



## Response Tier Development Document Barton Springs Salamander Catastrophic Spill Plan

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### ABSTRACT

*The Barton Springs Salamander Catastrophic Spill Plan describes when and how endangered salamanders would be protected or rescued should a catastrophic spill occur in the Barton Spring watershed. The best response to any particular spill depends on a variety of factors, thus an effective spill response plan requires a method to determine thresholds that will elicit each tier of salamander rescue efforts. This plan focuses primarily on developing response tiers for gasoline, since it is considered to be the most common problematic spilled material with high toxicity and the potential for very large spills. The method developed for gasoline is based on some of the most toxic and abundant concentrations of gasoline contaminants including benzene, toluene, ethylbenzene, and xylene (BTEX) predicted in Barton Springs under a range of conceivable spatial, spill volume, and spring flow conditions. A screening model to make these predictions was developed as follows. First, toxicity data and water quality criteria for the BTEX contaminants were used to derive concentration thresholds that would establish the different response tiers. Second, a method to predict BTEX concentrations at Barton Springs from a gasoline spill entering the aquifer was chosen to guide responders in selecting the appropriate response tier in an emergency event. The goal was to select a model of contaminant transport based on previous studies of karst aquifer pollutant transport and supported by available groundwater time-of-travel and flow path data for the Barton Springs Segment of the Edwards Aquifer. Results from the model must be presented simply enough to quickly determine appropriate emergency response. Several methods were tested using a variety of spill attenuation, mixing volume, averaging period, and travel time assumptions. Ultimately, a simple published regression equation was selected that was developed from dye tracing data in a number of carbonate aquifers (Worthington and Smart, 2003). The predictions from this equation were compared with empirical dye study results for the Barton Springs Edwards Aquifer and found to be a conservative estimate for all conditions corresponding to available toxicity data. Solving for the threshold BTEX values enabled the generation of simple line graphs that can be used to quickly determine which tier of salamander rescue is appropriate based on volume of spill, springflow, and distance from Barton Springs. Similar methods were also used to develop response tiers in the event of a potentially catastrophic sewage spill, since these are the most common type of spill occurring within the Barton Springs watershed. However, the large majority of sewage spills are more likely to contribute to chronic degradation of Barton Springs than pose a catastrophic threat.*

### INTRODUCTION

This report describes the methods that underlie the salamander rescue strategies in the Barton Springs Salamander Catastrophic Spill Plan. While the information presented in this report is not critical to appropriate assessment and response selection during a spill event, it is important to understanding the basis for the response tier criteria. This report may also be useful for review of the Spill Plan by regulatory agencies, the scientific community, and the interested public. First, this document presents an overview of the salamander rescue response tiers. Second, the supporting toxicological information and water quality criteria used to develop values for acute and chronic exposure to pollutants that represent the four levels of risk defined in the response tiers are summarized. Third, the hydrogeological and modeling information used to predict the magnitude of a potential threat from a given spill are described.

This section includes the comparisons to dye tracing data used to verify the accuracy and suitability of estimations of time of travel of a pollutant through the watershed and expected pollutant concentrations at Barton Springs. Finally, the document describes the safety factors included in the response plan that would ensure a liberal estimate of potential detrimental effects from spill contaminants while reducing the detrimental effects of full scale salamander rescue on the natural populations.

## **OVERVIEW OF TIERED SALAMANDER RESCUE RESPONSE**

Rapid response to toxic spills requires a balance between protection of aquatic salamanders from toxic compounds and detrimental effects of the rescue efforts themselves. Since the toxicities of gasoline and other petroleum products on Barton Springs and Austin blind salamanders are unknown, the potential exists to overestimate or underestimate the impacts of a spill. Underestimating the impacts could result in an inadequate response to a potentially catastrophic spill. Overestimating the impacts could harm the Barton Springs ecosystem by collecting salamanders and other aquatic organisms unnecessarily. Given these unknowns, a multi-tiered approach to salamander rescue has been developed to ensure appropriate response to a spill without needlessly disrupting the salamander populations and their habitat:

- **Tier 1:** Full-scale salamander rescue: Spill responders believe the spill has a high potential to degrade or destroy the entire Barton Springs ecosystem and cause the extinction of the Barton Springs and Austin blind salamander species. Maximum equipment, personnel, and collection efforts are immediately deployed. Rescue efforts continue as long as it is safe to do so or until threat has passed.
- **Tier 2:** Partial salamander rescue: Spill responders believe the spill has the potential to result in mortality of some salamanders but is not likely to affect the entire species. Collections should be done slowly and carefully by a limited number of personnel as long as it is safe to do so or until threat has passed.
- **Tier 3:** Close monitoring of salamander populations: Spill responders believe the spill is not likely to result in mortality but could result in some harmful effects. Salamander biologists will make frequent daily inspections to assess the condition of the salamander populations and other aquatic biota at Barton Springs. Geologists will monitor water quality to determine if and when the spill could arrive at Barton Springs. Monitoring should continue until the threat has passed or spill responders determine that Tier 1 or 2 should be implemented.
- **Tier 4:** Normal spill response: Spill responders believe the size and location of the spill is too small to have a significant impact on Barton Springs.

## **TOXICOLOGICAL SUPPORT FOR GASOLINE RESPONSE TIERS**

Research into endangered species toxicology for the purpose of spill response planning is limited to the occasional risk assessment undertaken during specific species USFWS consultations. However, application of toxicity data for this purpose is relatively straightforward if the tested species and test conditions are similar to anticipated spill events. Unfortunately, for the Barton Springs and Austin blind salamanders, literature data must be extrapolated to provide an objective basis for developing response tiers. The following sections provide the background and logic for this extrapolation.

