07	11/27/07 00:00	400001	(LC-MS-MS)	Carbamazepine	206	ng/l	5.0	1
11/19/07	11/27/07 00:00	400001	(LC-MS-MS)	Esterone	ND	ng/l	1.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Estradiol	ND	ng/l	1.0	1
11/19/07	11/27/07 00:00	400001	(LC-MS-MS)	Ethinyl Estradiol -17 alpha	ND	ng/l	5.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Fluoxetine	ND	ng/l	1.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Gemfibrozil	1400	ng/l	10	10
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Ibuprofen	990	ng/l	1.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Iopromide	164	ng/l	5.0	1
11/19/07	11/27/07 00:00	400001	(LC-MS-MS)	Progesterone	60	ng/l	1.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Sulfamethoxazole	35	ng/l	10	10
11/19/07	11/27/07 00:00	400001	(LC-MS-MS)	Testosterone	ND	ng/l	1.0	1
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Triclosan	300	ng/l	50	10
11/19/07	11/27/07 18:12	400001	(LC-MS-MS)	Trimethoprim	86	ng/l	1.0	1
			(LC-MS-MS)	Caffeine-C13(70-130)	NA	% Rec		
				EDC-Phenols-waste indic screen				
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	2,6-di-tert-butylphenol	ND	ng/l	10	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	4-Methylphenol	76800	ng/l	2500	100
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	4-Nonyl Phenol	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Alpha Chlordane	ND	ng/l	10	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Bis Phenol A (BPA)	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Caffeine by GCMS LLE	35700	ng/l	2500	100
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Carbaryl	ND	ng/l	50	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Chlorpyrifos	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	DEET	ND	ng/l	500	20
11/16/07	11/30/07 00:00	402227	(USGS4MOD)	Diazinon	ND	ng/l	25	1

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Laboratory
Data Report
#222621

City of Oklahoma City EDC
Monitoring
(continued)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Dieldrin	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Methyl Parathion	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Phenol	2510	ng/l	2000	20
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) TDCPP	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Tris (2-butoxyethyl) phosphate	9840	ng/l	2000	20
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Tris (2-chloroethyl) phosphate	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Triphenylphosphate	ND	ng/l	25	1
11/16/07	11/30/07 00:00	402227	(USGS4MOD	) Triclosan	2460	ng/l	1000	20
			(USGS4MOD	) BHT-d21(70-130)	0	% Rec		
			(USGS4MOD	) Caffeine-C13(70-130)	0	% Rec		

DC-INFLUENT (2711150409) Sampled on 11/13/07 11:36

EDC-Phenols-waste indic screen

11/16/07			(USGS4MOD	) 2,6-di-tert-butylphenol		ng/l	10	1
11/16/07			(USGS4MOD	) 4-Methylphenol		ng/l	25	1
11/16/07			(USGS4MOD	) 4-Nonyl Phenol		ng/l	25	1
11/16/07			(USGS4MOD	) Alpha Chlordane		ng/l	10	1
11/16/07			(USGS4MOD	) Bis Phenol A (BPA)		ng/l	25	1
11/16/07			(USGS4MOD	) Caffeine by GCMS LLE		ng/l	25	1
11/16/07			(USGS4MOD	) Carbaryl		ng/l	50	1
11/16/07			(USGS4MOD	) Chlorpyrifos		ng/l	25	1
11/16/07			(USGS4MOD	) DEET		ng/l	25	1
11/16/07			(USGS4MOD	) Diazinon		ng/l	25	1
11/16/07			(USGS4MOD	) Dieldrin		ng/l	25	1
11/16/07			(USGS4MOD	) Methyl Parathion		ng/l	25	1
11/16/07			(USGS4MOD	) Phenol		ng/l	100	1
11/16/07			(USGS4MOD	) TDCPP		ng/l	25	1
11/16/07			(USGS4MOD	) Tris (2-butoxyethyl) phosphate		ng/l	100	1
11/16/07			(USGS4MOD	) Tris (2-chloroethyl) phosphate		ng/l	25	1
11/16/07			(USGS4MOD	) Triphenylphosphate		ng/l	25	1
11/16/07			(USGS4MOD	) Triclosan		ng/l	50	1

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Laboratory
QC Summary
#222621

City of Oklahoma City EDC
Monitoring

QC Ref #400001 - EDC screen by LC-MS-MS Analysis Date: 11/27/2007

2711150406	DC-PRIMARY EFF
2711150406	DC-PRIMARY EFF

QC Ref #402227 - EDC-Phenols-waste indic screenAnalysis Date: 11/30/2007

2711150406	DC-PRIMARY EFF

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Laboratory
QC Report
#222621

City of Oklahoma City EDC
Monitoring

QC Ref #400001 EDC screen by LC-MS-MS

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 27	11090521	NONE		(0-0)	
LCS1	Acetaminophen	50	60.5	NGL	121.0	(70-130)	
LCS2	Acetaminophen	50	35.1	NGL	70.2	(70-130)	
MBLK	Acetaminophen	ND	<1.0	NGL			
MS	Acetaminophen	50	46.7	NGL	93.4	(70-130)	
MSD	Acetaminophen	50	51.0	NGL	102.0	(70-130)	
LCS1	Caffeine	50	46.3	NGL	92.6	(70-130)	
LCS2	Caffeine	50	50.6	NGL	101.2	(70-130)	
MBLK	Caffeine	ND	<1.0	NGL			
MS	Caffeine	50	49.0	NGL	98.0	(70-130)	
MSD	Caffeine	50	48.2	NGL	96.4	(70-130)	
LCS1	Carbamazepine	50	50.4	NGL	100.8	(70-130)	
LCS2	Carbamazepine	50	52.6	NGL	105.2	(70-130)	
MBLK	Carbamazepine	ND	<5.0	NGL			
MS	Carbamazepine	50	51.3	NGL	102.6	(70-130)	
MSD	Carbamazepine	50	50.8	NGL	101.6	(70-130)	
LCS1	Esterone	50	49.9	NGL	99.8	(70-130)	
LCS2	Esterone	50	47.4	NGL	94.8	(70-130)	
MBLK	Esterone	ND	<1.0	NGL			
MS	Esterone	50	53.5	NGL	107.0	(70-130)	
MSD	Esterone	50	51.7	NGL	103.4	(70-130)	
LCS1	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS2	Estradiol	50	47.5	NGL	95.0	(70-130)	
MBLK	Estradiol	ND	<1.0	NGL			
MS	Estradiol	50	51.2	NGL	102.4	(70-130)	
MSD	Estradiol	50	51.3	NGL	102.6	(70-130)	
LCS1	Ethinyl Estradiol -17 alpha	50	48.4	NGL	96.8	(70-130)	
LCS2	Ethinyl Estradiol -17 alpha	50	49.9	NGL	99.8	(70-130)	
MBLK	Ethinyl Estradiol -17 alpha	ND	<5.0	NGL			
MS	Ethinyl Estradiol -17 alpha	50	53.0	NGL	106.0	(70-130)	
MSD	Ethinyl Estradiol -17 alpha	50	52.3	NGL	104.6	(70-130)	
LCS1	Fluoxetine	50	61.2	NGL	122.4	(70-130)	

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LCS2	Fluoxetine	50	54.8	NGL	109.6	(70-130)
MBLK	Fluoxetine	ND	<1.0	NGL		
MS	Fluoxetine	50	56.9	NGL	113.8	(70-130)
MSD	Fluoxetine	50	62.8	NGL	125.6	(70-130)
LCS1	Gemfibrozil	50	48.8	NGL	97.6	(70-130)
LCS2	Gemfibrozil	50	49.6	NGL	99.2	(70-130)
MBLK	Gemfibrozil	ND	<1.0	NGL		
MS	Gemfibrozil	50	51.0	NGL	102.0	(70-130)
MSD	Gemfibrozil	50	53.4	NGL	106.8	(70-130)
LCS1	Ibuprofen	50	39	NGL	78.0	(70-130)
LCS2	Ibuprofen	50	56.5	NGL	113.0	(70-130)
MBLK	Ibuprofen	ND	<1.0	NGL		
MS	Ibuprofen	50	60.8	NGL	121.6	(70-130)
MSD	Ibuprofen	50	40.7	NGL	81.4	(70-130)
LCS1	Iopromide	50	47.5	NGL	95.0	(70-130)
LCS2	Iopromide	50	43.6	NGL	87.2	(70-130)
MBLK	Iopromide	ND	<5.0	NGL		
MS	Iopromide	50	56.8	NGL	113.6	(70-130)
MSD	Iopromide	50	55.9	NGL	111.8	(70-130)
LCS1	Progesterone	50	56.2	NGL	112.4	(70-130)
LCS2	Progesterone	50	55.5	NGL	111.0	(70-130)
MBLK	Progesterone	ND	<1.0	NGL		
MS	Progesterone	50	50.8	NGL	101.6	(70-130)
MSD	Progesterone	50	49.1	NGL	98.2	(70-130)
LCS1	Sulfamethoxazole	50	49.4	NGL	98.8	(70-130)
LCS2	Sulfamethoxazole	50	48.2	NGL	96.4	(70-130)
MBLK	Sulfamethoxazole	ND	<1.0	NGL		
MS	Sulfamethoxazole	50	46.9	NGL	93.8	(70-130)
MSD	Sulfamethoxazole	50	60.2	NGL	120.4	(70-130)
LCS1	Testosterone	50	52.2	NGL	104.4	(70-130)
LCS2	Testosterone	50	51.9	NGL	103.8	(70-130)
MBLK	Testosterone	ND	<1.0	NGL		
MS	Testosterone	50	51.0	NGL	102.0	(70-130)
MSD	Testosterone	50	52.4	NGL	104.8	(70-130)
LCS1	Triclosan	50	55.1	NGL	110.2	(70-130)

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LCS2	Triclosan	50	58.1	NGL	116.2	(70-130)
MBLK	Triclosan	ND	<5.0	NGL		
MS	Triclosan	50	62.2	NGL	124.4	(70-130)
MSD	Triclosan	50	67.3	NGL	134.6	(70-130)
LCS1	Trimethoprim	50	44.1	NGL	88.2	(70-130)
LCS2	Trimethoprim	50	52.7	NGL	105.4	(70-130)
MBLK	Trimethoprim	ND	<1.0	NGL		
MS	Trimethoprim	50	37.6	NGL	75.2	(70-130)
MSD	Trimethoprim	50	46.6	NGL	93.2	(70-130)

QC Ref #402227 EDC-Phenols-waste indic screen

QC	Analyte	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPD (%)
LCS1	2,6-di-tert-butylphenol	100	67.8	NGL	67.8	(50-150)	
MBLK	2,6-di-tert-butylphenol	ND	<10	NGL			
MS	2,6-di-tert-butylphenol	100	57.0	NGL	57.0	(50-150)	
MSD	2,6-di-tert-butylphenol	100	56.2	NGL	56.2	(50-150)	
RPD_MS	2,6-di-tert-butylphenol	57.000	56.200	NGL	1.4	(0-20)	
LCS1	4-Methylphenol	100	51.0	NGL	51.0	(50-150)	
MBLK	4-Methylphenol	ND	<25	NGL			
MS	4-Methylphenol	100	44.1	NGL	44.1	(50-150)	
MSD	4-Methylphenol	100	38.0	NGL	38.0	(50-150)	
RPD_MS	4-Methylphenol	44.100	38.000	NGL	14.9	(0-20)	
LCS1	4-Nonyl Phenol	100	59.6	NGL	59.6	(50-150)	
MBLK	4-Nonyl Phenol	ND	<25	NGL			
MS	4-Nonyl Phenol	100	55.0	NGL	55.0	(50-150)	
MSD	4-Nonyl Phenol	100	47.3	NGL	47.3	(50-150)	
RPD_MS	4-Nonyl Phenol	55.000	47.300	NGL	15.1	(0-20)	
MS	Spiked sample	Lab # 27	11160574	NONE		(0-0)	
LCS1	Alpha Chlordane	100	85.7	NGL	85.7	(50-150)	
MBLK	Alpha Chlordane	ND	<10	NGL			
MS	Alpha Chlordane	100	66.6	NGL	66.6	(50-150)	
MSD	Alpha Chlordane	100	64.8	NGL	64.8	(50-150)	
RPD_MS	Alpha Chlordane	66.600	64.800	NGL	2.7	(0-20)	

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LCS1	Bis Phenol A (BPA)	100	47.9	NGL	47.9	(50-150)
MBLK	Bis Phenol A (BPA)	ND	<25	NGL		
MS	Bis Phenol A (BPA)	100	48.8	NGL	48.8	(50-150)
MSD	Bis Phenol A (BPA)	100	39.8	NGL	39.8	(50-150)
RPD_MS	Bis Phenol A (BPA)	48.800	39.800	NGL	20.3	(0-20)
LCS1	Caffeine by GCMS LLE	100	67.5	NGL	67.5	(50-150)
MBLK	Caffeine by GCMS LLE	ND	<25	NGL		
MS	Caffeine by GCMS LLE	100	52.4	NGL	52.4	(50-150)
MSD	Caffeine by GCMS LLE	100	52.1	NGL	52.1	(50-150)
RPD_MS	Caffeine by GCMS LLE	52.400	52.100	NGL	0.6	(0-20)
LCS1	Carbaryl	100	115	NGL	115.0	(50-150)
MBLK	Carbaryl	ND	<50	NGL		
MS	Carbaryl	100	93.1	NGL	93.1	(50-150)
MSD	Carbaryl	100	95.1	NGL	95.1	(50-150)
RPD_MS	Carbaryl	93.100	95.100	NGL	2.1	(0-20)
LCS1	Chlorpyrifos	100	93.5	NGL	93.5	(50-150)
MBLK	Chlorpyrifos	ND	<25	NGL		
MS	Chlorpyrifos	100	73.8	NGL	73.8	(50-150)
MSD	Chlorpyrifos	100	70.6	NGL	70.6	(50-150)
RPD_MS	Chlorpyrifos	73.800	70.600	NGL	4.4	(0-20)
LCS1	DEET	100	89.6	NGL	89.6	(50-150)
MBLK	DEET	ND	<25	NGL		
MS	DEET	100	72.3	NGL	72.3	(50-150)
MSD	DEET	100	69.0	NGL	69.0	(50-150)
RPD_MS	DEET	72.300	69.000	NGL	4.7	(0-20)
LCS1	Diazinon	100	92.0	NGL	92.0	(50-150)
MBLK	Diazinon	ND	<25	NGL		
MS	Diazinon	100	75.7	NGL	75.7	(50-150)
MSD	Diazinon	100	68.5	NGL	68.5	(50-150)
RPD_MS	Diazinon	75.700	68.500	NGL	10.0	(0-20)
LCS1	Dieldrin	100	88.4	NGL	88.4	(50-150)
MBLK	Dieldrin	ND	<25	NGL		
MS	Dieldrin	100	68.1	NGL	68.1	(50-150)
MSD	Dieldrin	100	67.6	NGL	67.6	(50-150)
RPD_MS	Dieldrin	68.100	67.600	NGL	0.7	(0-20)

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LCS1	Methyl Parathion	100	95.8	NGL	95.8	(50-150)
MBLK	Methyl Parathion	ND	<25	NGL		
MS	Methyl Parathion	100	83.6	NGL	83.6	(50-150)
MSD	Methyl Parathion	100	102	NGL	102.0	(50-150)
RPD_MS	Methyl Parathion	83.600	102.000	NGL	19.8	(0-20)
LCS1	Phenol	100	75.0	NGL	75.0	(50-150)
MBLK	Phenol	ND	<100	NGL		
MS	Phenol	100	465	NGL	465.0	(50-150)
MSD	Phenol	100	87.1	NGL	87.1	(50-150)
RPD_MS	Phenol	465.000	87.100	NGL	136.9	(0-20)
LCS1	BHT-d21	100	59	%R	59.0	(50-150)
MBLK	BHT-d21	100	86	%R	86.0	
MS	BHT-d21	100	53	%R	53.0	(50-150)
MSD	BHT-d21	100	57	%R	57.0	(50-150)
LCS1	Caffeine-C13	100	71	%R	71.0	(50-150)
MBLK	Caffeine-C13	100	79	%R	79.0	
MS	Caffeine-C13	100	53	%R	53.0	(50-150)
MSD	Caffeine-C13	100	49	%R	49.0	(50-150)
LCS1	TDCPP	100	98.6	NGL	98.6	(50-150)
MBLK	TDCPP	ND	<25	NGL		
MS	TDCPP	100	79.4	NGL	79.4	(50-150)
MSD	TDCPP	100	83.9	NGL	83.9	(50-150)
RPD_MS	TDCPP	79.400	83.900	NGL	5.5	(0-20)
LCS1	Tris (2-butoxyethyl) phosphate	100	136	NGL	136.0	(50-150)
MBLK	Tris (2-butoxyethyl) phosphate	ND	<100	NGL		
MS	Tris (2-butoxyethyl) phosphate	100	160	NGL	160.0	(50-150)
MSD	Tris (2-butoxyethyl) phosphate	100	96.4	NGL	96.4	(50-150)
RPD_MS	Tris (2-butoxyethyl) phosphate	160.000	96.400	NGL	49.6	(0-20)
LCS1	Tris (2-chloroethyl) phosphate	100	102	NGL	102.0	(50-150)
MBLK	Tris (2-chloroethyl) phosphate	ND	<25	NGL		
MS	Tris (2-chloroethyl) phosphate	100	78.8	NGL	78.8	(50-150)
MSD	Tris (2-chloroethyl) phosphate	100	79.0	NGL	79.0	(50-150)
RPD_MS	Tris (2-chloroethyl) phosphate	78.800	79.000	NGL	0.3	(0-20)
LCS1	Triphenylphosphate	100	102	NGL	102.0	(50-150)
MBLK	Triphenylphosphate	ND	<25	NGL		

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MS	Triphenylphosphate	100	75.3	NGL	75.3	(50-150)
MSD	Triphenylphosphate	100	67.4	NGL	67.4	(50-150)
RPD_MS	Triphenylphosphate	75.300	67.400	NGL	11.1	(0-20)
LCS1	Triclosan	100	91.8	NGL	91.8	(50-150)
MBLK	Triclosan	ND	<50	NGL		
MS	Triclosan	100	89.0	NGL	89.0	(50-150)
MSD	Triclosan	100	72.1	NGL	72.1	(50-150)
RPD_MS	Triclosan	89.000	72.100	NGL	21.0	(0-20)

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APPENDIX B

The Top 200 Prescriptions* for 2000 by Number of US Prescriptions Dispensed
Generic name link leads to Drug Monograph information where available.