### **Composition of Gasoline**

The toxicity of petroleum products, including crude oils and refined products, depends on the composition of the materials and their chemical properties in air, soil, and water. For gasoline and other petroleum products, the chemical composition is highly complex and varies considerably depending on the type of product, the manufacturer, grade, time of year, and other factors. Virtually all compositions

have the potential to be spilled in the Barton Springs watershed. For example, refined products to be carried by the Longhorn Pipeline alone include multiple gasoline grades, diesel fuel, and jet fuel, each with its own composition and resulting toxicity.<sup>1</sup> Gasoline is considered to be the most problematic potential contaminant. It contains higher fractions of light hydrocarbons and aromatics than crude oil; its composition typically includes alkanes, alkenes, olefins, and aromatics, including the BTEX compounds (benzene, toluene, ethylbenzene, xylenes). Limited reports indicate that these aromatic hydrocarbons are generally about 28 percent by volume,<sup>2</sup> with toluene and the p- and m-xylenes the most abundant,<sup>3</sup> and benzene and xylene generally each contributing up to 5 to 7 percent to a given volume of gasoline.<sup>4,5</sup> Other gasoline components (such as naphthalene and other polynuclear aromatic hydrocarbons) may be more toxic than the BTEX compounds but typically occur in much smaller amounts.<sup>6</sup>

Beyond such generalities, however, a representative composition of gasoline is essentially not available. The proportions of BTEX constituents in gasoline are highly variable among producers, and formulation data are not typically released due to industry competition considerations. Because of the variable and limited information on gasoline composition, determining its toxicity is problematic. For the purpose of deriving response tiers for salamander rescue, BTEX compounds were evaluated because they are acutely toxic at low levels and are present in all gasoline formulations at relatively high concentrations in comparison to toxicity.

### Toxicity of Petroleum Products

Toxicity is a highly complex phenomenon and depends on a wide array of variables, including species, life stage (juveniles are often more sensitive than adults), exposure duration, and test methods. The U.S. Environmental Protection Agency has provided an online database, ECOTOX (<http://www.epa.gov/ecotox/>), which can be used to research single chemical toxicity testing data for freshwater species. Because most toxicity tests are conducted using single constituents, the synergistic and additive effects from a mixture of many toxic compounds such as gasoline remain unknown.

Data on toxicity of petroleum products to amphibians are very limited, and typically experiments are conducted on species such as the African clawed toad (*Xenopus laevis*) and Mexican axolotl (*Ambystoma mexicanum*) that are not solely aquatic and may be much less sensitive than the Barton Springs and Austin blind salamanders. Thus, using toxicity data for these species could seriously underestimate the concentrations that could impact the salamander populations at Barton Springs.

In general, lighter fuel oils tend to be more acutely toxic than heavier crude oils. For example, 96-hour LC50s for wood frog (*Rana sylvatica*) tadpoles ranged from 0.062 ml/L for an emulsion of No. 2 fuel oil to greater than 250 ml/L for the water-soluble fraction of mixed blend sweet crude oil,<sup>7</sup> while the LC50 for spotted salamander (*Ambystoma maculatum*) larvae was 0.096 ml/L for a flowing emulsion of No. 2 fuel oil.<sup>8</sup> Although heavier oils may be less acutely toxic, they still can smother organisms. For example, bullfrog (*Rana catesbeiana*) tadpoles that came into contact with Bunker C, No. 6 fuel oil began to float within 8 hours, and many became bloated, presumably from impaired gas exchange or edema.<sup>9</sup>

Appendix A presents the BTEX LC50 data for freshwater vertebrates and invertebrates obtained from the ECOTOX database. **The LC50 is the lowest concentration of a toxicant that is lethal (fatal) to 50% of the organisms tested in a specified time period of testing.** Table 1 summarizes the lowest LC50 data, as well as the available lowest observed effect concentrations (LOECs) and no observed effect concentrations (NOECs) for amphibians, common fish test species native to Texas (bluegill, fathead minnow), one of the most sensitive test species (rainbow trout), and the most sensitive freshwater invertebrate species tested.

In addition to mortality, sublethal effects (such as impaired reproduction, growth, feeding, and behavior), indirect effects (including impacts to the salamanders' prey base), and the potential for bioaccumulation

can contribute to the demise of the salamanders and the Barton Springs ecosystem. Further, if a gasoline spill emerges from Barton Springs during daylight hours, UV radiation can increase the toxicity of oil and petroleum products to aquatic organisms from 2 to over 100 times.<sup>10,11,12,13</sup>

**Table 1**  
**Summary of Lowest LC50 BTEX Mean Concentrations for Selected Freshwater Animals from the EPA ECOTOX database**

Compound	Exposure Duration and Lowest Reported LC50 Values (mg/L) for Selected Freshwater Species									
	1h	2h	4h	8h	16h	24h	48h	72h	96h	7 Days
Benzene	Brown trout 12	--	--	--	--	Rainbow trout 9.2	Bluegill 20	--	Rainbow trout 5.3 (F)	--
						Bluegill 20			Bluegill 22.49	--
						Fathead minnow 34.42	Fathead minnow 32		Fathead minnow 12.5 (F)	Fathead minnow 14.01 (F) (NOEC = 10.2)
						Mexican axolotl 370				
						African clawed toad 190				
	--	--	--	--	--	Water flea 18.4	Damselfly 10	--	Scud 12.1 (F)	--
Ethylbenzene	--	--	--	--	--	Rainbow trout 14	Bluegill 32	--	Rainbow trout 4.2	--
						Bluegill 35.08			Bluegill 32	
						Fathead minnow 42.33	Fathead minnow 42.33		Fathead minnow 9.09 (F)	
						Water flea 77	Water flea 13.9	-	Scud 1.94 (F)	--
Toluene	--	--	--	--	--	Rainbow trout 7.25 (F)	Rainbow trout 6.78 (F)	Goldfish 25.33 (F)	Rainbow trout 5.8	--
						Bluegill 17	Bluegill 24		Bluegill 13	
						Fathead minnow 16 (F)	Fathead minnow 46.31		Fathead minnow 12.6	
									African clawed toad 179 (LOEC <= 131)	
		--	--	--	--	--	Water flea 9	Zebra danio 25 (midge NOEC: 5.6)	--	Pond snail 55.6
Xylene	--	Rainbow trout (LC0 =7.1)	--	--	--	Rainbow trout 3.3	--	--	Rainbow trout 3.3	--
	Bluegill 30,500 (F)	Bluegill 19.9 (F)	Bluegill 15.9 (F)	Bluegill 13.6 (F)	Bluegill 11 (F)	Bluegill 10.4 (F)	Bluegill 16.5 (F)	Bluegill 16.5 (F)	Bluegill 8.6	
	Fathead minnow 46	--	--	--	--	Fathead minnow 28.77	Fathead minnow 27.71	Fathead minnow 42	Fathead minnow 13.4 (F)	
									African clawed toad 54 (LOEC = 41)	
	--	--	--	--	--	Water flea 150	Zebra danio 20 (F)	--	Calanoid copepod 99.5	

(F) = flow through study LOEC = lowest observed effect concentration, NOEC = no observed effect concentration

## Summary of Existing Toxicity Data for Barton Springs Salamanders and Related Species

Research has shown that amphibians are sensitive to many pollutants, including heavy metals, pesticides, and organic compounds.<sup>14</sup> The Barton Springs and Austin blind salamanders are particularly vulnerable to contaminants because they have evolved under very stable environmental conditions, remain aquatic throughout their entire life cycle, have severely restricted ranges at the main discharge point of the Barton Springs watershed, and cannot escape contaminants in their environment. Since gas exchange occurs through highly permeable skin and gills, virtually the entire organism is susceptible to the uptake of pollutants. Thus, any spill that could rapidly and significantly alter the ambient water quality of Barton Springs should be considered a threat to the salamander species.

However, quantitative toxicity studies using *Eurycea* salamanders are virtually non-existent, and no data exist for gasoline. The Edwards Aquifer Research and Data Center conducted toxicity studies using very small sample sizes of San Marcos salamanders (*Eurycea nana*) and fathead minnow larvae (*Pimephales promelas*) to calculate lethal concentrations (LC50) of saline water from the “bad water” zone of the Edwards Aquifer and the toxicants dieldrin and chlorine.<sup>15</sup> The no observed effect concentrations (NOEC) and calculated LC50s for the San Marcos salamander and the fathead minnow larvae were similar for all three constituents. The USGS Columbia Environmental Research Center also conducted preliminary toxicity studies using very small sample sizes (i.e., 3-4 individuals) of adult Barton Springs and Comal Springs (*Eurycea* sp.) salamanders (Table 2), bluegill sunfish (*Lepomis macrochirus*), and rainbow trout (*Oncorhynchus mykiss*) to calculate LC50s for five contaminants: carbaryl, copper, diazinon, flouranthene, and permethrin.<sup>16</sup> The results indicate that adult Barton Springs salamanders may be as or less sensitive than the bluegill and rainbow trout.

**Table 2**  
**Summary of existing toxicity studies using Barton Springs and related salamanders.**

Species	Compound	No Observed Effect Concentration (NOEC)/Exposure Duration	LC50/Exposure Duration	LC100/Exposure Duration
San Marcos salamander	Chlorine	0.0625 mg/L / 48-hours	0.0884 mg/L / 48 hours	0.125 mg/L / 24 hours
San Marcos salamander	Dieldrin	0.025 mg/L / 7 days	0.0315 mg/L / 7 days	
San Marcos salamander	“Bad water”		29.73% dilution / 7 days	
Barton Springs salamander	Carbaryl		4.3 mg/L / 96 hrs	
Comal Springs salamander	Copper		>0.5 mg/L / 96 hrs	
Barton Springs salamander	Diazinon		>0.343 mg/L / 96 hrs	
Barton Springs salamander	Flouranthene		>0.490 mg/L / 96 hrs	
Comal Springs salamander	Permethrin		>0.02 mg/L / 96 hrs	

## Review of Existing Water Quality Standards

Since data on the toxicity of gasoline to Barton Springs and closely related salamanders do not exist, an effort was made to determine whether water quality criteria for BTEX have been established for the protection of aquatic life. The Texas Surface Water Quality Standards<sup>17</sup> do not list specific numerical criteria for BTEX. However, TCEQ has developed non-regulatory freshwater acute and chronic Aquatic Life Surface Water Risk-Based Exposure Limits (RBELs) for BTEX (Table 3). TCEQ defines RBEL as “the concentration of a chemical of concern at the point of exposure within an exposure medium (e.g., soil, sediment, vegetables, groundwater, surface water, or air), which is protective of human health [emphasis added]. RBELs are the fundamental risk-based values that are initially determined and used in the development of protective concentration levels. RBELs do not account for cumulative effects from

exposure to multiple chemicals of concern, combined exposure pathways, and cross-media or lateral transport of chemicals of concern within environmental media.”<sup>18</sup>

### **Methods for Calculating Acute and Chronic Levels Where Specific Numerical Criteria Do Not Exist**

For toxic materials for which specific numerical criteria have not been established, the Texas Surface Water Quality Standards (30 TAC Section 307.6(c)(7)) specify that the LC50 for the most sensitive aquatic organism may be used to derive a value protective of aquatic life as follows:

$$\text{Acute Criteria} = (\text{LC50 of the most sensitive aquatic species})(0.3)$$

$$\begin{aligned} \text{Chronic Criteria for Non-Persistent Toxic Compounds} \\ = (\text{LC50 of the most sensitive aquatic species})(0.1) \end{aligned}$$

The Texas Administrative Code (30 TAC 307.3(1)) defines acute toxicity as "toxicity which exerts a stimulus severe enough to rapidly induce an effect". In TCEQ usage, the "duration of exposure applicable to acute toxicity is typically 96 hours or less" and "tests of total toxicity normally use lethality as the measure of acute impacts".

Chronic toxicity is defined by TCEQ as "toxicity which continues for a long-term period after exposure to toxic substances". As used by TCEQ, "chronic exposure produces sub-lethal effects, such as growth impairment and reduced reproductive success, but it may also produce lethality". In TCEQ toxicity testing, "the duration of exposure applicable to the most common chronic toxicity test is seven days or more".

In selecting toxicity data to calculate a criteria value, TCEQ guidance<sup>19</sup> states that LC50 test results are preferred, and freshwater species indigenous to Texas are typically used. Flow-through tests with exposure times of 96 hours (for vertebrates) are preferred, although static test results can be used particularly where the data indicate a higher sensitivity. If more than one LC50 data point is available for a given species and exposure duration, the geometric mean is typically calculated.