View List Alphabetically

Brand Name	Manufacturer	Generic Name
Hydrocodone w/APAP	Various	Hydrocodone w/APAP
Lipitor	Parke-Davis	Atorvastatin
Premarin	Wyeth-Ayerst	Conjugated Estrogens
Synthroid	Knoll	Levothyroxine
Atenolol	Various	Atenolol
Furosemide (oral)	Various	Furosemide
Prilosec	Astra	Omeprazole
Albuterol	Various	Albuterol
Norvasc	Pfizer	Amlodipine
Alprazolam	Various	Alprazolam
Propoxyphene N/APAP	Various	Propoxyphene N/APAP
Glucophage	B-M Squibb	Metformin
Cephalexin	Various	Cephalexin
Amoxicillin	Various	Amoxicillin
Claritin	Schering	Loratadine
Trimox	Apothecon	Amoxicillin
Hydrochlorothiazide	Various	Hydrochlorothiazide
Zoloft	Pfizer	Sertraline
Zithromax (Z-Pack)	Pfizer	Azithromycin
Prozac	Lilly	Fluoxetine
Ibuprofen	Various	Ibuprofen
Paxil	SK Beecham	Paroxetine
Triamterene/HCTZ	Various	Triamterene/HCTZ
Celebrex	Searle	Celecoxib
Acetaminophen/Codeine	Various	Acetaminophen/Codeine
Prevacid	Tap Pharm	Lansoprazole
Zestril	Zeneca	Lisinopril

Augmentin	SK Beecham	Amoxicillin/Clavulanate
Prempro	Wyeth-Ayerst	Conj. Estrogens/Medroxyprogesterone
Prednisone (oral)	Various	Prednisone
Zocor	Merck	Simvastatin
Vioxx	Merck	Rofecoxib
Ortho Tri-Cyclen	Ortho Pharm	Norgestimate/Ethinyl Estradiol
Lorazepam	Various	Lorazepam
Trimethoprim/Sulfa	Various	Trimeth/Sulfameth
Lanoxin	Glaxo Wellcome	Digoxin
Metoprolol Tartrate	Various	Metoprolol
Amitriptyline	Various	Amitriptyline
Ranitidine	Various	Ranitidine
Levoxyl	Jones Medical Ind	Levothyroxine
Allegra	Hoech Mar R	Fexofenadine
Amoxil	SK Beecham	Amoxicillin
Cipro	Bayer Pharm	Ciprofloxacin
Ambien	Searle	Zolpidem
Zyrtec	Pfizer	Cetirizine
Naproxen	Various	Naproxen
Coumadin	Dupont	Warfarin
Accupril	Parke-Davis	Quinapril
Pravachol	B-M Squibb	Pravastatin
Viagra	Pfizer	Sildenafil Citrate
Glyburide	Various	Glyburide
Cyclobenzaprine	Various	Cyclobenzaprine
Toprol-XL	Astra	Metoprolol
Ultram	McNeil	Tramadol
Glucotrol XL	Pfizer	Glipizide
Flonase	Glaxo Wellcome	Fluticasone
Verapamil SR	Various	Verapamil
Trazodone	Various	Trazodone
Prinivil	Merck	Lisinopril
Diazepam	Mylan	Diazepam
Clonazepam	Various	Clonazepam
Celexa	Forest Pharm	Citalopram
Neurontin	Parke-Davis	Gabapentin
Vasotec	Merck	Enalapril
Medroxyprogesterone	Various	Medroxyprogesterone
K-Dur	Key Pharm	Potassium Chloride
Fosamax	Merck	Alendronate

Wellbutrin SR	Glaxo Well	Bupropion HCL
Carisoprodol	Various	Carisoprodol
Diflucan	Pfizer	Fluconazole
Levaquin	McNeil	Levofloxacin
Potassium Chloride	Various	Potassium Chloride
Doxycycline	Various	Doxycycline
Lotensin	Novartis	Benazepril
Flovent	Glaxo Wellcome	Fluticasone Propionate
Albuterol (nebulized)	Various	Albuterol
Singulair	Schein	Montelukast
Effexor XR	Wyeth-Ayerst	Venlafaxine
Cardura	Pfizer	Doxazosin
Biaxin	Abbott	Clarithromycin
Depakote	Abbott	Divalproex
Allopurinol	Various	Allopurinol
Isosorbide Mononitrate	Various	Isosorbide Mononitrate S.A.
Zithromax (susp)	Pfizer	Azithromycin
Humulin N	Lilly	Human Insulin NPH
Methylprednisolone	Various	Methylprednisolone
Estradiol	Various	Estradiol
Nasonex	Schering	Mometasone
Veetids	Apothecon	Penicillin VK
Cozaar	Merck	Losartan
Claritin D 12HR	Schering	Loratidine/Pseudoephedrine
Clonidine	Various	Clonidine
Warfarin	Various	Warfarin
Claritin D 24HR	Schering	Loratidine/Pseudoephedrine
Xalatan	Pharmacia/Upjohn	Latanoprost
Adderall	Shire Rchwd	Amphetamine Mixed Salts
Serevent	Glaxo Wellcome	Salmeterol
Monopril	B-M Squibb	Fosinopril
Temazepam	Various	Temazepam
Risperdal	Janssen	Risperidone
Hydroxyzine	Various	Hydroxyzine
Meclizine	Various	Meclizine
Cartia XT	Andrx	Diltiazem
Pepcid	Merck	Famotidine
Plavix	Sanofi	Clopidogrel
Allegra-D	Hoech Mar R	Fexofenadine / Pseudoephedrine
Triphasil	Wyeth-Ayerst	L-Norgestrel/Ethinyl Estradiol

Ortho-Novum 7/7/7	Ortho Pharm	Norethindrone/Ethinyl Estradiol
Cefzil	B-M Squibb	Cefprozil
Ziac	Lederle	Bisoprolol/HCTZ
Adalat CC	Bayer Pharm	Nifedipine
Dilantin	Parke-Davis	Phenytoin
Folic Acid	Various	Folic Acid
Penicillin VK	Various	Penicillin VK
Metronidazole	Various	Metronidazole
Diovan	Novartis	Valsartan
Guaifenesin/Phenylpropanolamine	Various	Guaifenesin / Phenylpropanolamine
Oxycontin	Purdue	Oxycodone
Oxycodone / APAP	Various	Oxycodone / APAP
Evista	Lilly	Raloxifene
Lotrel	Novartis	Amlodipine/Benazepril
Gemfibrozil	Various	Gemfibrozil
Propranolol	Various	Propranolol
Lotrisone	Key	Clotrimazole/Betamethasone
Ceftin	Glaxo Wellcome	Cefuroxime
Amaryl	Hoech Mar R	Glimepiride
Avandia	SK-Beecham	Rosiglitazone maleate
Procardia XL	Pfizer	Nifedipine
Zyprexa	Lilly	Olanzapine
Terazosin	Various	Terazosin
Butalbital / APAP/ Caffiene	Various	Butalbital / APAP/ Caffiene
Glipizide	Various	Glipizide
Promethazine (tabs)	Various	Promethazine
Triamcinolone (topical)	Various	Triamcinolone
Alesse	Wyeth-Ayerst	Levonorgestrel/Ethinyl Estradiol
Captopril	Various	Captopril
Humulin 70/30	Lilly	Human Insulin 70/30
Acyclovir	Various	Acyclovir
Methylphenidate	Various	Methylphenidate
Lescol	Novartis	Fluvastatin
Hyzaar	Merck	Losartan/HCTZ
Minocycline	Various	Minocycline
Relafen	SK Beecham	Nabumetone
Combivent	Boehr Ingel	Ipratropium / Albuterol
Metoclopramide	Various	Metoclopramide
Zestoretic	Zeneca	Lisinopril/HCTZ
Levothroid	Forest	Levothyroxine

Promethazine / Codeine	Various	Promethazine / Codeine
Serzone	B-M Squibb	Nefazodone
Spironolactone	Various	Spironolactone
Ortho-Cyclen	Ortho Pharm	Norgestimate/Ethinyl Estradiol
Cimetidine	Various	Cimetidine
Necon 1/35	Watson	Ethinyl Estradiol / Norethindrone
Roxicet	Roxane	Oxycodone/APAP
Detrol	Pharmacia-Upjohn	Tolterodine
Macrobid	Procter & Gamble	Nitrofurantoin
Klor-Con	Upsher-Smith	Potassium Chloride
Imitrex	Glaxo Wellcome	Sumatriptan
Baycol	Bayer	Cerivastatin
Bactroban	SK Beecham	Mupirocin
Cardizem CD	Hoech Mar R	Diltiazem
Nortriptyline	Various	Nortriptyline
Flomax	Abbott	Tamsulosin
Avapro	B-M Squibb	Irbesartan
Actos	Takeda	Pioglitazone
Lo/Ovral	Wyeth-Ayerst	Norgestrel/Ethinyl Estradiol
Altace	Monarch	Ramipril
Albuterol (Liquid)	Various	Albuterol
Miacalcin	Novartis	Calcitonin Salmon
Claritin Reditabs	Schering	Loratadine
Atrovent	Boehr Ingel	Ipratropium
Naproxen Sodium	Various	Naproxen Sodium
Plendil	Astra	Felodipine
Clindamycin	Various	Clindamycin
Valtrex	Glaxo Wellcome	Valacyclovir
Tamoxifen	Various	Tamoxifen
Phenobarbital	Various	Phenobarbital
BuSpar	B-M Squibb	Buspirone
Tiazac	Forest	Diltiazem
Proventil HFA	Key	Albuterol
Azmacort	RPR Pharm	Triamcinolone aerosol
Phenazopyridine	Various	Phenazopyridine
Remeron	Organon	Mirtazapine
Benzonatate	Various	Benzonatate
Nitroglycerin	Various	Nitroglycerin
Theophylline SR	Various	Theophylline
Vicoprofen	Knoll	Hydrocodone / Ibuprofen

Ery-Tab	Abbott	Erythromycin
Loestrin Fe 1/20	Parke Davis	Norethindrone / Ethinyl Estradiol
Elocon	Schering	Mometasone
Diovan HCT	Novartis	Valsartan / HCTZ
Hyoscyamine	Various	Hyoscyamine
Doxepin	Various	Doxepin
Digoxin	Various	Digoxin
Aciphex	Eisai	Rabeprazole
Tobradex	Alcon	Tobramycin/Dexamethasone
Diclofenac Sodium	Various	Diclofenac
Zyrtec Syrup	Pfizer	Cetirizine
Mircette	Organon	Desogestrel/Ethinyl Estradiol
Methocarbamol	Various	Methocarbamol

Previous Years: 1999 1998 1997 1996 1995

*Source: Scott-Levin, Newton PA - Based on more than 2.04 billion prescriptions

The Top 200 Prescriptions for 2002 by Number of US Prescriptions Dispensed
[Click Here for Alphabetical Listing]
Generic name link leads to Drug Monograph information where available.

Based upon more than 3.05 billion prescriptions: Data furnished by NDC Health

Brand Name	Manufacturer	Generic Name
Hydrocodone w/APAP	Various	Hydrocodone w/APAP
Lipitor	Pfizer	Atorvastatin
Atenolol	Various	Atenolol
Synthroid	Knoll	Levothyroxine
Premarin	Wyeth-Ayerst	Conjugated Estrogens
Zithromax	Pfizer	Azithromycin
Furosemide	Various	Furosemide
Amoxicillin	Various	Amoxicillin
Norvasc	Pfizer	Amlodipine
Hydrochlorothiazide	Various	Hydrochlorothiazide
Alprazolam	Various	Alprazolam
Albuterol Aerosol	Various	Albuterol
Zoloft	Pfizer	Sertraline
Paxil	GlaxoSmithKline	Paroxetine
Zocor	Merck	Simvastatin
Prevacid	Tap Pharm	Lansoprazole
Ibuprofen	Various	Ibuprofen
Triamterene/HCTZ	Various	Triamterene/HCTZ
Toprol-XL	AstraZeneca	Metoprolol
Cephalexin	Various	Cephalexin
Celebrex	Searle	Celecoxib
Zyrtec	Pfizer	Cetirizine
Levoxyl	Jones Medical Ind	Levothyroxine
Allegra	Hoech Mar R	Fexofenadine
Ortho Tri-Cyclen	Ortho-McNeil	Norgestimate/Ethinyl Estradiol
Celexa	Forest Pharm	Citalopram
Prednisone	Various	Prednisone
Prilosec	AstraZeneca	Omeprazole
Vioxx	Merck	Rofecoxib
Claritin	Schering	Loratadine
Fluoxetine	Various	Fluoxetine
Acetaminophen/Codeine	Various	Acetaminophen/Codeine
Ambien	Searle	Zolpidem
Metoprolol Tartrate	Various	Metoprolol
Lorazepam	Various	Lorazepam

Fosamax	Merck	Alendronate
Propoxyphene N/APAP	Various	Propoxyphene N/APAP
Metformin	Various	Metformin
Ranitidine HCl	Various	Ranitidine
Amitriptyline	Various	Amitriptyline
Viagra	Pfizer	Sildenafil Citrate
Prempro	Wyeth-Ayerst	Conj. Estrogens/Medroxyprogesterone
Trimox	Apothecon	Amoxicillin
Neurontin	Parke-Davis	Gabapentin
Wellbutrin SR	Glaxo Well	Bupropion HCL
Pravachol	B-M Squibb	Pravastatin
Augmentin	GlaxoSmithKline	Amoxicillin/Clavulanate
Nexium	AstraZeneca	Esomeprazole
Accupril	Parke-Davis	Quinapril
Lisinopril	Various	Lisinopril
Effexor XR	Wyeth-Ayerst	Venlafaxine
Singulair	Schein	Montelukast
Zestril	AstraZeneca	Lisinopril
Potassium Chloride	Various	Potassium Chloride
Clonazepam	Various	Clonazepam
Naproxen	Various	Naproxen
Warfarin	Various	Warfarin
Trazodone	Various	Trazodone
Cipro	Bayer Pharm	Ciprofloxacin
Flonase	GlaxoSmithKline	Fluticasone
Cyclobenzaprine	Various	Cyclobenzaprine
Verapamil HCl	Various	Verapamil
Enalapril	Various	Enalapril
Albuterol Sulfate	Various	Albuterol
Isosorbide Mononitrate	Various	Isosorbide Mononitrate S.A.
Levaquin	McNeil	Levofloxacin
Diazepam	Mylan	Diazepam
Glucotrol XL	Pfizer	Glipizide
Coumadin	Dupont	Warfarin
Plavix	Sanofi	Clopidogrel
Diflucan	Pfizer	Fluconazole
Advair Diskus	GlaxoSmithKline	Salmeterol/Fluticasone
Protonix	Wyeth-Ayerst	Pantoprazole
Lotrel	Novartis	Amlodipine/Benazepril
Amoxil	GlaxoSmithKline	Amoxicillin