As described below, a modified approach to calculating acute and chronic levels was used to derive the response tiers. The lowest reported 96-hour LC50 value, rather than the geometric mean, was used where multiple values were reported in the ECOTOX database. Also, data for the most sensitive species, the rainbow trout, was used, although this species is not native to Texas (see Identifying Surrogate Species, below). These modifications were intended to err toward the side of ensuring an adequate level of response to a potentially catastrophic spill. Thus, the possibility exists that the estimated threshold levels for the response tiers may be lower than necessary. At the same time, other factors are likely to exacerbate toxic effects, such as the potential for synergistic and additive effects from other toxic compounds in gasoline and UV radiation.

### **Identifying Surrogate Species**

LC50 data for the rainbow trout were used to derive acute and chronic toxicity of BTEX to the Barton Springs and Austin blind salamanders. Although the rainbow trout is not native to Texas, it is often one of the most sensitive of freshwater vertebrate species and is a common test organism frequently cited in the ECOTOX database. As mentioned above, preliminary studies indicate the rainbow trout may be as or more sensitive than adult Barton Springs salamanders for some contaminants. Relative sensitivity of the rainbow trout compared to Barton Springs salamander egg, larvae, and juveniles is unknown.

**Table 3**  
**LC50 BTEX Data for Rainbow Trout from the EPA ECOTOX Database Calculated Acute and Chronic Levels, and Aquatic Life Surface Water Risk-Based Exposure Limits**

Compound	Exposure Duration and Lowest Reported LC50 Mean Concentrations (mg/L) for Rainbow Trout										Calculated Acute Level* (mg/L)	Calculated Chronic Level** (mg/L)	Aquatic Life Surface Water RBEL, Freshwater	
	1h	2h	4h	8h	16h	24h	48h	72h	96h	7 Days			Acute (mg/L)	Chronic (mg/L)
<b>Benzene</b>	--	--	--	--	--	9.2			<b>5.3</b> (F)	--	<b>1.59</b>	(use Chronic RBEL, 130ug/L)***	--	0.13
<b>Ethylbenzene</b>	--	--	--	--	--	14	--	--	<b>4.2</b>	--	<b>1.26</b>	<b>0.42</b>	--	2.18
<b>Toluene</b>	--	--	--	--	--	7.25 (F)	6.78 (F)	--	<b>5.8</b>	--	<b>1.74</b>	<b>0.58</b>	8.7	2.9
<b>Xylene</b>	--	--	--	--	--	3.3	--	--	<b>3.3</b>	--	<b>0.990</b>	<b>0.33</b>	4.02	1.34

Numerical values in bold include LC50s used to derive acute and chronic toxicity levels and the resulting calculated levels and RBELs (F) = flow through study

\*Lowest 96-hr LC50 value for rainbow trout x 0.3

\*\*Lowest 96-hr LC50 value for rainbow trout x 0.1 (safety factor used for non-persistent chemicals)

\*\*\*Chronic RBEL (risk-based exposure level) is lower than the calculated chronic value

### **Deriving Response Tiers**

The following discussions indicate how the thresholds for each response tier were chosen in relation to the acute and chronic toxicity data and safety factors derived from water quality standards and pollutant transport in the aquifer.

#### **Estimating Potential No Effect Level (Tier 4)**

Tier 4 is set below the lowest chronic toxicity level for BTEX. To estimate the threshold concentration below which toxic effects are not anticipated, the lowest reported 96-hour LC50 value for the most sensitive species, rainbow trout (Appendix A) was multiplied by 0.1 for each of the BTEX compounds as per TCEQ water quality standards. These calculated chronic toxicity levels are reported in Table 3.

In addition to the calculated chronic toxicity levels, chronic aquatic life surface water RBELs were examined.<sup>20,21</sup> The chronic RBEL for benzene (0.13 mg/L) is lower than all of the calculated chronic toxicity levels (Table 3). It is also lower than the available LC50, LOEC, and NOEC data for BTEX (Table 1). This value is essentially the chronic water quality criteria derived for the 2000 Texas Surface Water Quality Standards and recommended for use in ecological risk assessments in TCEQ guidance.<sup>22</sup>

Chronic toxicity typically refers to sublethal effects after an exposure of 7 days or longer. For the purpose of deriving salamander rescue response tiers, here the assumption is that adverse effects are unlikely at or below the chronic RBEL for benzene (0.13 mg/L) provided the exposure period is 96 hours or less.<sup>22, 23</sup> Toxic effects are still possible for longer exposure durations, but given observed rapid depuration periods in dye study results, the probability of these longer duration events is remote.

#### **Estimating Potential Chronic Effect Level (Tier 3)**

The lower limit of Tier 3 is the chronic RBEL for benzene (0.13 mg/L). The upper limit of Tier 3 is the lowest acute toxicity value for BTEX, which is the calculated acute value for xylene (3.3 mg/L \* 0.3 =

0.99 mg/L) (see Tier 2). For concentrations above the benzene RBEL of 0.13 mg/L and below the xylene concentration of 0.99 mg/L, some adverse impacts are possible, and close surveillance is recommended.

### **Estimating Potential Acute Lethal Effect Level (Tier 2)**

The lower limit of Tier 2 is the lowest acute toxicity value for BTEX. To calculate the lowest acute toxicity value for each of the BTEX compounds, the lowest 96-hour LC50 mean concentration obtained from the ECOTOX database for rainbow trout was selected as a conservative estimate for salamander toxicity (Appendix A). These calculated acute values are reported in Table 3. Xylene has the lowest calculated acute value of the BTEX compounds ( $3.3 \text{ mg/L} * 0.3 = 0.99 \text{ mg/L}$ ). This value is the estimated point at which acute lethal effects could occur. It is considerably lower than the acute aquatic life surface water RBELs (Table 3) and the available LC50, LOEC, and NOEC data for the BTEX compounds (Appendix A). The upper limit of Tier 2 is the point at which catastrophic effects are possible, which is described under Tier 1.