Diovan	Novartis	Valsartan
Glyburide	Various	Glyburide
Carisoprodol	Various	Carisoprodol
Altace	Monarch	Ramipril
Allopurinol	Various	Allopurinol
Estradiol	Various	Estradiol
Avandia	GlaxoSmithKline	Rosiglitazone maleate
Actos	Takeda	Pioglitazone
Lotensin	Novartis	Benazepril
Clarinex	Schering	Desloratadine
Medroxyprogesterone	Various	Medroxyprogesterone
Oxycodone/APAP	Various	Oxycodone/APAP
Doxycycline Hyclate	Various	Doxycycline
Lanoxin	GlaxoSmithKline	Digoxin
Cozaar	Merck	Losartan
Nasonex	Schering	Mometasone
Diltiazem HCl	Various	Diltiazem
Clonidine	Various	Clonidine
Prinivil	Merck	Lisinopril
Digitek	Bertek	Digoxin
Methylprednisolone	Various	Methylprednisolone
Evista	Lilly	Raloxifene
Folic Acid	Various	Folic Acid
Glucophage XR	B-M Squibb	Metformin
Penicillin VK	Various	Penicillin VK
Flovent	GlaxoSmithKline	Fluticasone Propionate
Risperdal	Janssen	Risperidone
Cotrim	Teva	Trimeth/Sulfameth
Promethazine	Various	Promethazine
Diovan HCT	Novartis	Valsartan / HCTZ
Aciphex	Eisai	Rabeprazole
Zyprexa	Lilly	Olanzapine
Allegra-D	Hoech Mar R	Fexofenadine / Pseudoephedrine
Levothroid	Forest	Levothyroxine
Doxazosin	Various	Doxazosin
Xalatan	Pharmacia/Upjohn	Latanoprost
Gemfibrozil	Various	Gemfibrozil
Flomax	Abbott	Tamsulosin
Temazepam	Various	Temazepam
Ultram	McNeil	Tramadol

Hyzaar	Merck	Losartan/HCTZ
Oxycontin	Purdue	Oxycodone
Humulin N	Lilly	Human Insulin NPH
Depakote	Abbott	Divalproex
Concerta	Alza	Methylphenidate XR
Klor-Con	Upsher-Smith	Potassium Chloride
Glucovance	B-M Squibb	Glyburide / Metformin
Imitrex Oral	GlaxoSmithKline	Sumatriptan
Terazosin	Various	Terazosin
Claritin D 24HR	Schering	Loratidine/Pseudoephedrine
Cartia XT	Andrx	Diltiazem
Amaryl	Hoech Mar R	Glimepiride
Spironolactone	Various	Spironolactone
Tricor	Abbott	Fenofibrate
Ortho-Novum	Ortho-McNeil	Norethindrone/Ethinyl Estradiol
Hydroxyzine HCl	Various	Hydroxyzine
Monopril	B-M Squibb	Fosinopril
Combivent	Boehr Ingel	Ipratropium / Albuterol
Meclizine	Various	Meclizine
Triamcinolone Acetonide	Various	Triamcinolone
Klor-Con M20	Upsher-Smith	Potassium Chloride
Metoclopramide	Various	Metoclopramide
Minocycline	Various	Minocycline
Bisoprolol/HCTZ	Various	Bisoprolol/HCTZ
Propranolol	Various	Propranolol
Glucophage	B-M Squibb	Metformin
Propacet	Various	Propoxyphene N/APAP
Valtrex	GlaxoSmithKline	Valacyclovir
Remeron	Organon	Mirtazapine
Famotidine	Various	Famotidine
Metronidazole	Various	Metronidazole
Bextra	Pharmacia/Upjohn	Valdecoxib
Avapro	B-M Squibb	Irbesartan
Glipizide	Various	Glipizide
Buspirone	Various	Buspirone
Nystatin	Various	Nystatin
Skelaxin	Elan	Metaxalone
Serevent	GlaxoSmithKline	Salmeterol
Dilantin	Parke-Davis	Phenytoin
Promethazine/Codeine	Various	Promethazine / Codeine

Necon	Watson	Ethinyl Estradiol / Norethindrone
Captopril	Various	Captopril
Clindamycin	Various	Clindamycin
Aspirin	Various	Aspirin
Seroquel	AstraZeneca	Quetiapine
Acyclovir	Various	Acyclovir
Macrobid	Procter & Gamble	Nitrofurantoin
Claritin D 12HR	Schering	Loratidine/Pseudoephedrine
Amoxicillin/Clavulanate	Various	Amoxicillin/Clavulanate
Adderall XR	Shire Rchwd	Amphetamine Mixed Salts
Biaxin XL	Abbott	Clarithromycin
Trivora-28	Watson	Levonorgestrel / Ethinyl Estradiol
Ortho-Cyclen	Ortho-McNeil	Norgestimate/Ethinyl Estradiol
Cefzil	B-M Squibb	Cefprozil
Humulin 70/30	Lilly	Human Insulin 70/30
Detrol LA	Pharmacia-Upjohn	Tolterodine
Coreg	GlaxoSmithKline	Carvedilol
Tiazac	Forest	Diltiazem
Biaxin	Abbott	Clarithromycin
Tramadol	Various	Tramadol
Nasacort AQ	Hoech Mar R	Triamcinolone Acetonide
Humalog	Lilly	Insulin Lispro
Ultracet	Ortho-McNeil	Tramadol/Acetaminophen
Endocet	Endo	Oxycodone/APAP
Bactroban	GlaxoSmithKline	Mupirocin
Veetids	Apothecon	Penicillin VK
Trimethoprim/Sulfamethoxazole	Various	Trimeth/Sulfameth
Timolol Maleate	Various	Timolol Maleate
Rhinocort Aqua	AstraZeneca	Budesonide
Claritin Reditabs	Schering	Loratadine
Nortriptyline	Various	Nortriptyline
Aviane	Barr	Levonorgestrel/Ethinyl Estradiol
Actonel	Procter & Gamble	Risedronate
Topamax	Ortho-McNeil	Topiramate
Microgestin Fe	Watson	Norethindrone/Ethinyl Estradiol
Tamoxifen	Various	Tamoxifen
Mircette	Organon	Desogestrel/Ethinyl Estradiol
Nifedipine	Various	Nifedipine
Ditropan XL	Alza	Oxybutynin
Tetracycline	Various	Tetracycline

Apri	**Barr**	**Desogestrel/Ethinyl Estradiol**
Zestoretic	**AstraZeneca**	**Lisinopril/HCTZ**
Diclofenac	**Various**	**Diclofenac**
Augmentin ES-600	**GlaxoSmithKline**	**Amoxicillin/Clavulanate**
Carbidopa/Levodopa	**Various**	**Carbidopa/Levodopa**

Previous Years 2001: 2000 1999 1998 1997 1996 1995

The Top 200 Prescriptions for 2003 by Number of US Prescriptions Dispensed
Click here for Alphabetical sort

Generic name link leads to Drug Monograph information where available.

Based upon more than 3 billion prescriptions: Data furnished by NDCHealth

Brand Name	Manufacturer	Generic Name
Hydrocodone w/APAP *	Various **	Hydrocodone w/APAP
Lipitor	Pfizer US Pharm	Atorvastatin
Synthroid	Abbott	Levothyroxine
Atenolol	Various	Atenolol
Zithromax	Pfizer US Pharm	Azithromycin
Amoxicillin	Various	Amoxicillin
Furosemide	Various	Furosemide
Hydrochlorothiazide	Various	Hydrochlorothiazide
Norvasc	Pfizer US Pharm	Amlodipine
Lisinopril	Various	Lisinopril
Alprazolam	Various	Alprazolam
Zoloft	Pfizer US Pharm	Sertraline
Albuterol Aerosol	Various	Albuterol
Toprol-XL	AstraZeneca	Metoprolol
Zocor	MSD	Simvastatin
Premarin	Wyeth Pharm	Conjugated Estrogens
Prevacid	Tap Pharm	Lansoprazole
Zyrtec	Pfizer US Pharm	Cetirizine
Ibuprofen	Various	Ibuprofen
Levoxyl	Monarch Pharm	Levothyroxine
Propoxyphene N/APAP	Various	Propoxyphene N/APAP
Triamterene/HCTZ	Various	Triamterene/HCTZ
Celebrex	Pharmacia Upjohn	Celecoxib
Ambien	Sanofi	Zolpidem
Allegra	Aventis	Fexofenadine
Cephalexin	Various	Cephalexin

Nexium	AstraZeneca	Esomeprazole
Fosamax	MSD	Alendronate
Vioxx	MSD	Rofecoxib
Singulair	MSD	Montelukast
Ortho Tri-Cyclen	Ortho	Norgestimate/Ethinyl Estradiol
Prednisone	Various	Prednisone
Metoprolol Tartrate	Various	Metoprolol
Fluoxetine	Various	Fluoxetine
Effexor XR	Wyeth Pharm	Venlafaxine
Neurontin	Pfizer US Pharm	Gabapentin
Lorazepam	Various	Lorazepam
Clonazepam	Various	Clonazepam
Celexa	Forest	Citalopram
Viagra	Pfizer US Pharm	Sildenafil Citrate
Wellbutrin SR	GlaxoSmithKline	Bupropion HCL
Paxil	GlaxoSmithKline	Paroxetine
Pravachol	BMS Primary Care	Pravastatin
Plavix	BMS Primary Care	Clopidogrel
Trimox	Sandoz	Amoxicillin
Potassium Chloride	Various	Potassium Chloride
Protonix	Wyeth Pharm	Pantoprazole
Advair Diskus	GlaxoSmithKline	Salmeterol/Fluticasone
Flonase	Allen&Hanburys	Fluticasone
Metformin	Various	Metformin
Amoxicillin/Clavulanate	Various	Amoxicillin/Clavulanate
Amitriptyline	Various	Amitriptyline
Ranitidine HCl	Various	Ranitidine
Acetaminophen/Codeine	Various	Acetaminophen/Codeine
Lexapro	Forest Pharm	Escitalopram
Accupril	Pfizer US Pharm	Quinapril
Levaquin	Ortho	Levofloxacin
Altace	Monarch Pharm	Ramipril
Diovan	Novartis	Valsartan
Lotrel	Novartis	Amlodipine / Benazepril
Warfarin	Barr	Warfarin
Omeprazole	Kremers Urban	Omeprazole
Cyclobenzaprine	Various	Cyclobenzaprine
Glucotrol XL	Pfizer US Pharm	Glipizide
Diflucan	Pfizer US Pharm	Fluconazole
Verapamil	Various	Verapamil

Bextra	Pharmacia Upjohn	Valdecoxib
Penicillin VK	Various	Penicillin VK
Cozaar	MSD	Losartan
Actos	Takeda	Pioglitazone
Trazodone	Various	Trazodone
Glyburide	Various	Glyburide
Naproxen	Various	Naproxen
Diovan HCT	Novartis	Valsartan / HCTZ
Coumadin	BMS	Warfarin
Ortho Evra	Ortho	Norelgestromin / Ethinyl Estradiol
Avandia	GlaxoSmithKline	Rosiglitazone maleate
Paxil CR	GlaxoSmithKline	Paroxetine
Risperdal	Janssen	Risperidone
Flomax	Abbott	Tamsulosin
Aciphex	Eisai	Rabeprazole
Digitek	Bertek	Digoxin
Cipro	Bayer	Ciprofloxacin
Nasonex	Schering	Mometasone
Oxycodone/APAP	Mallinkrt Pharm	Oxycodone/APAP
Glucophage XR	BMS Primary Care	Metformin
Lotensin	Novartis	Benazepril
Evista	Lilly	Raloxifene
Zyprexa	Lilly	Olanzapine
Diltiazem HCl	Various	Diltiazem
Allegra-D	Aventis	Fexofenadine / Pseudoephedrine
Clonidine	Mylan	Clonidine
Lanoxin	GlaxoSmithKline	Digoxin
Hyzaar	MSD	Losartan/HCTZ
Amoxil	GlaxoSmithKline	Amoxicillin
Actonel	P&G Pharm	Risedronate
Oxycontin	Purdue	Oxycodone
Cotrim	Teva	Trimeth/Sulfameth
Xalatan	Pharmacia Upjohn	Latanoprost
Tricor	Abbott	Fenofibrate
Amaryl	Aventis	Glimepiride
Concerta	McNeil	Methylphenidate XR
Flovent	GlaxoSmithKline	Fluticasone Propionate
Glucovance	BMS Primary Care	Glyburide / Metformin
Combivent	BI	Ipratropium / Albuterol
Adderall XR	Shire	Amphetamine Mixed Salts

Prilosec	AstraZeneca	Omeprazole
Seroquel	AstraZeneca	Quetiapine
Yasmin 28	Berlex	Drospirenone / Ethinyl Estradiol
Valtrex	GlaxoSmithKline	Valacyclovir
Depakote	Abbott	Divalproex
Prempro	Wyeth	Conj. Estrogens/Medroxyprogesterone
Carisoprodol	Various	Carisoprodol
Isosorbide Mononitrate	Warrick	Isosorbide Mononitrate S.A.
Levothroid	Forest Pharm	Levothyroxine
Avapro	BMS Primary Care	Irbesartan
Diazepam	Mylan	Diazepam
Detrol LA	Pharmacia Upjohn	Tolterodine
Humulin N	Lilly	Human Insulin NPH
Lantus	Aventis	Insulin Glargine
Coreg	GlaxoSmithKline	Carvedilol
Enalapril	Various	Enalapril
Ultracet	McNeil	Tramadol / Acetaminophen
Promethazine	Sandoz	Promethazine
Endocet	Endo	Oxycodone/APAP
Gemfibrozil	Teva	Gemfibrozil
Topamax	McNeil	Topiramate
Skelaxin	Monarch Pharm	Metaxalone
Biaxin XL	Abbott	Clarithromycin
Cartia XT	Andrx	Diltiazem
Monopril	BMS Primary Care	Fosinopril
Zetia	Merck / Schering	Ezetimibe
Folic Acid	Danbury	Folic Acid
Rhinocort Aqua	AstraZeneca	Budesonide
Omnicef	Abbott	Cefdinir
Meclizine	Par Pharm	Meclizine
Nasacort AQ	Aventis	Triamcinolone Acetonide
Augmentin ES-600	GlaxoSmithKline	Amoxicillin/Clavulanate
Macrobid	P&G Pharm	Nitrofurantoin
Temazepam	Mylan	Temazepam
Doxycycline Hyclate	Watson	Doxycycline
Imitrex	GlaxoSmithKline	Sumatriptan
Necon	Watson	Ethinyl Estradiol / Norethindrone
Klor-Con	Upsher-Smith	Potassium Chloride
Klor-Con M20	Upsher-Smith	Potassium Chloride
Allopurinol	Mylan	Allopurinol

Dilantin	Pfizer Pharm	Phenytoin
SMZ-TMP	Mutual	Trimeth/Sulfameth
Microgestin Fe	Watson	Norethindrone/Ethinyl Estradiol
Humalog	Lilly	Insulin Lispro
Cefzil	BMS Primary Care	Cefprozil
Duragesic	Janssen	Fentanyl
Bactroban	GlaxoSmithKline	Mupirocin
Patanol	Alcon	Olopatadine
Humulin 70/30	Lilly	Human Insulin 70/30
Aricept	Eisai	Donepezil
Miralax	Braintree	PEG 3350
Aviane	Barr	Levonorgestrel/Ethinyl Estradiol
Zyrtec-D	Pfizer US Pharm	Cetirizine / Pseudoephedrine
Ditropan XL	McNeil	Oxybutynin
Biaxin	Abbott	Clarithromycin
Ciprofloxacin	Barr	Ciprofloxacin
Niaspan	Koss Pharm	Niacin
Strattera	Lilly	Atomoxetine
Inderal LA	Wyeth Pharm	Propranolol
Elidel	Novartis	Pimecrolimus
Pulmicort	AstraZeneca	Budesonide
Trivora-28	Watson	Levonorgestrel / Ethinyl Estradiol
Albuterol	Warrick	Albuterol
Nifedipine ER	Barr	Nifedipine
Methylprednisolone	Barr	Methylprednisolone
Tussionex	Celltech Pharm	Hydrocodone / Chlorpheniramine
Mobic	Abbott	Meloxicam
Timolol	Falcon Pharm	Timolol
Atacand	AstraZeneca	Candesartan
Phenytoin	Mylan	Phenytoin
Alphagan P	Allergan	Brimonidine
Avelox	Bayer	Moxifloxacin
Clotrimazole / Betamethasone	Taro Pharm USA	Clotrimazole / Betamethasone
Triamcinolone	Fougera	Triamcinolone
Lescol XL	Novartis	Fluvastatin
Miacalcin	Novartis	Calcitonin
Ortho-Novum	Ortho-McNeil	Norethindrone/Ethinyl Estradiol
Plendil	AstraZeneca	Felodipine
Promethazine/Codeine	Alpharma US	Promethazine / Codeine
Nitroquick	Ethex	Nitroglycerin

Spironolactone	Mylan	Spironolactone
Terazosin	Sandoz	Terazosin
Proscar	MSD	Finasteride
Avalide	BMS Primarycare	Irbesartan / HCTZ
Kariva	Barr	Desogestrel / Ethinyl Estradiol
Low-Ogestrel	Watson	Norgestrel / Ethinyl Estradiol
Tobradex	Alcon	Tobramycin / Dexamethasone
Remeron	Organon	Mirtazapine
Roxicet	Roxane	Oxycodone / Acetaminophen
Percocet	Endo	Oxycodone / Acetaminophen
Atrovent	BI	Ipratropium
Propranolol	Pliva	Propranolol
Nifediac CC	Teva	Nifedipine
Apri	Barr	Desogestrel/Ethinyl Estradiol

Previous Years 2002: 2001: 2000 1999 1998 1997 1996 1995

*Hydrocodone / APAP = 85.1 million prescriptions
Lipitor = 65.5 million prescriptions
Synthroid = 47.2 million prescriptions
Atenolol = 40.9 million prescriptions
Zithromax = 39.5 million prescriptions

**When Manufacturer listed = Various the data for two or more generic manufacturers has been combined

Click Here to download all values in an Excel spreadsheet

The Top 300 Prescriptions for 2005 by Number of US Prescriptions Dispensed
Click here for Alphabetical sort

Drug Name	Total Prescriptions (X1000)
Hydrocodone/Acetaminophen	101,639
Lipitor	63,219
Amoxicillin	52,104
Lisinopril	47,829
Hydrochlorothiazide	42,757
Atenolol	42,001
Zithromax	38,110
Furosemide	34,782
Alprazolam	34,230
Toprol-XL	33,598
Albuterol Aerosol	32,679
Norvasc	32,580
Levothyroxine	32,465
Synthroid	30,695
Metformin	29,202
Zoloft	26,976
Lexapro	24,788
Ibuprofen	24,327
Cephalexin	24,092
Ambien	23,145
Prednisone	23,001
Nexium	22,883
Triamterenew/HCTZ	22,820
Propoxyphene-N/Acetaminophen	22,655
Zocor	22,325
Singulair	22,167
Prevacid	22,152
Metoprolol	21,992
Fluoxetine	21,403
Lorazepam	19,002
Plavix	18,823
Oxycodone w/Acetaminophen	18,373
Amoxicillin/Potassium Clavulanate	18,326
Advair Diskus	18,289
Fosamax	17,915
Effexor XR	17,179
Warfarin	17,067
Paroxetine	16,889
Clonazepam	16,763
Zyrtec	16,426
Protonix	16,402

Potassium Chloride	16,278
Acetaminophen/Codeine	15,679
Trimethoprim/Sulfamethoxazole	15,283
Gabapentin	15,164
Premarin	14,845
Flonase	14,736
Trazodone	14,505
Cyclobenzaprine	14,480
Amitriptyline	14,385
Levaquin	14,235
Tramadol	13,301
Ciprofloxacin	13,280
Lotrel	12,863
Ranitidine	12,801
Allegra	12,796
Levoxyl	12,772
Diovan	12,595
Enalapril	12,567
Diazepam	12,093
Naproxen	11,771
Fluconazole	11,519
Lisinopril/HCTZ	11,489
Klor-Con	11,355
Altace	11,211
Wellbutrin XL	11,044
Celebrex	10,965
Viagra	10,913
Doxycycline	10,716
Zetia	10,453
Avandia	10,385
Lovastatin	10,328
Diovan HCT	10,292
Carisoprodol	10,207
Yasmin 28	10,152
Allopurinol	9,828
Clonidine	9,823
Methylprednisolone	9,754
Actos	9,737
Pravachol	9,733
Actonel	9,660
Ortho Evra	9,355
Citalopram	9,266
Verapamil SR	9,248
Isosorbide	9,137

Penicillin VK	8,872
Glyburide	8,733
Adderall XR	8,653
Nasonex	8,604
Folic Acid	8,506
Seroquel	8,420
Cozaar	8,278
Tricor	8,277
Coreg	8,228
Concerta	8,201
Vytorin	8,154
Lantus	8,133
Promethazine	8,063
Mobic	7,856
Flomax	7,817
Crestor	7,797
Glipizide ER	7,716
Ortho Tri-Cyclen Lo	7,590
Temazepam	7,570
Omeprazole	7,360
Omnicef	7,345
Albuterol Nebulizer Sol.	7,335
Risperdal	7,301
Aciphex	7,081
Digitek	7,069
Spironolactone	7,045
Valtrex	6,988
Xalatan	6,890
Metformin ER	6,616
Hyzaar	6,424
Quinapril	6,351
Clindamycin	6,192
Metronidazole Tabs	6,146
Triamcinlnolone	6,111
Topamax	6,061
Combivent	6,016
Benazepril	5,992
Gemfibrozil	5,797
Avapro	5,788
Amaryl	5,787
Trinessa	5,773
Estradiol	5,744
Hydroxyzine	5,725
Metoclopramide	5,652

Allegra-D 12 Hour	5,634
Doxazosin	5,547
Coumadin	5,517
Glipizide	5,398
Diclofenac	5,281
Evista	5,246
DiltiazemCD	5,165
Detrol LA	5,163
Meclizine	5,149
Glyburide/Metformin	5,086
Strattera	4,991
Cymbalta	4,938
Nitrofurantoin	4,927
Promethazine/Codeine	4,912
Benicar	4,771
Mirtazapine	4,766
Bisoprolol/HCTZ	4,750
Clarinex	4,743
Oxycodone	4,715
Minocycline	4,663
Imitrex	4,619
Nabumetone	4,611
Zyprexa	4,540
Lamictal	4,487
Zyrtec Syrup	4,466
Glycolax	4,445
Acyclovir	4,420
Propranolol	4,340
Nasacort AQ	4,303
Aricept	4,292
Butalbital/Acetaminophen/Caffeine	4,267
Niaspan	4,248
Azithromycin	4,160
Depakote	4,077
Buspirone	4,054
Tri-Sprintec	4,012
Methotrexate	3,969
OxyContin	3,967
Rhinocort Aqua	3,940
Benicar HCT	3,935
Terazosin	3,918
Skelaxin	3,880
Clotrimazole/Betamethasone	3,850
Cialis	3,847

Avalide	3,818
Fexofenadine	3,817
Ortho Tri-Cyclen	3,803
Bupropion SR	3,765
Benzonatate	3,733
Patanol	3,728
Quinine	3,722
CartiaXT	3,670
Humalog	3,612
Paxil CR	3,609
Aviane	3,534
Lanoxin	3,516
Amphetamine Mixed Salts	3,513
Famotidine	3,490
Digoxin	3,486
Levothroid	3,450
Nifedipine ER	3,319
Nortriptyline	3,314
Tussionex	3,306
Nitroquick	3,303
Phenytoin	3,265
Endocet	3,259
Etodolac	3,258
Atenolol/Chlorthalidone	3,256
Phentermine	3,218
Tramadol /Acetaminophen	3,213
Tizanidine	3,202
Zyrtec-D	3,201
Depakote ER	3,200
Humulin N	3,190
Lithium Carbonate	3,169
Fosinopril	3,155
Budeprion SR	3,137
Kariva	3,128
Phenazopyridine	3,078
Abilify	3,050
Biaxin XL	3,036
Methocarbamol	3,027
Trimox	3,018
Phenobarbital	2,981
Lunesta	2,981
Prempro	2,953
Avelox	2,946
Spiriva	2,938

Flovent HFA	2,915
Apri	2,903
Hyoscyamine	2,899
Captopril	2,898
Inderal LA	2,898
Chlorhexidine Gluconate	2,893
Medroxyprogesterone	2,893
Indomethacin	2,859
Vigamox	2,823
Nystatin	2,809
Morphine	2,803
Dicyclomine	2,792
Trileptal	2,750
Hydroxychloroquine	2,744
Low-Ogestrel	2,729
Tetracycline	2,728
Ditropan XL	2,645
Dilantin	2,637
Colchicine	2,636
Trivora-28	2,630
NuvaRing	2,619
Ketek	2,608
Fentanyl	2,606
Clobetasol	2,603
Baclofen	2,592
Ketoconazole	2,571
Nitroglycerin	2,563
Lescol XL	2,534
Necon 1/35	2,529
Hydrocortisone	2,525
Alphagan P	2,515
Cosopt	2,506
Cefuroxime	2,484
Mupirocin	2,478
Elidel	2,463
Clindamycin (Topical)	2,462
Vivelle-DOT	2,449
Fluocinonide	2,439
Proscar	2,429
Prednisolone	2,413
Cefzil	2,411
Pulmicort Respules	2,406
Armour Thyroid	2,382
Labetalol	2,358

Nystatin (Topical)	2,353
Lidoderm	2,352
Tobradex	2,343
Humulin 70/30	2,338
Atacand	2,316
Ultracet	2,296
Augmentin XR	2,291
Carbamazepine	2,284
Hydrocodone/Ibuprofen	2,282
Xopenex	2,274
Diphenoxylate/Atropine	2,264
Tamiflu	2,251
Ovcon-35	2,250
Carbidopa/Levodopa	2,237
Doxepin	2,230
Namenda	2,220
Oxybutynin	2,216
Lamisil	2,192
Astelin	2,192
Naproxen Sodium	2,174
Hydroxyzine (Paomate)	2,164
Amiodarone	2,155
Tamoxifen	2,143
Piroxicam	2,140
Benztropine	2,131
Zelnorm	2,127
Estrostep Fe	2,111
Promethazine DM	2,097
Amoxil	2,094
Methadose	2,084
Prometrium	2,075
Diltiazem SR	2,045
NovoLog	1,989
Levitra	1,987
Sprintec	1,970
Hycoclear Tuss	1,955
Flexeril	1,951
Bactroban	1,946
BenzaClin	1,941
Miacalcin	1,940
Methylphenidate	1,939

Data by Verispan, VONA

APPENDIX C

City: Oklahoma City, OK - *North Canadian*

Pollutant: **Arsenic**

DATE	**INFLUENT**			**EFFLUENT**		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	<10	5.00	49.71	<10	5.00
28-Jun-00	68.05	21.00	21.00	68.05	<10	5.00
13-Sep-00	46.60	<10	5.00	46.60	<10	5.00
06-Dec-00	53.01	<10	5.00	53.01	<10	5.00
07-Mar-01	55.61	<10	5.00	55.61	<10	5.00
24-Apr-01	47.20	<10	5.00	47.20	<10	5.00
09-Nov-01	50.44	<10	5.00	41.87	<10	5.00
04-Dec-01	47.84	<10	5.00	44.98	<10	5.00
28-Jan-02	47.91	<10	5.00	43.32	<10	5.00
29-Apr-02	55.44	10.00	10.00	51.20	<10	5.00
05-Aug-02	52.74	<10	5.00	49.91	<10	5.00
11-Nov-02	51.64	<10	5.00		<10	5.00
19-Feb-03	46.99	1.20	1.20	50.56	1.20	1.20
29-Apr-03	46.02	<2	1.00		<2	1.00
25-Feb-04	41.33	2.00	2.00	39.38	<1	0.50
25-May-04	46.02	2.00	2.00	45.67	2.00	2.00
17-Aug-04	51.46	<2.0	1.00	52.08	<2.0	1.00
01-Nov-04	53.10	<2.0	1.00	55.48	<2.0	1.00
Average 00-06	50.62	2.47	4.81	49.66	0.66	3.42

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Cadmium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	<1.0	0.50	49.71	<1.0	0.50
28-Jun-00	68.05	<1.0	0.50	68.05	<1.0	0.50
13-Sep-00	46.60	<1.0	0.50	46.60	<1.0	0.50
06-Dec-00	53.01	<1.0	0.50	53.01	<1.0	0.50
07-Mar-01	55.61	3.00	3.00	55.61	<1.0	0.50
24-Apr-01	47.20	<1.0	0.50	47.20	<1.0	0.50
09-Nov-01	50.44	<1.0	0.50	41.87	<1.0	0.50
04-Dec-01	47.84	<1.0	0.50	44.98	<1.0	0.50
28-Jan-02	47.91	1.40	1.40	43.32	<1.0	0.50
29-Apr-02	55.44	1.16	1.20	51.20	1.00	1.00
05-Aug-02	52.74	<1.0	0.50	49.91	<1.0	0.50
11-Nov-02	51.64	<1.0	0.50		<1.0	0.50
19-Feb-03	46.99	6.60	6.60	50.56	<0.5	0.25
29-Apr-03	46.02	<1	0.50		<1	0.50
25-Feb-04	41.33	<1.0	0.50	39.38	<1.0	0.50
25-May-04	46.02	2.00	2.00	45.67	<1.0	0.50
17-Aug-04	51.46	<1.0	0.50	52.08	<1.0	0.50
01-Nov-04	53.10	<1.0	0.50	55.48	<1.0	0.50
07-Feb-05		<0.50	0.25		<0.50	0.25
09-May-05		<0.50	0.25		<0.50	0.25
29-Aug-05		1.20	1.20		1.70	1.70
01-Nov-05		6.00	6.00		3.40	3.40
06-Feb-06		< 0.24	0.12		1.50	1.50
09-May-06		4.50	4.50		2.40	2.40
11-Sep-06		4.90	4.90		< 0.50	0.25
28-Nov-06		< 0.50	0.25		< 0.50	0.25
Average 00-06	50.62	1.18	1.47	49.66	0.38	0.74

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Chromium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	20.00	20.00	49.71	<10.0	5.00
28-Jun-00	68.05	11.90	11.90	68.05	<10.0	5.00
13-Sep-00	46.60	<10.0	5.00	46.60	<10.0	5.00
06-Dec-00	53.01	<10.0	5.00	53.01	<10.0	5.00
07-Mar-01	55.61	10.00	10.00	55.61	<10.0	5.00
09-Nov-01	50.44	11.00	11.00	41.87	<10.0	5.00
04-Dec-01	47.84	17.00	17.00	44.98	<10.0	5.00
28-Jan-02	47.91	<10	5.00	43.32	<10	5.00
29-Apr-02	55.44	6.00	6.00	51.20	<10	5.00
05-Aug-02	52.74	<10	5.00	49.91	<10	5.00
11-Nov-02	51.64	<10	5.00		<10	5.00
19-Feb-03	46.99	7.00	7.00	50.56	<2	1.00
	46.02	10.00	10.00		<7	3.50
25-Feb-04	41.33	11.00	11.00	39.38	<1.0	0.50
25-May-04	46.02	11.00	11.00	45.67	1.00	1.00
17-Aug-04	51.46	<10.0	5.00	52.08	<10.0	5.00
01-Nov-04	53.10	13.00	13.00	55.48	17.00	17.00
07-Feb-05		8.90	8.90		<0.5	0.25
09-May-05		17.00	17.00		2.90	2.90
29-Aug-05		11.80	11.80		2.90	2.90
01-Nov-05		42.40	42.40		42.60	42.60
06-Feb-06		16.40	16.40		1.40	1.40
09-May-06		174.70	174.70		135.90	135.90
11-Sep-06		6.20	6.20		< 0.50	0.25
28-Nov-06		18.00	18.00		< 0.50	0.25
Average 00-06	50.62	16.28	17.63	49.66	7.83	10.56