### **Estimating Potential Catastrophic Level (Tier 1)**

Several safety factors were employed in deriving the acute and chronic toxicity levels, described above, and in the regression model of predicted spill concentrations, described below. To estimate the point at which contaminant concentrations at Barton Springs could potentially become catastrophic, these safety factors are removed to reduce the likelihood that extreme rescue measures would be taken unnecessarily. A 3.3 multiplier is applied to the calculated acute value for xylene (0.99 mg/L) to estimate the point at which catastrophic consequences are possible. The rationale for the 3.3 multiplicative factor is provided in the description of the regression model and comparisons to dye study data. Removing the safety factors to determine a level for full scale rescue operations is a reflection of the mortality expected from wholesale salamander removal from the spring habitat.

The resulting xylene concentration (3.3 mg/L) is equal to the lowest xylene 96-hour LC50 reported for the rainbow trout in the ECOTOX database (Appendix A). It is also roughly the same as one-third of the lowest 96-hour BTEX LC50s reported for the fathead minnow (Table 1), a species native to Texas. It is slightly higher than one-third of the lowest xylene LC50 for the bluegill sunfish (2.6 mg/L).

### **Summary of Response Tiers for Gasoline**

In summary, threshold levels and tiers for determining what level of salamander rescue should be initiated in response to a gasoline spill entering the Barton Springs segment of the Edwards Aquifer are as follows:

- **Tier 1:** Full Scale Salamander Rescue: A spill predicted to result in xylene concentrations of 3.3 mg/L or more at Barton Springs.
- **Tier 2:** Partial Salamander Rescue: A spill predicted to result in xylene concentrations between 0.99 mg/L (calculated acute value for xylene) and 3.3 mg/L at Barton Springs.
- **Tier 3:** Close Monitoring of Salamander Populations: A spill predicted to result in concentrations between the calculated acute value for xylene (0.99 mg/L) and the chronic RBEL for benzene (0.13 mg/L) at Barton Springs.
- **Tier 4:** Normal Spill Response: A spill predicted to result in benzene concentrations below the chronic RBEL for benzene (0.13 mg/L) at Barton Springs.

Tiers 1-4 all assume an exposure of 96 hours or less. Exposures lasting longer than 96 hours will have more severe consequences. These values are based on very little species specific data, and should be revised as more testing is performed on similar species. It is recommended that during periodic review of the Catastrophic Spill Plan, a new data retrieval from the ECOTOX database be made and the tiers re-evaluated.

## **Summary of Toxicological Support for Selected Response Tier Thresholds**

The following assumptions were made in determining the acute and chronic toxicity values for BTEX used for spill response planning. The derived values are estimates only, based on very little data, and should be revised as new and better information becomes available.

### ***Assumptions:***

- The Texas Surface Water Quality Standards "rule of thumb" for deriving acute (0.3 times the LC50) and chronic values (0.1 times the LC50 for non-persistent compounds) for the most sensitive aquatic species is appropriate for determining salamander rescue tier thresholds.
- Although the rainbow trout is not native to Texas, it is the most sensitive vertebrate species for each of the 96-hour LC50s for BTEX, and thus, is an appropriate model species to include for deriving conservative (err on the side of safety) acute and no effect threshold levels.
- Brine shrimp are typically found in more saline waters, thus, these LC50 data were not considered appropriate for response threshold development.
- To be as protective as possible, the calculated acute and no effect threshold levels are based on the lowest 96-hr LC50 value for the rainbow trout, rather than the lowest geometric or arithmetic mean for all values for all species for that test duration in ECOTOX as typically applied in water quality criteria development.
- The maximum exposure time used in calculated acute and no effect threshold levels is 96 hours reflective of dye study results and TSWQS definitions.
- If a surface-water RBEL value exists (i.e., chronic RBEL for benzene) for an appropriate model species, and it is less than the value calculated by our method, the RBEL value is used.
- If no data exist on an appropriate model species under a 96-hour exposure period, chronic toxicity values are used as the no effect threshold.

## **HYDROGEOLOGICAL SUPPORT FOR GASOLINE CONCENTRATION ESTIMATES AT BARTON SPRINGS**

In order to use the tiers of spill response described above, concentration estimates at Barton Springs tied to the information available at the spill site are needed. Because surface distribution and fate of a spill is highly variable based on hydrologic conditions, it was assumed that the primary need was for prediction of subsurface transport. First, previous attempts at predicting Barton Springs concentrations from spill events were reviewed. Second, literature methods were researched and a suitable equation was selected. Third, the results of this method were compared to local dye study results to determine if they would be sufficiently conservative to result in protective salamander recovery under the conditions observed in the tracings. Fourth, the tracing data was compared to assumptions used in determining estimated acute and chronic water quality criteria used in response tier definitions. Finally, cumulative safety factors based on assumptions in using the toxicity data and concentration estimates were removed from the equation to support a catastrophic spill response level where the most extreme measures of salamander recovery would be appropriate with less concern about incidental losses of individuals from recovery activities (Tier 1).

### **Previous Spill Concentration Estimates**

A number of previous studies have attempted to estimate the water quality response of Barton Springs to spills in the contributing and recharge zone. The following is a brief description of how these studies influenced the methods selected for the Catastrophic Spill Plan.

### **CRWR Barton Springs Edwards Aquifer Model (Barrett, 1996)<sup>24</sup>**

In this groundwater modeling study, the aquifer was represented as a series of completely mixed tanks with different hydraulic characteristics representing each recharging creek basin. Calibration to flow and well records as well as nitrogen concentrations was adequate. A pulse hydraulic loading was simulated as well as a pulse contaminant loading. Both of these loading scenarios are typically used to evaluate spill conditions in groundwater modeling. However, geographically, this loading could only be located to the larger basin and significant sub watershed flow paths had not been determined from dye studies at this point. Initial results at zero to moderate longitudinal dispersion indicated that a contaminant loading in the Onion Creek basin during periods of maximum recharge from all basins would not appear at Barton Springs until 65 days later and not peak for three years, but would persist for the entire simulation period, in this case 14 years. At higher dispersion rates arrival time would increase to 30 days, but the peaking time and persistence remained unchanged. Given the rapid changes documented in Barton Springs water quality during recharging storm events, and more recent dye tracer results, the travel times and concentrations predicted by the model were not supported.

Due to the coarse spatial representation and assumption of completely mixed cells, the model estimates should not be used to direct spill response, but as potential boundary conditions for monitoring the effects of a spill. Using smaller completely mixed cells supported by dye tracing results was also considered as a methodology for the current estimates. This would require a major revision to the model including recalibration of both flow and water quality. Unfortunately, even if modified, responders could not feasibly use this model in a spill event due to its lack of portability (FORTRAN code with batch run processing), data entry needs (time series flows and well levels), and output interpretation (no user interface or post processing summaries are available).

### **Radian International, Inc. Longhorn Pipeline Environmental Assessment (EA) and Biological Assessment (BA) (Radian 2000)**

Both the EA and BA scopes included modeling the impacts of specific scenarios of pipeline spills on Barton Springs. Existing models of the aquifer at the time were evaluated and none found to be supportable for use in spill scenario calculations. As an alternative, overland and surface flow attenuation was modeled and stream flow loss/gain studies combined with preliminary dye tracing results from the BS/EACD study ongoing at the time were used to make estimates of Barton Springs impacts. The resulting calculations are specific to the pipeline spill scenario and not reproducible from the information on calculation methods and data provided in the Radian reports. The conclusion of the study was that using a 7% aromatic hydrocarbon percentage of gasoline, the peak concentration at Barton Springs from a segment specific worst case spill volume (81,000 to 193,000 gallons) would be between 15 and 83,600 ppb. A toxicological literature review indicated that xylene and ethylbenzene could cause lethality to some invertebrates under these worst-case conditions at a spring concentration of 580 ppb.

The calculations provided by Longhorn are not reproducible using the referenced dye study data; however, the use of the critical toxicity levels from the BTEX compounds was incorporated into the current evaluation in predicting the controlling factors in spill response. In addition, the 7% aromatic hydrocarbon percentage was used in the absence of more market specific data on gasoline composition and the assumption of a maximum 7% of each BTEX compound was selected as a conservative assumption for toxicity comparisons.

### **Barton Springs/Edwards Aquifer Conservation District and City of Austin Groundwater Tracing Study (Hauwert, et al., 2004 (draft))**

The bulk of flow path and travel time data relevant to Barton Springs spill impact assessment was generated by this six year tracing study. Twenty dye traces were performed in all major contributing watersheds supplying water to Barton Springs. Recovery of dye varied widely over the traces and peak

concentrations were difficult to define due to variable sampling frequency. The study better defined the sub-watersheds contributing preferentially to various flow paths leading to Cold, Main Barton, Upper Barton, Eliza, and Old Mill Springs. In most traces, the apparent peak concentration reached the discharge within hours after the initial detection of the tracer indicating extremely low dispersion rates and high peak to average dye concentration ratios of several orders of magnitude. Travel time along one of the longest flow paths from Onion Creek was measured at 14-16 days as compared to the 30-65 days estimated in the CRWR model. Other travel times were considerably shorter.

Although spill attenuation was not estimated in this study, the data would support a representation of spill transport that was rapid, advective, and conduit rather than porous media flow. However, the variation in dye recovery would indicate that several attenuation percentages and a range of short mixing periods could be considered, and that the assumption of no attenuation was conservative. Although this study provided the only local data available on time of travel and flowpaths in the aquifer, it does not provide a predictive tool to estimate pollutant concentrations at Barton Springs based on parameters available at the time a salamander recovery response to a spill is needed.

### **Generalized Flow Paths and Time of Travel**

For the spill response plan usage, a screening level estimate of time of travel along surface and recharge flow paths to Barton Springs was desired. As indicated above, none of the previous methods of estimation were adaptable for this spill plan although information gained from each of these previous efforts was used when appropriate. Regardless of the formal method related to concentration estimates and toxicity, a general idea of where a spill may be headed and how fast is crucial to decision making during responses. The following describes the methods used to make maps of flow paths and travel times primarily on the basis of the data supplied by studies described above.

#### **Surface Flow Pathways**

Methods used previously in time of travel and concentration estimates made use of standard hydrological equations (NRCS hydrology, Mannings equation hydraulics) for flow overland and in channels from specific locations such as from the Longhorn Pipeline to recharge features or to Barton Springs. This was also generalized by major creek basins in the CRWR model. However, none of the studies subdivided areas of the contributing watersheds geographically and assigned any specific travel times to the recharge zone boundary. In order to present this visually, a screening level Surface Water Assessment Tool (SWAT) model<sup>25</sup> was used within the structure of the EPA Better Assessment Science Integrating Point and Non-Point Sources (BASINS)<sup>26</sup> program to generate average velocities for average flows in the contributing zone using a gross Digital Elevation Model from USGS mapping, historical rainfall records from the National Weather Service, landuse from multiple entities including the City of Austin, and soils from U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) mapping. The predicted channel velocities were used to assign subbasin travel times and build a cumulative travel time zone map with the recharge zone boundary as the outlet. This map is provided as Figure 1. The model cannot be considered calibrated without additional work, but provides a visual estimate of travel times that may be useful to responders. In particular, any surface diversions, coffer dams, carbon socks, carbon flow-through barriers, aeration, or other surface best management practices used to mitigate groundwater impacts could be generally located and planned using this cumulative travel time map.