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Copper**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	90.00	90.00	49.71	1.80	1.80
28-Jun-00	68.05	62.00	62.00	68.05	30.00	30.00
13-Sep-00	46.60	61.00	61.00	46.60	33.00	33.00
06-Dec-00	53.01	<10	5.00	53.01	<10	5.00
07-Mar-01	55.61	43.00	43.00	55.61	<5	2.50
24-Apr-01	47.20	49.00	49.00	47.20	<5	2.50
09-Nov-01	50.44	63.00	63.00	41.87	<5	2.50
04-Dec-01	47.84	89.00	89.00	44.98	15.00	15.00
28-Jan-02	47.91	61.00	61.00	43.32	29.00	29.00
29-Apr-02	55.44	58.00	58.00	51.20	13.00	13.00
05-Aug-02	52.74	61.00	61.00	49.91	125.00	125.00
11-Nov-02	51.64	46.00	46.00		<10	5.00
19-Feb-03	46.99	73.00	73.00	50.56	8.40	8.40
29-Apr-03	46.02	61.00	61.00		<5	2.50
25-Feb-04	41.33	68.00	68.00	39.38	<1.0	0.50
25-May-04	46.02	125.00	125.00	45.67	4.00	4.00
17-Aug-04	51.46	<10.0	5.00	52.08	<10.0	5.00
01-Nov-04	53.10	64.00	64.00	55.48	<10.0	5.00
07-Feb-05		32.00	32.00		<0.50	0.25
09-May-05		74.00	74.00		3.80	3.80
29-Aug-05		103.00	103.00		37.50	37.50
01-Nov-05		57.00	57.00		10.20	10.20
06-Feb-06		30.20	30.20		16.80	16.80
09-May-06		153.90	153.90		96.70	96.70
11-Sep-06		63.00	63.00		2.30	2.30
28-Nov-06		81.00	81.00		< 0.50	0.25
Average 00-06	50.62	64.16	64.54	49.66	16.40	17.60

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Lead**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	59.00	59.00	49.71	<5.0	2.50
28-Jun-00	68.05	<5.0	2.50	68.05	<5.0	2.50
13-Sep-00	46.60	<5.0	2.50	46.60	<5.0	2.50
06-Dec-00	53.01	<5.0	2.50	53.01	<5.0	2.50
07-Mar-01	55.61	14.00	14.00	55.61	<5.0	2.50
24-Apr-01	47.20	12.00	12.00	47.20	<5.0	2.50
09-Nov-01	50.44	37.00	37.00	41.87	<5.0	2.50
04-Dec-01	47.84	34.00	34.00	44.98	<5.0	2.50
28-Jan-02	47.91	<5	2.50	43.32	7.00	7.00
29-Apr-02	55.44	13.00	13.00	51.20	8.00	8.00
05-Aug-02	52.74	19.00	19.00	49.91	<5	2.50
11-Nov-02	51.64	<5	2.50		<5	2.50
19-Feb-03	46.99	24.00	24.00	50.56	<2	1.00
29-Apr-03	46.02	6.00	6.00		<2	1.00
25-Feb-04	41.33	9.00	9.00	39.38	<1.0	0.50
25-May-04	46.02	19.00	19.00	45.67	2.00	2.00
17-Aug-04	51.46	4.40	4.40	52.08	<1.5	0.75
01-Nov-04	53.10	9.50	9.50	55.48	<1.5	0.75
07-Feb-05		12.00	12.00		<0.5	0.25
09-May-05		16.00	16.00		2.50	2.50
29-Aug-05		17.70	17.70		11.40	11.40
01-Nov-05		6.50	6.50		<2.2	1.10
06-Feb-06		< 2.2	1.10		< 2.2	1.10
09-May-06		19.00	19.00		3.70	3.70
11-Sep-06		9.60	9.60		< 0.50	0.25
28-Nov-06		27.00	27.00		< 0.50	0.25
Average 00-06	50.62	14.14	14.67	49.66	1.33	2.56

City: Oklahoma City, OK - *North Canadian*

Pollutant: **Mercury**

DATE	**INFLUENT**			**EFFLUENT**		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	2.70	2.70	49.71	<.2	0.10
28-Jun-00	68.05	<.2	0.10	68.05	<.2	0.10
13-Sep-00	46.60	<.2	0.10	46.60	<.2	0.10
06-Dec-00	53.01	<.2	0.10	53.01	<.2	0.10
07-Mar-01	55.61	<.2	0.10	55.61	<.2	0.10
24-Apr-01	47.20	<.2	0.10	47.20	<.2	0.10
09-Nov-01	50.44	0.20	0.20	41.87	<.2	0.10
04-Dec-01	47.84	0.50	0.50	44.98	0.20	0.20
28-Jan-02	47.91	<0.2	0.10	43.32	<0.2	0.10
29-Apr-02	55.44	<0.2	0.10	51.20	<0.2	0.10
05-Aug-02	52.74	0.34	0.30	49.91	<0.2	0.10
11-Nov-02	51.64	0.55	0.60		<0.2	0.10
19-Feb-03	46.99	<0.2	0.10	50.56	<0.2	0.10
29-Apr-03	46.02	<0.2	0.10		<0.2	0.10
25-Feb-04	41.33	<0.2	0.10	39.38	<0.2	0.10
25-May-04	46.02	<0.2	0.10	45.67	<0.2	0.10
17-Aug-04	51.46	<0.2	0.10	52.08	<0.2	0.10
01-Nov-04	53.10	<0.2	0.10	55.48	<0.2	0.10
07-Feb-05		<0.2	0.10		<0.2	0.10
09-May-05		0.21	0.20		<0.2	0.10
29-Aug-05		<0.20	0.10		<0.2	0.10
01-Nov-05		0.30	0.30		<0.2	0.10
06-Feb-06		< 0.2	0.10		< 0.2	0.10
09-May-06		< 0.2	0.10		< 0.2	0.10
11-Sep-06		2.70	2.70		0.60	0.60
28-Nov-06		0.20	0.20		< 0.20	0.10
Average 00-06	54.79	0.26	0.32	54.05		0.13

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Molybdenum**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	<20	10.00	49.71	8.12	8.12
28-Jun-00	68.05	7.50	7.50	68.05	<5.7	2.85
14-Sep-00	46.60	<5.7	2.85	46.60	<5.7	2.85
06-Dec-00	53.01	<20	10.00	53.01	<20	10.00
07-Mar-01	55.61	<30	15.00	55.61	<30	15.00
24-Apr-01	47.20	<30	15.00	47.20	<30	15.00
09-Nov-01	50.44	<30	15.00	41.87	<30	15.00
04-Dec-01	47.84	<30	15.00	44.98	<30	15.00
28-Jan-02	47.91	<30		43.32	<30	
29-Apr-02	55.44	13.00		51.20	5.00	
05-Aug-02	52.74	<30		49.91	<30	
11-Nov-02	51.64	<30			<30	
29_Apr-03	46.02	<5	2.50		<5	2.50
25-Feb-04	41.33	11.00	11.00	39.38	9.00	9.00
25-May-04	46.02	18.00	18.00	45.67	11.00	11.00
17-Aug-04	51.46	8.80	8.80	52.08	10.00	10.00
01-Nov-04	53.10	11.00	11.00	55.48	10.00	10.00
07-Feb-05		16.00	16.00		7.40	7.40
09-May-05		3.80	3.80		<0.5	0.25
29-Aug-05		4.50	4.50		6.10	6.10
01-Nov-05		7.60	7.60		4.30	4.30
06-Feb-06		< 3	1.50		< 3	1.50
09-May-06		< 3	1.50		< 3	1.50
11-Sep-06		< 0.50	0.25		< 0.50	0.25
28-Nov-06		14.00	14.00		< 0.50	0.25
Average 00-06	50.83	4.61	9.09	49.60	2.84	7.04

Pollutant: **Nickel**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	20.44	20.44	49.71	5.01	5.01
28-Jun-00	68.05	21.50	21.50	68.05	13.30	13.30
13-Sep-00	46.60	10.80	10.80	46.60	<8.3	4.15
06-Dec-00	53.01	<20.0	10.00	53.01	<20.0	10.00
03-Mar-01	55.61	11.00	11.00	55.61	<5	2.50
24-Apr-01	47.20	8.00	8.00	47.20	<5	2.50
09-Nov-01	50.44	<40	20.00	41.87	<40	20.00
04-Dec-01	47.84	<40	20.00	44.98	<40	20.00
28-Jan-02	47.91	8.00	8.00	43.32	<40	20.00
29-Apr-02	55.44	6.00	6.00	51.20	9.00	9.00
05-Aug-02	52.74	<40	20.00	49.91	<40	20.00
11-Nov-02	51.64	<40	20.00		<40	20.00
19-Feb-03	46.99	12.00	12.00	50.56	<2.5	1.25
29-Apr-03	46.02	43.00	43.00		26.00	26.00
25-Feb-04	41.33	6.00	6.00	39.38	5.00	5.00
25-May-04	46.02	9.00	9.00	45.67	6.00	6.00
17-Aug-04	51.46	<10.0	5.00	52.08	<10.0	5.00
01-Nov-04	53.10	<10.	5.00	55.48	<10.0	5.00
07-Feb-05		3.20	3.20		<05	0.25
09-May-05		11.00	11.00		4.90	4.90
29-Aug-05		17.00	17.00		18.10	18.10
01-Nov-05		27.40	27.40		23.40	23.40
06-Feb-06		16.40	16.40		< 4.52	2.26
09-May-06		66.60	66.60		50.60	50.60
11-Sep-06		3.00	3.00		0.94	0.94
28-Nov-06		13.00	13.00		< 0.50	0.25
Average 00-06	50.62	12.05	15.90	49.66	6.24	11.36

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Selenium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	<5	2.5	49.71	<5	2.5
28-Jun-00	68.05	<5	2.5	68.05	<5	2.5
13-Sep-00	46.60	<5	2.5	46.60	<5	2.5
06-Dec-00	53.01	<5	2.5	53.01	<5	2.5
07-Mar-01	55.61	<5	2.5	55.61	<5	2.5
24-Apr-01	47.20	<5	2.5	47.20	<5	2.5
09-Nov-01	50.44	<5	2.5	41.87	<5	2.5
04-Dec-01	47.84	<5	2.5	44.98	<5	2.5
28-Jan-02	47.91	<5	2.5	43.32	5.0	
29-Apr-02	55.44	<5	2.5	51.20	<5	2.5
05-Aug-02	52.74	<5	2.5	49.91	<5	2.5
11-Nov-02	51.64	<5	2.5		<5	2.5
19-Feb-03	46.99	<1	0.5	50.56	<1	0.5
26-Apr-03	46.02	<2	1.0		<2	1.0
25-Feb-04	41.33	<1	0.5	39.38	<1.0	0.5
25-May-04	46.02	1.0	1.0	45.67	<1.0	0.5
17-Aug-04	51.46	<3.0	1.5	52.08	<3.0	1.5
01-Nov-04	53.10	<3.0	1.5	55.48	<3.0	1.5
07-Feb-05		<1.0	0.5		<1.0	0.5
09-May-05		3.1	3.1		<1.0	0.5
29-Aug-05		10.5	10.5		10.6	10.6
01-Nov-05		17.8	17.8		13.8	13.8
06-Feb-06		< 4.93	2.5		< 4.93	2.5
09-May-06		< 4.93	2.5		< 4.93	2.5
11-Sep-06		< 1.0	0.5		< 0.50	0.3
28-Nov-06		< 1.0	0.5		< 1.0	0.5
Average 00-06	54.79	2.3	4.0	54.05	1.6	3.3

City:
Pollutant: **Silver**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	6.00	6.00	49.71	<2.0	1.00
28-Jun-00	68.05	<2.0	1.00	68.05	<2.0	1.00
13-Sep-00	46.60	<2.0	1.00	46.60	<2.0	1.00
06-Dec-00	53.01	<2.0	1.00	53.01	<2.0	1.00
07-Mar-01	55.61	5.00	5.00	55.61	<2.0	1.00
24-Apr-01	47.20	<2.0	1.00	47.20	<2.0	1.00
09-Nov-01	50.44	54.00	54.00	41.87	<2.0	1.00
04-Dec-01	47.84	7.00	7.00	44.98	<2.0	1.00
28-Jan-02	47.91	<2	1.00	43.32	<2	1.00
29-Apr-02	55.44	10.00	10.00	51.20	<2	1.00
05-Aug-02	52.74	<2	1.00	49.91	<2	1.00
11-Nov-02	51.64	<2	1.00		<2	1.00
19-Feb-03	46.99	29.00	29.00	50.56	<1.6	0.80
29-Apr-03	46.02	10.00	10.00		1.80	1.80
25-Feb-04	41.33	6.00	6.00	39.38	<1.0	0.50
25-May-04	46.02	9.00	9.00	45.67	<1.0	0.50
17-Aug-04	51.46	1.30	1.30	52.08	<1.0	0.50
01-Nov-04	53.10	6.20	6.20	55.48	<1.0	0.50
07-Feb-05		<1.0	0.50		<1.0	0.50
09-May-05		3.70	3.70		<1.0	0.50
29-Aug-05		4.60	4.60		<3.0	1.50
01-Nov-05		<3	1.50		<3	1.50
06-Feb-06		< 3	1.50		< 3	1.50
09-May-06		< 3	1.50		< 3	1.50
11-Sep-06		< 0.50	0.25		< 0.50	0.25
28-Nov-06		4.80	4.80		< 0.50	0.25
Average 00-06	50.62	6.02	6.49	49.66	0.07	0.93

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Thallium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	<10	5.00	49.71	<10	5.00
28-Jun-00	68.05	<10	5.00	68.05	<10	5.00
13-Sep-00	46.60	<10	5.00	46.60	<10	5.00
06-Dec-00	53.01	<10	5.00	53.01	<10	5.00
07-Mar-01	55.61	<10	5.00	55.61	<10	5.00
24-Apr-01	47.20	<10	5.00	47.20	<10	5.00
09-Nov-01	50.44	<10	5.00	41.87	<10	5.00
04-Dec-01	47.84	<10	5.00	44.98	<10	5.00
28-Jan-02	47.91	<10	5.00	43.32	<10	5.00
29-Apr-02	55.44	<10	5.00	51.20	<10	5.00
05-Aug-02	52.74	<10	5.00	49.91	<10	5.00
11-Nov-02	51.64	<10	5.00		<10	5.00
19-Feb-03	46.99	<1	0.50	50.56	<1	0.50
29-Apr-03	46.02	<1	0.50		<1	0.50
25-Feb-04	41.33	<2.0	1.00	39.38	<2.0	1.00
25-May-04	46.02	<2.0	1.00	45.67	<2.0	1.00
17-Aug-04	51.46	<2.0	1.00	52.08	<2.0	1.00
01-Nov-04	53.10	<2.0	1.00	55.48	<2.0	1.00
07-Feb-05		11.00	11.00		<1.0	0.50
09-May-05		<1.0	0.50		<1.0	0.50
29-Aug-05		39.90	39.90		<8.08	4.04
01-Nov-05		<8.08	4.04		<8.08	4.04
06-Feb-06		< 8.08	4.04		< 8.08	4.04
09-May-06		< 8.08	4.04		< 8.08	4.04
11-Sep-06		< 1.40	0.70		< 0.50	0.25
28-Nov-06		< 1.40	0.70		< 1.40	0.70
Average 00-06	50.62	1.96	5.00	49.66	0.00	3.20

City: Oklahoma City, OK - *North Canadian*
Pollutant: **Zinc**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	49.71	1060.0	1060.0	49.71	124.0	124.0
28-Jun-00	68.05	211.0	211.0	68.05	74.0	74.0
13-Sep-00	46.60	268.0	268.0	46.60	105.0	105.0
06-Dec-00	53.01	1300.0	1300.0	53.01	190.0	190.0
07-Mar-01	55.61	371.0	371.0	55.61	46.0	46.0
24-Apr-01	47.20	482.0	482.0	47.20	51.0	51.0
09-Nov-01	50.44	158.0	158.0	41.87	60.0	60.0
04-Dec-01	47.84	838.0	838.0	44.98	187.0	187.0
28-Jan-02	47.91	277.0	277.0	43.32	92.0	92.0
29-Apr-02	55.44	138.0	138.0	51.20	67.0	67.0
05-Aug-02	52.74	150.0	150.0	49.91	123.0	123.0
11-Nov-02	51.64	763.0	763.0		44.0	44.0
19-Feb-03	46.99	140.0	140.0	50.56	64.0	64.0
29-Apr-03	46.02	160.0	160.0		59.0	59.0
25-Feb-04	41.33	99.0	99.0	39.38	22.0	22.0
25-May-04	46.02	340.0	340.0	45.67	30.0	30.0
17-Aug-04	51.46	120.0	120.0	52.08	5.0	5.0
01-Nov-04	53.10	110.0	110.0	55.48	34.0	34.0
07-Feb-05		130.0	130.0		28.0	28.0
09-May-05		250.0	250.0		35.0	35.0
29-Aug-05		169.0	169.0		99.2	99.2
01-Nov-05		159.0	159.0		28.0	28.0
06-Feb-06		126.8	126.8		45.4	45.4
09-May-06		159.8	159.8		24.8	24.8
11-Sep-06		150.0	150.0		46.0	46.0
28-Nov-06		230.0	230.0		22.0	22.0
Average 00-06	50.62	321.52	321.52	49.66	65.59	65.59