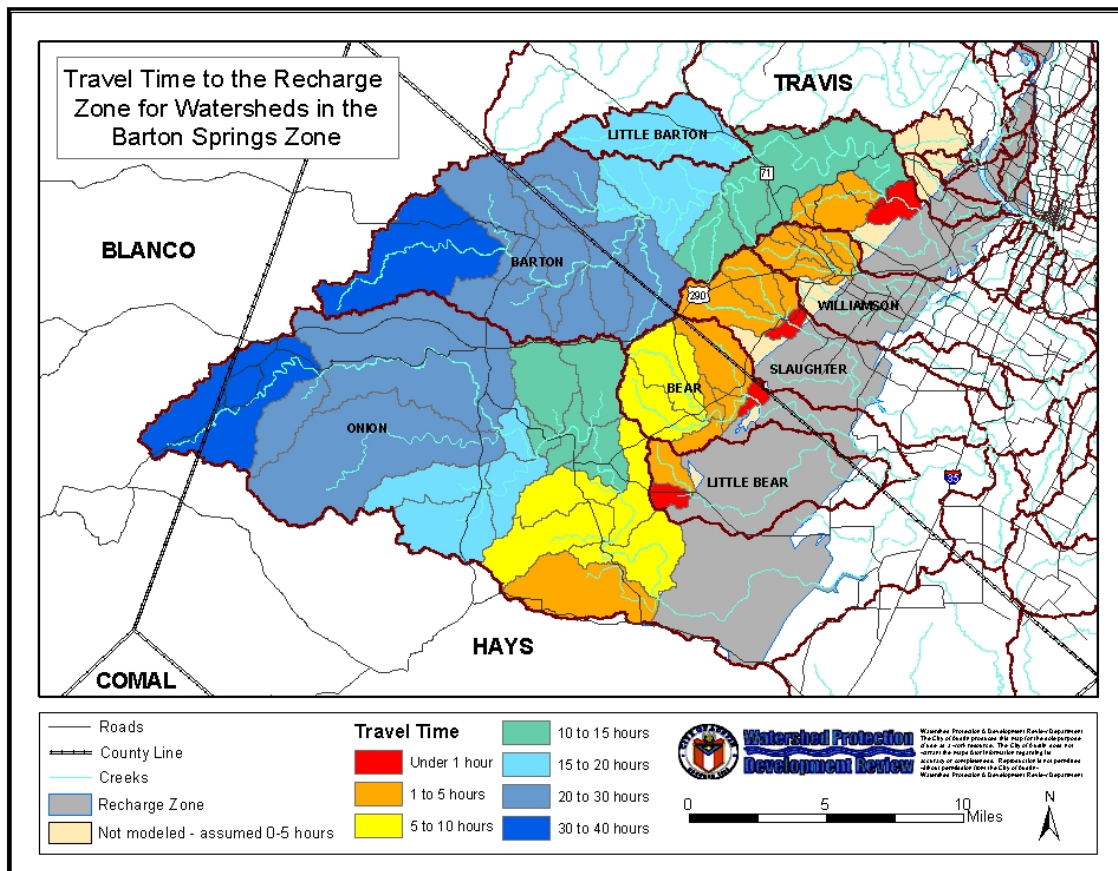
#### **Ground Water Flow Pathways**

Dye tracing studies have shown that groundwater flows rapidly through the BSEA to discharge at Barton Springs. Depending on water level in the aquifer, flow rates can range from 0.6 miles per day to over 4 miles per day. This provides for potentially rapid contaminant flow through the aquifer to Barton Springs, where it can impact the Barton Springs salamander. The relatively rapid movement of groundwater under any flow conditions provides little time for mitigation efforts to reduce potential

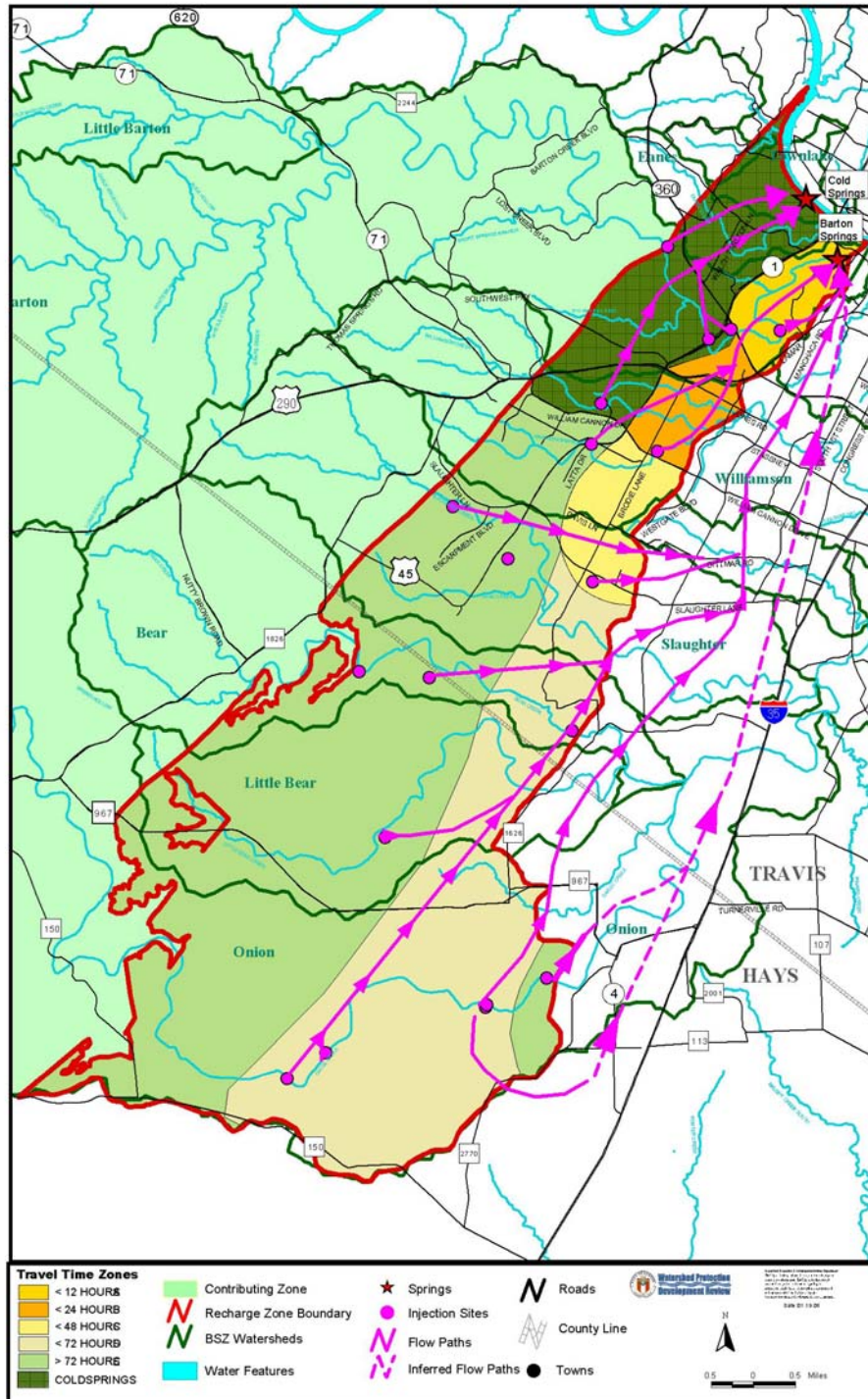
damage from a hazardous material release to groundwater supplies or spring and surface-water ecosystems.