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Arsenic**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	<10	5	6.21	<10	5
28-Jun-00	12.52	<10	5	12.52	<10	5
14-Sep-00	4.72	<10	5	4.72	<10	5
06-Dec-00	10.92	<10	5	10.92	<10	5
07-Mar-01	12.774	<10	5	12.774	<10	5
24-Apr-01	6.638	<10	5	6.638	<10	5
11-Sep-01	8.325	<10	5	6.638	<10	5
07-Dec-01	10.166	<10	5	6.638	<10	5
29-Jan-02		<1	0.5	8.325	b	0.5
29-Apr-02	10.166	<1	0.5	11.249	<1	0.5
05-Aug-02	7.269	<1	0.5	10.065	<1	0.5
11-Nov-02	9.671	<1	0.5	10.721	<1	0.5
19-Feb-03	7.843	<1	0.5	8.756	<1	0.5
29-Apr-03	9.17	<2	1	8.52	<2	1
25-Feb-04	8.59	2.0	2.0	9.41	2.0	2.0
25-May-04	8.73	2.0	2.0	7.47	2.0	2.0
17-Aug-04	11.51	<2.0	1.0	11.58	<2.0	1.0
01-Nov-04	10.34	<2.0	1.0	13.13	<2.0	1.0
14-Feb-05		<0.5	0.3		<0.5	0.3
09-May-05		<0.5	0.3		<0.5	0.3
29-Aug-05		<4.74	2.4		<4.74	2.4
01-Nov-05		12.4	12.4		6.4	6.4
06-Feb-06		< 4.74	2.4		< 4.74	2.4
09-May-06		< 4.74	2.4		4.9	4.9
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		9.2	9.2		< 0.50	0.3
Average	9.63	1.34	5.08	9.60	0.54	4.79

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Cadmium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
29-Apr-03	9.17	<1.0	0.5	8.52	<1.0	0.5
05-May-03	8.663	<1.0	0.5	7.515	<1.0	0.5
13-May-03	9.343	<1.0	0.5	9.696	<1.0	0.5
19-May-03	8.878	<1.0	0.5	9.088	<1.0	0.5
26-May-03	9.221	<1.0	0.5	7.164	<1.0	0.5
01-Jun-03	8.862	<1.0	0.5	15.163	<1.0	0.5
08-Jun-03	9.633	<1.0	0.5	7.704	<1.0	0.5
15-Jun-03	8.461	4.4	4.4	6.564	3.6	3.6
22-Jun-03	9.197	<1.0	0.5	7.332	<1.0	0.5
29-Jun-03	8.141	<1.0	0.5	7.042	<1.0	0.5
07-Jul-03	8.523	<1.0	0.5	5.618	<1.0	0.5
14-Jul-03	7.698	<1.0	0.5	4.805	<1.0	0.5
21-Jul-03	8.237	<1.0	0.5	4.879	<1.0	0.5
28-Jul-03	8.179	<1.0	0.5	4.759	<1.0	0.5
03-Aug-03	8.84	<1.0	0.5	6.882	<1.0	0.5
10-Aug-03	8.036	<1.0	0.5	7.857	<1.0	0.5
17-Aug-03	8.752	<1.0	0.5	6.914	<1.0	0.5
24-Aug-03	7.72	<1.0	0.5	7.72	<1.0	0.5
08-Sep-03	8.522	<1.0	0.5	8.255	<1.0	0.5
15-Sep-03	8.604	<1.0	0.5	8.417	<1.0	0.5
21-Sep-03	8.425	<1.0	0.5	12.13	<1.0	0.5
28-Sep-03	8.944	<1.0	0.5	8.942	<1.0	0.5
05-Oct-03	7.925	<1.0	0.5	8.614	<1.0	0.5
12-Oct-03	9.523	<1.0	0.5	9.297	<1.0	0.5
19-Oct-03	8.699	<1.0	0.5	9.244	<1.0	0.5
26-Oct-03	8.101	<1.0	0.5	8.615	<1.0	0.5
25-Feb-04	8.59	<1.0	0.5	9.41	<1.0	0.5
25-May-04	8.73	<1.0	0.5	7.47	<1.0	0.5
17-Aug-04	11.51	<1.0	0.5	11.58	<1.0	0.5
01-Nov-04	10.34	<1.0	0.5	13.13	<1.0	0.5
14-Feb-05		<0..5	0.3		<0.5	0.3
09-May-05		<0.5	0.3		<0.5	0.3
29-Aug-05		2	2		1	1
01-Nov-05		2.8	2.8		1.9	1.9
06-Feb-06		1.2	1.2		0.7	0.7
09-May-06		4.2	4.2		4.5	4.5
11-Sep-06		< 0.50	0.25		< 0.50	0.25
28-Nov-06		3.6	3.6		< 0.50	0.25
Average	9.42	0.53	0.99	9.44	0.54	1.00

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Chromium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	<10.0	5.00	6.21	<10.0	5.00
28-Jun-00	12.52	<10.0	5.00	12.52	<10.0	5.00
14-Sep-00	4.72	<10.0	5.00	4.72	<10.0	5.00
06-Dec-00	10.92	<10.0	5.00	10.92	<10.0	5.00
07-Mar-01	12.774	<10.0	5.00	12.774	<10.0	5.00
24-Apr-01	6.638	<10.0	5.00	6.638	<10.0	5.00
11-Sep-01	8.277	<10.0	5.00	6.638	<10.0	5.00
07-Dec-01	10.166	<10.0	5.00	6.638	<10.0	5.00
29-Jan-02	8.325	<2.0	1.00	8.325	<2.0	1.00
29-Apr-02	10.166	<2.0	1.00	11.249	<2.0	1.00
05-Aug-02	7.269	<2.0	1.00	10.065	<2.0	1.00
11-Nov-02	9.671	<2.0	1.00	10.721	<2.0	1.00
19-Feb-03	7.843	<2.0	1.00	8.756	<2.0	1.00
29-Apr-03	9.17	<7	3.5	8.52	<7	3.5
25-Feb-04	8.59	2.0	2.0	9.41	<1.0	0.5
25-May-04	8.73	1.0	1.0	7.47	<1.0	0.5
17-Aug-04	11.51	<10.0	5.0	11.58	<10.0	5.0
01-Nov-04	10.34	<10.0	5.0	13.13	12.0	12.0
14-Feb-05		<0.5	0.3		<0.5	0.3
09-May-05		<0.5	0.3		<0.5	0.3
29-Aug-05		5.8	5.8		15.4	15.4
01-Nov-05		32.60	32.60		17.20	17.20
06-Feb-06		< 0.44	0.22		1.10	1.10
09-May-06		10.40	10.40		6.80	6.80
11-Sep-06		< 0.50	0.25		< 0.50	0.25
28-Nov-06		0.76	0.76		< 0.50	0.25
Average	9.45	2.45	4.81	9.48	1.26	4.38

City: Oklahoma City, OK - *Deer Creek*

Pollutant: **Copper**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	21	21	6.21	<10.0	5
28-Jun-00	12.52	53	53	12.52	40	40
14-Sep-00	4.72	78	78	4.72	32	32
06-Dec-00	10.92	<10.0	5	10.92	<10.0	5
07-Mar-01	12.774	13	13	12.774	<10.0	5
24-Apr-01	6.638	38	38	6.638	<10.0	5
11-Sep-01		38	38		<10.0	5
07-Dec-01	7.269	38	38	7.269	<10.0	5
29-Jan-02		24	24	8.325	3.11	3.11
29-Apr-02	10.166	21	21	11.249	25	25
05-Aug-02	7.269	42	42	10.065	<10	5
11-Nov-02	9.671	<10	5	10.721	<10	5
19-Feb-03	7.843	15.00	15.00	8.756	<3.0	1.50
29-Apr-03	9.17	20	20	8.52	<5.0	2.5
25-Feb-04	8.59	20.0	20.0	9.41	<1.0	0.5
25-May-04	8.73	21.0	21.0	7.47	6.0	6.0
17-Aug-04	11.51	<10.0	5.0	11.58	<10.0	5.0
01-Nov-04	10.34	<10.0	5.0	13.13	<10.0	5.0
14-Feb-05		<0.50	0.3		<0.50	0.3
09-May-05		12.0	12.0		<0.5	0.3
29-Aug-05		105.0	105.0		51.9	51.9
01-Nov-05		23.4	23.4		2.5	2.5
06-Feb-06		36.1	36.1		15.2	15.2
09-May-06		129.7	129.7		99.7	99.7
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		25.0	25.0		< 0.50	0.3
Average	9.24	29.01	29.39	9.39	7.58	9.35

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Lead**

DATE	**INFLUENT**			**EFFLUENT**		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
08-Jun-03	9.633	<2.0	1.00	7.704	<2.0	1.00
15-Jun-03	8.461	<2.0	1.00	6.564	<2.0	1.00
22-Jun-03	9.197	<2.0	1.00	7.332	<2.0	1.00
29-Jun-03	8.141	<2.0	1.00	7.042	<2.0	1.00
07-Jul-03	8.523	3	1.00	5.618	<2.0	1.00
14-Jul-03	7.698	<2	1.00	4.805	<2.0	1.00
21-Jul-03	8.237	<2.0	1.00	4.879	<2.0	1.00
28-Jul-03	8.179	2.6	2.60	4.759	<2.0	1.00
03-Aug-03	8.84	3.4	3.4	6.882	<2.0	1
10-Aug-03	8.036	<2.0	1	7.857	<2.0	1
17-Aug-03	8.752	2.6	1	6.914	<2.0	1
24-Aug-03	7.72	<2.0	1	7.72	<2.0	1
08-Sep-03	8.522	<2.0	1	8.255	<2.0	1
15-Sep-03	8.604	<2.0	1	8.417	<2.0	1
21-Sep-03	8.425	<2.0	1	12.13	<2.0	1
28-Sep-03	8.944	<2.0	1	8.942	<2.0	1
05-Oct-03	7.925	2.1	2.1	8.614	<2.0	1
12-Oct-03	9.523	<2.0	1	9.297	<2.0	1
19-Oct-03	8.699	<2.0	1	9.244	<2.0	1
26-Oct-03	8.101	<2.0	1	8.615	<2.0	1
25-Feb-04	8.59	2.0	2.0	9.41	<1.0	0.5
25-May-04	8.73	2.0	2.0	7.47	2.0	2.0
17-Aug-04	11.51	<1.5	0.8	11.58	<1.5	0.8
01-Nov-04	10.34	1.8	1.8	13.13	<1.5	0.8
14-Feb-05		2.6	2.6		<0.50	0.3
09-May-05		1.0	1.0		<0.50	0.3
29-Aug-05		10.4	10.4		2.9	2.9
01-Nov-05		<2.2	1.1		<2.2	1.1
06-Feb-06		< 2.2	1.1		< 2.2	1.1
09-May-06		7.0	7.0		3.0	3.0
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		6.5	6.50		< 0.50	0.25
Average	9.43	1.95	3.99	9.45	1.16	3.33

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Mercury**

DATE	**INFLUENT**			**EFFLUENT**		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	0.2	0.2	6.21	<0.2	0.1
28-Jun-00	12.52	<0.2	0.1	12.52	<0.2	0.1
14-Sep-00	4.72	<0.2	0.1	4.72	<0.2	0.1
06-Dec-00	10.92	<0.2	0.1	10.92	<0.2	0.1
07-Mar-01	12.774	<0.2	0.1	10.92	<0.2	0.1
24-Apr-01	6.638	<0.2	0.1	10.92	<0.2	0.1
11-Sep-01	6.638	<0.2	0.1	10.92	<0.2	0.1
07-Dec-01	6.638	<0.2	0.1	10.92	<0.2	0.1
29-Jan-02	8.325	<0.2	0.10	8.335	<0.2	0.1
29-Apr-02	10.166	0.2	0.10	11.249	0.6	0.3
05-Aug-02	7.269	<0.2	0.10	10.065	<0.2	0.1
11-Nov-02	9.671	<0.2	0.10	10.721	<0.2	0.1
19-Feb-03	7.843	<0.2	0.10	8.756	<0.2	0.10
29-Apr-03	9.17	<0.2	0.1	8.52	<0.2	0.1
25-Feb-04	8.59	<0.2	0.1	9.41	<0.2	0.1
25-May-04	8.73	<0.2	0.1	7.47	<0.2	0.1
17-Aug-04	11.51	<0.2	0.1	11.58	<0.2	0.1
01-Nov-04	10.34	<0.2	0.1	13.13	<0.2	0.1
14-Feb-05		<0.2	0.1		<0.2	0.1
09-May-05		<0.2	0.1		4.3	4.3
29-Aug-05		<0.2	0.1		<0.2	0.1
01-Nov-05		<0.2	0.1		<0.2	0.1
06-Feb-06		< 0.2	0.1		< 0.2	0.1
09-May-06		0.2	0.2		< 0.2	0.1
11-Sep-06		0.6	0.6		< 0.20	0.1
28-Nov-06		< 0.20	0.1		< 0.20	0.1
Average	9.43	0.10	0.18	9.63	0.05	0.14

City:
Pollutant: **Selenium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
03-Aug-03	8.84	<2.0	1	6.882	<2.0	1
10-Aug-03	8.036	<2.0	1	7.857	<2.0	1
17-Aug-03	8.752	<2.0	1	6.914	<2.0	1
24-Aug-03	7.72	<2.0	1	7.72	<2.0	1
08-Sep-03	8.522	<2.0	1	8.255	<2.0	1
15-Sep-03	8.604	<2.0	1	8.417	<2.0	1
21-Sep-03	8.425	<2.0	1	12.13	<2.0	1
28-Sep-03	8.944	2	2	8.942	<2.0	1
05-Oct-03	7.925	<2.0	1	8.614	<2.0	1
12-Oct-03	9.523	<2.0	1	9.297	<2.0	1
19-Oct-03	8.699	<2.0	1	9.244	<2.0	1
26-Oct-03	8.101	<2.0	1	8.615	<2.0	1
25-Feb-04	8.59	1.0	1.0	9.41	<1.0	0.5
25-May-04	8.73	2.0	2.0	7.47	3.0	3.0
17-Aug-04	11.51	<3.0	1.5	11.58	<3.0	1.5
01-Nov-04	10.34	<3.0	1.5	13.13	<3.0	1.5
14-Feb-05		<1	0.5		<1.0	0.5
09-May-05		1.6	1.6		1.1	1.1
29-Aug-05		<4.93	2.5		8.0	8.0
01-Nov-05		7.5	7.5		7.6	7.6
06-Feb-06		< 4.93	2.5		< 4.93	2.5
09-May-06		5.8	5.8		< 4.93	2.5
11-Sep-06		< 1.0	0.5		< 1.0	0.5
28-Nov-06		1.30	1.30		< 1.0	0.50
Average	9.43	0.59	2.78	9.56	0.56	2.74

City:
Pollutant: **Silver**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	6	6	6.21	8	8
28-Jun-00	12.52	<2.0	1	12.52	<2.0	1
14-Sep-00	4.72	<2.0	1	4.72	<2.0	1
06-Dec-00	10.92	<2.0	1	10.92	<2.0	1
07-Mar-01	12.774	<2.0	1	12.774	<2.0	1
24-Apr-01	6.638	<2.0	1	6.638	<2.0	1
29-Jan-02		<2.0	1	8.325	<2.0	1
29-Apr-02	10.166	<2.0	1	11.249	7	7
05-Aug-02	7.269	<2.0	1	10.065	<2.0	1
11-Nov-02	9.671	<2.0	1	10.721	<2.0	1
19-Feb-03	7.843	5.40	5.40	8.756	<1.2	0.60
29-Apr-03	9.17	26	26	8.52	<1.2	0.6
25-Feb-04	8.59	3.0	3.0	9.41	<1.0	0.5
25-May-04	8.73	<1.0	0.5	7.47	<1.0	0.5
17-Aug-04	11.51	<1.0	0.5	11.58	<1.0	0.5
01-Nov-04	10.34	1.6	1.6	13.13	<1.0	0.5
14-Feb-05		<1	0.5		<1	0.5
09-May-05		<1	0.5		<1	0.5
29-Aug-05		<3	1.5		<3	1.5
01-Nov-05		<3	1.5		<3	1.5
06-Feb-06		< 3	1.5		< 3	1.5
09-May-06		< 3	1.5		< 3	1.5
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		1.3	1.3		< 0.50	0.3
Average	9.70	5.31	5.79	9.80	0.69	1.45

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Thallium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	<10	5	6.21	<10	5
28-Jun-00	12.52	<10	5	12.52	<10	5
14-Sep-00	4.72	<10	5	4.72	<10	5
06-Dec-00	10.92	<10	5	10.92	106	106
07-Mar-01	12.774	<10	5	10.92	<10	5
24-Apr-01	6.638	<10	5	10.92	<10	5
29-Jan-02		<10	5	8.325	<10	5
29-Apr-02	10.166	<10	5	11.249	<10	5
05-Aug-02	7.269	<10	5	10.065	<10	5
11-Nov-02	9.671	<10	5	10.721	<10	5
19-Feb-03	7.843	<1	0.50	8.756	<1	0.50
29-Apr-03	9.17	26	26	8.52	<1	0.5
25-Feb-04	8.59	<2.0	1.0	9.41	<2.0	1.0
25-May-04	8.73	<2.0	1.0	7.47	<2.0	1.0
17-Aug-04	11.51	<2.0	1.0	11.58	<2.0	1.0
01-Nov-04	10.34	<2.0	1.0	13.13	<2.0	1.0
14-Feb-05		2.0	2.0		5.4	5.4
09-May-05		<1.0	0.5		<1.0	0.5
29-Aug-05		9.1	9.1		<8.08	4.0
01-Nov-05		<8.08	4.0		<8.08	4.0
06-Feb-06		< 8.08	4.0		< 8.08	4.0
09-May-06		< 8.08	4.0		< 8.08	4.0
11-Sep-06		< 1.40	0.7		< 1.40	0.7
28-Nov-06		< 1.40	0.7		< 1.40	0.7
Average	9.28	2.36	5.67	9.50	3.75	6.97

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Zinc**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
29-Jan-02		67	67	8.325	16.3	16.3
29-Apr-02	10.166	56	56	11.249	95	95
05-Aug-02	7.269	107	107	10.065	56	56
11-Nov-02	9.671	58	58	10.721	29	29
19-Feb-03	7.843	86.00	86.00	8.756	59.00	59.00
29-Apr-03	9.17	87	87	8.52	80	80
25-Feb-04	8.59	55.0	55.0	9.41	11.0	11.0
25-May-04	8.73	43.0	43.0	7.47	22.0	22.0
17-Aug-04	11.51	29.0	29.0	11.58	38.0	38.0
01-Nov-04	10.34	79.0	79.0	13.13	24.0	24.0
14-Feb-05		43.0	43.0		27.0	27.0
09-May-05		70.0	70.0		17.0	17.0
29-Aug-05		160.0	160.0		41.2	41.2
01-Nov-05		112.0	112.0		44.2	44.2
06-Feb-06		115.4	115.4		39.8	39.8
09-May-06		65.6	65.6		46.4	46.4
11-Sep-06		38.0	38.0		37.0	37.0
28-Nov-06		58.0	58.0		17.0	17.0
Average	9.28	78.98	79.21	9.50	41.26	41.71

City: Oklahoma City, OK - *Deer Creek*

Pollutant: **Molybdenum**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	<20	10	6.21	7.4	7.4
28-Jun-00	12.52	48	48	12.52	<5.7	2.85
14-Sep-00	4.72	<30	15	4.72	<30	15
06-Dec-00	10.92	<20	10	10.92	<20	10
07-Mar-01	12.774	<5.0	2.5	10.92	<5.0	2.5
24-Apr-01	6.638	5	5	10.92	<5.0	2.5
11-Sep-01	6.638	<5.0	2.5	10.92	<5.0	2.5
25-Sep-01	8.416			8.416		
07-Dec-01	7.269	<5.0	2.5	10.92	<5.0	2.5
29-Jan-02	8.325	<30	15	8.335	<30	15
29-Apr-02	10.166	<30	15	11.249	<30	15
05-Aug-02	7.269	<30	15	10.065	<30	15
11-Nov-02	9.671	<30	15	10.721	<30	15
19-Feb-03	7.843			8.756		
29-Apr-03	9.17	6.4	6.4	8.52	<5	2.5
25-Feb-04	8.59	7.0	7.0	9.41	4.0	4.0
25-May-04	8.73	5.0	5.0	7.47	6.0	6.0
17-Aug-04	11.51	<7.0	3.5	11.58	<7.0	3.5
01-Nov-04	10.34	9.9	9.9	13.13	<7.0	3.5
14-Feb-05		8.4	8.4		4.0	4.0
09-May-05		3.1	3.1		<0.5	0.3
29-Aug-05		4.8	4.8		5.3	5.3
01-Nov-05		4.1	4.1		<2.68	1.3
06-Feb-06		3.6	3.6		3.8	3.8
09-May-06		17.8	17.8		9.5	9.5
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		7.9	7.9		< 0.50	0.3
Average	8.60	3.83	9.39	9.10	1.20	6.91

City: Oklahoma City, OK - *Deer Creek*
Pollutant: **Nickel**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	6.21	3.956	3.956	6.21	0.231	0.231
28-Jun-00	12.52	47.2	47.2	12.52	17	17
14-Sep-00	4.72	<5.7	2.85	4.72	<8.3	4.15
06-Dec-00	10.92	<20.0	10	10.92	<15.0	7.5
07-Mar-01	12.774	<5.0	2.5	12.774	<5.0	2.5
24-Apr-01	6.638	<5.0	2.5	6.638	<5.0	2.5
11-Sep-01		<5.0	2.5	6.638	<5.0	2.5
07-Dec-01	7.269	<5.0	2.5	6.638	<5.0	2.5
29-Jan-02		<40	20	8.325	<40	20
29-Apr-02	10.166	<40	20	11.249	<40	20
05-Aug-02	7.269	<40	20	10.065	<40	20
11-Nov-02	9.671	<40	20	10.721	<40	20
19-Feb-03	7.843	8.70	8.70	8.756	8.20	8.20
29-Apr-03	9.17	35	35	8.52	28	28
25-Feb-04	8.59	2.0	2.0	9.41	<1.0	0.5
25-May-04	8.73	2.0	2.0	7.47	2.0	2.0
17-Aug-04	11.51	<10.0	5.0	11.58	<10.0	5.0
01-Nov-04	10.34	<10.	5.0	13.13	<10.0	5.0
14-Feb-05		<0.50	0.3		<0.50	0.3
09-May-05		1.4	1.4		0.8	0.8
29-Aug-05		66.4	66.4		12.2	12.2
01-Nov-05		18.2	18.2		13.0	12.0
06-Feb-06		< 4.52	2.3		< 4.52	2.3
09-May-06		7.8	7.8		7.6	7.6
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		4.6	4.5		< 0.50	0.3
Average	9.24	5.15	10.46	9.29	5.02	10.22

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Arsenic**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	<10	5	2.77	<10	5
28-Jun-00	7.12	<10	5	7.12	<10	5
14-Sep-00	2.59	<10	5	2.59	<10	5
06-Dec-00	2.3	<10	5	2.3	<10	5
07-Mar-01	4.2	<10	5	4.2	<10	5
24-Apr-01	3.6	<10	5	3.6	<10	5
11-Sep-01	3.6	<10	5	3.6	<10	5
05-Dec-01	3.6	<10	5	3.6	<10	5
29-Jan-02	3.483	<10	5	3.483	<10	5
30-Apr-02	4.787	<10	5	4.787	<10	5
06-Aug-02	2.986	<10	5	2.986	<10	5
12-Nov-02	4.091	<10	5	4.091	<10	5
19-Feb-03	4.072	1.5	1.5	4.072	<1	0.5
29-Apr-03	3.780	<2	1	3.790	<2.0	1
25-Feb-04	3.94	2.0	2.0	3.94	2.0	2.0
25-May-04	2.91	3.0	3.0	2.91	2.0	2.0
17-Aug-04	6.46	<2.0	1.0	6.46	<2.0	1.0
01-Nov-04	6.22	<2.0	1.0	6.22	<2.0	1.0
14-Feb-05		<0.50	0.3		<0.50	0.3
09-May-05		<0.50	0.3		<0.50	0.3
29-Aug-05		<4.74	2.4		5.7	5.7
01-Nov-05		11.5	11.5		7.0	7.0
06-May-06		<4.74	2.4		<4.74	2.4
09-May-06	4.73	<4.74	2.4	4.73	<4.74	2.4
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		9.9	9.9		< 0.50	0.3
Average	4.195	1.776	5.019	4.179	1.077	4.804

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Cadmium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
03-Nov-03	3.380	<1	0.5	3.380	<1.0	0.5
01-Dec-03	3.525	<1	0.5	3.525	<1.0	0.5
05-Jan-04	3.594	<1	0.5	3.594	<1.0	0.5
03-Feb-04	5.417	<1	0.5	5.417	<1.0	0.5
25-Feb-04	3.944	<1	0.5	3.944	<1.0	0.5
02-Mar-04	4.063	<1	0.5	4.063	<1.0	0.5
04-Apr-04	4.498	<1	0.5	4.498	<1.0	0.5
04-May-04	4.513	<1	0.5	4.513	<1.0	0.5
25-May-04	2.912	<1	0.5	2.912	<1.0	0.5
06-Jun-04	3.806	<1	0.5	3.806	<1.0	0.5
12-Jul-04	4.924			4.924	<1.0	0.5
02-Aug-04	4.418			4.418	<1.0	0.5
17-Aug-04	6.459	<1	0.5	6.459		0.5
07-Sep-04	4.5			4.5	<1.0	0.5
05-Oct-04	3.7			3.7	2.4	0.5
01-Nov-04	6.2	<1	0.5	6.2	<1.0	0.5
09-May-05		<0.50	0.25		<0.50	0.25
08-Aug-05				4.7	<0.5	0.25
29-Aug-05		4.3	4.3		1.4	1.4
02-Nov-05		2.6		4.5	2.2	0.25
06-Feb-06		0.7	0.7	4.7	0.6	0.25
06-Mar-06	4.0			4.0	<0.5	0.25
09-May-06	4.7	3.8	3.8	4.7	3	3
11-May-06		3.3	3.3		2.7	
12-Sep-06		4.8	4.8	4.3	<0.5	0.25
11-Oct-06				4.0	0.56	0.25
08-Nov-06		<0.5	0.25	6.7	<0.5	0.25
Average	4.102	0.327	0.772	4.061	0.266	0.708

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Chromium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
10-Aug-03	4.006	11	11	4.008	<7	3.5
17-Aug-03	3.435	<7	3.5	3.435	<7	3.5
24-Aug-03	3.529	12	12	3.529	<7	3.5
07-Sep-03	5.080	7.9	7.9	5.080	<7	3.5
14-Sep-03	3.857	<7	3.5	3.857	<7	3.5
21-Sep-03	4.095	10	10	4.095	7.2	7.2
28-Sep-03	3.556	14	0.5	3.556	<7	3.5
05-Oct-03	3.808	<7	3.5	3.808	<7	3.5
12-Oct-03	3.680	<7	3.5	3.839	<7	3.5
19-Oct-03	3.865	<7	3.5	3.865	<7	3.5
26-Oct-03	3.758	<7	3.5	3.758	<7	3.5
03-Nov-03	3.627	<7	3.5	3.627	<7	3.5
01-Dec-03	3.525	13	13	3.525	<7	3.5
05-Jan-04	3.594	14	14	3.594	<7	3.5
03-Feb-04	5.417	<7	3.5	5.417	<7	3.5
26-Feb-04	3.944	6	6	3.944	2	2
02-Mar-04	4.063	<10	5	4.063	<10	5
04-Apr-04	4.498	16	16	4.498	15	15
04-May-04	4.513	<10	5	4.513	<10	5
27-May-04	2.912	12	12	2.912	2	2
06-Jun-04	3.806	<10	5	3.806	<10	5
17-Aug-04	6.459	<10	5	6.459	<10.0	5
07-Sep-04	4.5			4.5	<10.0	5
05-Oct-04	3.7			3.7	<10.0	5
01-Nov-04	6.2	<10	5	6.2	<10.0	5
06-Dec-04	7.3	<10	5	7.3	<10.0	5
29-Aug-05		10.1	10.1		3.9	
02-Nov-05		41.2	41.2	4.5	28.3	0.25
06-Feb-06		6.1	6.1	0.7	<0.44	0.25
09-May-06		14.8	14.8		7.8	7.8
08-Aug-06				3.8	<0.5	0.25
12-Sep-06		12	12	4.3	<0.5	0.25
11-Oct-06				4.0	<0.5	0.25
08-Nov-06		12	12	6.7	<0.5	0.25

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Copper**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	75	75	2.77	<10.0	5
28-Jun-00	7.12	61	61	7.12	28	28
14-Sep-00	2.59	96	96	2.59	39	39
06-Dec-00	2.3	<10.0	5	2.3	<10.0	5
07-Mar-01	4.2	34	34	4.2	20	20
24-Apr-01	3.6	28	28	3.6	<10.0	5
11-Sep-01	3.6	<10.0	5	3.6	<10.0	5
05-Dec-01	3.6	70	70	3.6	16	16
29-Jan-02	3.483	45	45	3.483	15	15
30-Apr-02	4.787	31	31	4.787	7	7
06-Aug-02	2.986	90	90	2.986	<10	5
12-Nov-02	4.091	28	28	4.091	<10	5
19-Feb-03	4.093	65	65	4.093	8.6	8.6
29-Apr-03	3.780	32	32	3.780	<5	2.5
25-Feb-04	3.94	25.0	25.0	3.94	4.0	4.0
25-May-04	2.91	77.0	77.0	2.91	9.0	9.0
17-Aug-04	6.46	<10.0	5.0	6.46	<10.0	5.0
01-Nov-04	6.22	27.0	27.0	6.22	110.0	110.0
14-Feb-05		10.0	10.0		<0.50	0.3
09-May-05		15.0	15.0		<0.50	0.3
29-Aug-05		78.9	78.9		77.7	77.7
01-Nov-05		87.6	87.6		12.5	12.5
06-Feb-06		48.1	48.1		21.3	21.3
09-May-06	4.73	125.5	125.5	4.73	92.4	92.4
11-Sep-06		45.0			4.3	
28-Nov-06		34.0			<0.5	
Average	4.263	47.434	48.016	4.234	12.303	13.875

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Lead**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
28-Apr-03	3.954	3.7	3.7	3.954	<2.0	1
29-Apr-03	3.780	3.2	3.2	3.780	<2	1
05-May-03	3.782	2.9	2.9	3.782	<2	1
01-Jun-03	3.796	5	5	3.796	<2	1
08-Jun-03	4.266	3.7	3.7	4.266	<2	1
15-Jun-03	4.107	3	3	4.107	<2	1
22-Jun-03	4.474	8.7	8.7	4.474	<2	1
29-Jun-03	3.870	5.3	5.3	3.870	<2	1
07-Jul-03	3.515	8	8	3.515	<2	1
14-Jul-03	3.371	3.9	3.9	3.371	<2	1
21-Jul-03	3.177	2.9	2.9	3.177	<2	1
28-Jul-03	3.404	4.6	3.5	3.404	<2	1
03-Aug-03	3.969	5.9	5.9	3.959	<2	1
10-Aug-03	4.006	<2	1	4.008	<2	1
17-Aug-03	3.435	5.2	5.2	3.435	<2	1
24-Aug-03	3.529	5.8	5.8	3.529	<2	1
07-Sep-03	5.080	6.4	6.4	5.080	<2	1
14-Sep-03	3.857	4.1	4.1	3.857	<2	1
21-Sep-03	4.095	6.7	6.7	4.095	<2	1
28-Sep-03	3.556	4.3	4.3	3.556	<2	1
05-Oct-03	3.808	7.7	7.7	3.808	<2	1
12-Oct-03	3.680	4.3	4.3	3.839	<2	1
19-Oct-03	3.865	4.2	4.2	3.865	<2	1
26-Oct-03	3.758	3.5	3.5	3.758	<2	1
03-Nov-03	3.380	5.9	5.9	3.380	<2	1
01-Dec-03	3.525	4.3	4.3	3.525	<2	1
05-Jan-04	3.594	2.6	2.6	3.594	<2	1
03-Feb-04	5.417	2.6	2.6	5.417	<2	1
25-Feb-04	3.944	<1.0	0.5	3.944	<1.0	0.5
02-Mar-04	4.063	5.3	5.3	4.063	<2	1
04-Apr-04	4.498	2.6	2.6	4.498	<2	1
04-May-04	4.513	3.4	3.4	4.513	<2	1
25-May-04	2.912	8	8	2.912	2	2
06-Jun-04	3.806	<2	1	3.806	<2	1
17-Aug-04	6.459	5.7	5.7	6.459	<1.5	0.75
01-Nov-04	6.2	3.6	3.6	6.2	<1.5	0.75
06-Feb-06		13.9	13.9		<2.2	1.1
09-May-06	4.7	9.7	9.7	4.7	3	3
Average	4.11	3.21	4.81	4.20	1.03	2.86

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Mercury**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	0.4	0.4	2.77	<0.2	0.1
28-Jun-00	7.12	<0.2	0.1	7.12	<0.2	0.1
06-Dec-00	2.3	<0.2	0.1	2.3	<0.2	0.1
07-Mar-01	4.2	<0.2	0.1	4.2	0.26	0.26
24-Apr-01	3.6	<0.2	0.1	3.6	<0.2	0.1
05-Dec-01	3.6	0.4	0.4	3.6	<0.2	0.1
29-Jan-02	3.483	<0.2	0.1	3.483	<0.2	0.1
30-Apr-02	4.787	<0.2	0.1	4.787	<0.2	0.1
06-Aug-02	2.986	0.2	0.2	2.986	<0.2	0.1
12-Nov-02	4.091	<0.2	0.1	4.091	<0.2	0.1
19-Feb-03	4.072	<.2	0.1	4.072	<0.2	0.1
29-Apr-03	3.780	<0.2	0.1	3.780	<0.2	0.1
25-Feb-04	3.94	<0.2	0.1	3.94	<0.2	0.1
25-May-04	2.91	0.2	0.2	2.91	<0.2	0.1
17-Aug-04	6.46	0.3	0.3	6.46	<0.2	0.1
01-Nov-04	6.22	<0.2	0.1	6.22	<0.2	0.1
14-Feb-05		<0.2	0.1		<0.2	0.1
09-May-05		<0.2	0.1		<0.2	0.1
29-Aug-05		<0.2	0.1		<0.2	0.1
01-Nov-05		0.6	0.6		<0.2	0.1
06-Feb-06		< 0.2	0.1		< 0.2	0.1
09-May-06		0.2	0.2		< 0.2	0.1
11-Sep-06		0.31	0.3		< 0.20	0.1
28-Nov-06		< 0.20	0.1		< 0.20	0.1
Average	4.18	0.14	0.22	4.14	0.04	0.21

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Molybdenum**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	<20	10	2.77	4.5	4.5
28-Jun-00	7.12	<5.7	2.85	7.12	<5.7	2.85
14-Sep-00	2.59	17.5	17.5	2.59	<5.7	2.85
06-Dec-00	2.3	<20	10	2.3	<20	10
07-Mar-01	4.2	<5	2.5	4.2	<5.0	2.5
24-Apr-01	3.6	<5	2.5	3.6	5	5
11-Sep-01	3.6	<5	2.5	3.6	5	5
05-Dec-01	3.6	<5	2.5	3.6	5	5
29-Jan-02	3.483	<30	15	3.483	<30	15
30-Apr-02	4.787	<30	15	4.787	<30	15
06-Aug-02	2.986	<30	15	2.986	<30	15
12-Nov-02	4.091	<30	15	4.091	<30	15
19-Feb-03	4.1			4.1		
29-Apr-03	3.8	<5	2.5	3.8	<5	2.5
25-Feb-04	3.94	3.0	3.0	3.94	3.0	3.0
25-May-04	2.91	10.0	10.0	2.91	6.0	6.0
17-Aug-04	6.46	7.8	7.8	6.46	<7.0	3.5
01-Nov-04	6.22	<7.0	3.5	6.22	<7.0	3.5
14-Feb-05		<0.5	0.3		<0.5	0.3
09-May-05		<0.5	0.3		<0.5	0.3
29-Aug-05		<2.68	1.3		5.3	5.3
01-Nov-05		<2.68	1.3		<2.68	1.3
06-Feb-06		< 3	1.5		< 3	1.5
09-May-06		17.1	17.1		7.7	7.7
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		< 0.50	0.3		< 0.50	0.3
Average	3.95	2.79	8.35	3.95	1.97	7.27

Nickel

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	11.82	11.82	2.77	0.544	0.544
28-Jun-00	7.12	<8.3	4.15	7.12	<8.3	4.15
14-Sep-00	2.59	12	12	2.59	<8.3	4.15
06-Dec-00	2.3	<20.0	10	2.3	<20.0	10
07-Mar-01	4.2	<5	2.5	4.2	22	22
24-Apr-01	3.6	<5	2.5	3.6	<5.0	2.5
11-Sep-01	3.6	<5	2.5	3.6	<5.0	2.5
05-Dec-01	3.6	<5	2.5	3.6	<5.0	2.5
29-Jan-02	3.483	<40.0	20	3.483	<40.0	20
30-Apr-02	4.787	<40.0	20	4.787	<40.0	20
06-Aug-02	2.986	<40.0	20	2.986	<40.0	20
12-Nov-02	4.091	<40.0	20	4.091	<40.0	20
19-Feb-03	4.1	6.4	6.4	4.1	5.6	5.6
29-Apr-03	3.780	55	55	3.780	33	33
25-Feb-04	3.94	2.0	2.0	3.94	1.0	1.0
25-May-04	2.91	4.0	4.0	2.91	2.0	2.0
17-Aug-04	6.46	<10.0	5.0	6.46	<10.0	5.0
01-Nov-04	6.22	<10.	5.0	6.22	<10.0	5.0
14-Feb-05		<0.5	0.3		<0.5	0.3
09-May-05		23.0	23.0		1.0	1.0
29-Aug-05		23.6	23.6		43.6	43.6
01-Nov-05		18.1	18.1		14.6	14.6
06-Feb-06		< 4.52	2.3		< 4.52	2.3
09-May-06		12.1	12.1		6.0	6.0
11-Sep-06		< 0.50	0.3		< 0.50	0.3
28-Nov-06		6.4	6.4		< 0.50	0.25
Average	4.25	3.13	8.94	4.27	6.58	12.35

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Selenium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
03-Feb-04	5.417	<2	1	5.417	<2	1
26-Feb-04	3.944	2	2	3.944	<2	1
04-Mar-04	4.063	<3	1.5	4.063	<3	1.5
04-Apr-04	4.498	<3.6	1.8	4.498	<3.6	1.8
03-May-04	4.513	5.9	5.9	4.513	3.8	3.8
27-May-04	2.912	4	4	2.912	2	2
18-Aug-04	6.459	<3.0	1.5	6.459	<3.0	1.5
01-Nov-04	6.2	<3.0	1.5	6.2	<3.0	1.5
06-Dec-04	7.273			7.273	<3.0	1.5
03-Jan-05				5.4	<3.0	1.5
02-Feb-05				5.8	<2.0	1
14-Feb-05		<1	0.5		<1	0.5
06-Mar-05				6.900	<1.0	0.5
03-Apr-05				5.390	<1.0	0.5
02-May-05				4.778	<1.0	0.5
09-May-05		8.9	8.9		2.1	2.1
06-Jun-05				5.292	1.2	1.2
04-Jul-05				6.277	1.1	1.2
08-Aug-05				4.715	<1.0	0.5
29-Aug-05		<4.93	2.46		9.4	9.4
02-Nov-05		<4.93	2.46	4.463	6.4	0.5
06-Dec-05				4.026	<1.0	0.5
03-Jan-06				3.939	<1.0	0.5
06-Feb-06		<4.93		4.702	<4.93	0.5
01-May-06				4.257	1.1	1.6
09-May-06		7.6			5.2	
03-Jan-00				4.498	1.3	1.3
11-Jul-06				3.819	0.62	0.62
08-Aug-08				3.845	1.2	1.2
12-Sep-06		<1	0.5	4.289	<1	0.25
11-Oct-06				3.987	1.3	1.3
08-Nov-06				6.671	1.3	1.3
28-Nov-06		2.3			<1	
14-Feb-07				5.368	<0.15	0.075
16-Apr-07				5.644	1.4	1.4
13-May-07				11.018	1.8	1.9
07-Aug-07				5.334	<5	2.5
11-Sep-07				4.828	<5	2.5
Average	4.08	0.96	2.89	4.18	0.79	2.51

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Silver**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	4	4	2.77	<2.0	1
28-Jun-00	7.12	<2.0	1	7.12	<2.0	1
14-Sep-00	2.59	<2.0	1	2.59	<2.0	1
06-Dec-00	2.3	<2.0	1	2.3	<2.0	1
07-Mar-01	5.2	<2.0	1	4.8	<2.0	1
24-Apr-01	3.6	<2.0	1	3.4	<2.0	1
11-Sep-01	4.1	<2.0	1	4.1	<2.0	1
05-Dec-01	0.0	<2.0	1	0.0	<2.0	1
29-Jan-02	3.483	8	8	3.483	<2.0	1
30-Apr-02	4.787	<2	1	4.787	<2.0	1
06-Aug-02	2.986	<2	1	2.986	<2.0	1
12-Nov-02	4.091	<2	1	4.091	<2.0	1
19-Feb-03	4.1	6	6	4.1	<1.2	0.6
29-Apr-03	3.8	11	11	3.8	5.4	5.4
25-Feb-04	3.94	1.0	1.0	3.94	<1.0	0.5
25-May-04	2.91	2.0	2.0	2.91	<1.0	0.5
17-Aug-04	6.46	<1.0	0.5	6.46	<1.0	0.5
01-Nov-04	6.22	1.1	1.1	6.22	<1.0	0.5
14-Feb-05		<0.5	0.3		<0.5	0.3
09-May-05		<1.0	0.5		<1.0	0.5
29-Aug-05		<3.0	1.5		<3.0	1.5
01-Nov-05		<3.0	1.5		<3.0	1.5
06-Feb-06		3.5	3.5		< 3	1.5
09-May-06		< 3	1.5		< 3	1.5
11-Sep-06		1	1		< 0.50	0.25
28-Nov-06		1.3	1.3		< 0.50	0.25
Average	4.15	1.87	2.46	4.10	0.38	1.27

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Thallium**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	<10.0	5	2.77	<10.0	5
28-Jun-00	7.12	<10.0	5	7.12	<10.0	5
14-Sep-00	2.59	<10.0	5	2.59	<10.0	5
06-Dec-00	2.3	<10.0	5	2.3	<10.0	5
07-Mar-01	5.2	<10.0	5	4.8	<10.0	5
24-Apr-01	3.6	<10.0	5	3.4	<10.0	5
11-Sep-01	4.1	<10.0	5	4.1	<10.0	5
05-Dec-01	0.0	<10.0	5	0.0	<10.0	5
29-Jan-02	3.483	<10.0	5	3.483	<10.0	5
30-Apr-02	4.787	<10.0	5	4.787	<10.0	5
06-Aug-02	2.986	<10.0	5	2.986	<10.0	5
12-Nov-02	4.091	<10.0	5	4.091	<10.0	5
19-Feb-03	4.1	<1.0	0.5	4.1	<1	0.5
29-Apr-03	3.780	<1.0	0.5	3.780	<1	0.5
25-Feb-04	3.94	<2.0	1.0	3.94	<2.0	1.0
25-May-04	2.91	<2.0	1.0	2.91	<2.0	1.0
17-Aug-04	6.46	<2.0	1.0	6.46	<2.0	1.0
01-Nov-04	6.22	<2.0	1.0	6.22	<2.0	1.0
14-Feb-05		<1	0.5		<1	0.5
09-May-05		<1	0.5		<1	0.5
29-Aug-05		<8.08	4.0		38.4	38.4
01-Nov-05		<8.08	4.0		<8.08	4.0
06-Feb-06		< 8.08	4.0		< 8.08	4.0
09-May-06		< 8.08	4.0		< 8.08	4.0
11-Sep-06		< 1.40	0.7		< 1.40	0.7
28-Nov-06		< 1.40	0.7		< 1.40	0.7
Average	4.21	1.88	4.99	4.07	2.55	5.55

City: Oklahoma City, OK - *Chisholm Creek*
Pollutant: **Zinc**

DATE	INFLUENT			EFFLUENT		
	Flow *mgd*	**Act. Conc.** *ug/L*	**Mass** *ppd*	**Flow** *mgd*	**Act. Conc.** *ug/L*	**Equiv. Conc.** *ug/L*
12-Jan-00	2.77	184	4.3	2.77	36	36
28-Jun-00	7.12	91	5.4	7.12	37	37
14-Sep-00	2.59	136	2.9	2.59	49	49
06-Dec-00	2.3	100	1.9	2.3	60	60
07-Mar-01	5.2	79	3.4	5.2	43	43
24-Apr-01	3.6	66	2.0	3.6	20	20
11-Sep-01	4.1	32	1.1	4.1	46	46
05-Dec-01	0.0	202	0.0	0.0	90	90
29-Jan-02	3.483	142	4.1	3.5	30	30
30-Apr-02	4.787	112	4.5	4.8	30	30
06-Aug-02	2.986	525	13.1	3.0	27	27
12-Nov-02	4.091	53.15	1.8	4.1	49	49
19-Feb-03	4.1	360	12.2	4.1	82.0	82
29-Apr-03	3.780	150	4.7	3.8	62	62
25-Feb-04	3.94	34.0	34.0	3.94	24.00	24.0
25-May-04	2.91	117.0	117.0	2.91	41.00	41.0
17-Aug-04	6.46	120.0	120.0	6.46	19.00	19.0
01-Nov-04	6.22	9.0	9.0	6.22	52.00	52.0
14-Feb-05		63.0	63.0		23.00	23.0
09-May-05		130.0	130.0		36.00	36.0
29-Aug-05		109.0	109.0		229.00	229.0
01-Nov-05		209	209.0		69.1	69.1
06-Feb-06		83	83		42.7	42.7
09-May-06		61.9	61.9		45.9	45.9
11-Sep-06		130	130		43.0	43.0
28-Nov-06		140	140		21.0	21.0
Average	4.21	139.13	26.07	4.18	52.29	52.11

VITA

Crystal Lynn Kowalik

Master of Science

Thesis: INVESTIGATION INTO ENDOCRINE DISRUTORS AT THE CITY OF OKLAHOMA CITY'S SELECTED WASTEWATER TREATMENT PLANTS

Major Field: Environmental Engineering

Biographical:

Personal Data: Born in Grand Forks, North Dakota, On August 1, 1970, the daughter of Linda and James Kowalik

Education: Graduated from Choctaw High School, Choctaw, Oklahoma in May 1988; attended Rose State College and the Oklahoma City Community College; received a Bachelor of Science degree in Civil Engineering from The University of Oklahoma in December 1994. Completed the requirements fro the Master of Science degree with a major in Environmental Engineering at Oklahoma State University in (May, 2008).

Experience: Employed as an intern for the Oklahoma Department of Environmental Quality; employed by the City of Muskogee, Muskogee, Oklahoma, as a Engineering Intern, 1995 to 1999; employed by the City of Tulsa, Tulsa, Oklahoma, as a Engineering Intern, 1999 to 2003; employed by Tetra Tech, Oklahoma City, Oklahoma, as a Civil Engineer, 2003 to 2004; employed by the City of Oklahoma City, OKC, Oklahoma, 2004 to present.

Professional Memberships: Water Environmental Federation, Engineers without Borders, American Society of Engineering, Oklahoma Society of Professional Engineers.

Name: Crystal Lynn Kowalik Date of Degree: May, 2008

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: INVESTIGATION INTO ENDOCRINE DISRUTORS AT THE CITY OF OKLAHOMA CITY'S SELECTED WASTEWATER TREATMENT PLANTS

Pages in Study: 279 Candidate for the Degree of Master of Science

Major Field: Environmental Engineering

Scope and Method of Study: Oklahoma City's three largest WWTPs were evaluated for potential vulnerability to EDCs and pharmaceutical pollutants in the influent wastewater streams. A list of candidates for screening was compiled based on potential for occurrence and analytical capability for testing the compounds of interest. Several of the compounds detected include: acetaminophen, caffeine, gemfibrozil (a cholesterol regulator), triclosan (antibacterial agent), sulfamethoxazole (a sulfa-based antibiotic), carbamazepine (anti-anxiety mood stabilizer), progesterone (female hormone), iopromide (iodinated contrast media), trimethoprim (antibiotic), and 4-methylphenol (intermediate organic widely used in industrial processes). In addition to the list of compounds, information regarding common usage, industrial application, and selected chemical properties is provided.

Findings and Conclusions: The data presented in this report represent a single sampling event, or snapshot, of WWTP water quality. The findings are from a single point in time and do not include influence from factors such as seasonal variation of flow in to the WWTP, changes in treatment (i.e. chlorination/dechlorination), and application of pesticides, fertilizers, etc. by both residential and agricultural users. Concentrations in the plant effluent imply the need for further work to more fully characterize seasonal variability. Few conclusions can be reliably formed without further testing, however, it is clear that some chemicals do appear to pass-through the treatment process at some level. More work needs to be performed to gain a better understanding of the potential impacts to Oklahoma City source waters and natural waters of the state. Although the City's WWTPs do not discharge to any of the City's drinking water sources, additional work should be conducted to determine potential impact from upstream activities on the North Canadian River.

ADVISER'S APPROVAL: Dr. John Veenstra