These studies have also documented specific flow paths through the aquifer, illustrating which surface areas above the aquifer contribute to flow at the various springs. Mapping of these recharge areas and their approximate range of travel times are provided in Figure 2.

**Figure 1**  
**Average Surface Water Flowpaths and Travel Times to Recharge Zone Boundary**



**Figure 2**  
**Ground Water Flowpaths and Travel Times to Barton Springs**



## Regression Method for Estimating Spring Concentrations

Given the absence of a calibrated predictive deterministic model for transport of spills in the Barton Springs Edwards aquifer, several empirical models were considered. At first, a model based on dye study results and assumptions of mixing volumes and attenuation factors was used in a spreadsheet format to predict Barton Springs concentrations. However, the discontinuities in the relatively small data set forced arbitrary choices for averaging periods, dispersion, and mixing volumes that were found to be too subjective. The alternative was to use literature regression equations from a large number of dye tracer studies in carbonate aquifers. Although specifics in formation and flowpaths of the Barton Springs segment are not considered, the weight of the data, ability to get continuous values over the range of spill conditions, and good correlation of all the dye studies used in development made this an attractive approach. The following empirical regression equation, which relates peak concentrations to input mass, spring flow and the distance between injection and recovery sites, was derived from approximately 185 tracer tests in carbonate aquifers and found to be the best predictive tool in a recent review of dye study data (Worthington and Smart, 2003)<sup>27</sup>:

$$m = 19 (LQc)^{0.95} \quad (1)$$

where:

m is the mass of dye injected in grams,

Q is the output discharge in m<sup>3</sup>/s,

c is the peak recovery dye concentration in g/m<sup>3</sup>, and

L is the distance in meters between injection and recovery points.

Solving for concentration the equation becomes:

$$c = 0.045 m^{1.0526} / LQ \quad (2)$$

Converting to English units, assuming a 7% by weight xylene composition of gasoline and a density of 1 g/cm<sup>3</sup> the equation becomes:

$$C = 0.3 G^{1.0526} / LQ \quad (3)$$

where:

C is the peak predicted concentration of Xylene in mg/L at Barton Springs,

G is the spill volume of gasoline entering the aquifer

L is the distance in miles from Barton Springs to the spill site.

Q is Barton Springs discharge in ft<sup>3</sup>/s,

## Model Verification: Comparison to Local Dye Traces

In order to determine if equation (1) was appropriate for use in predicting peak concentrations of spilled toxins near the Austin area spring sites with endangered salamanders, the predicted values were compared with the empirical data of Hauwert et al. (BSEACD, 2004 (draft)). Trace injection locations, flow paths and recovery springs are shown in Figure 3. Receiving sites in these studies were monitored using a combination of adsorbent charcoal packet receptors and grab water samples.

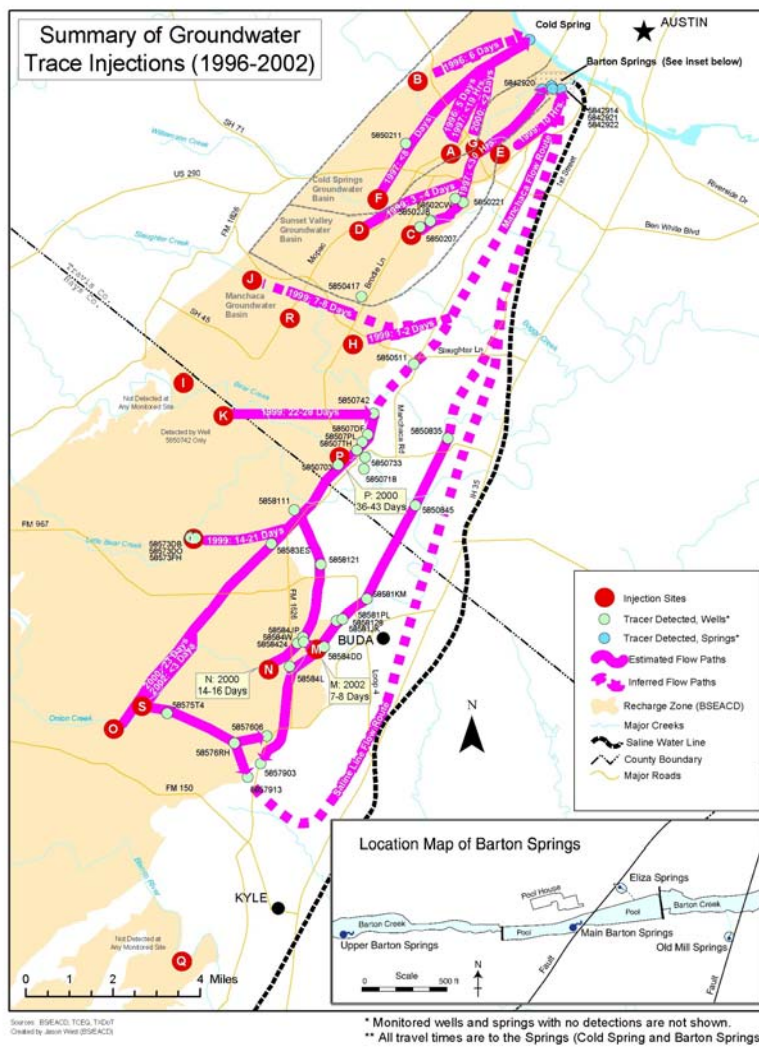
### Comparison to Grab Sample Data

The grab sample results from eleven traces are listed in Table 4. Measured grab sample water concentrations for the Austin area traces were compared to the peaks predicted by equation (1). For most of the traces, grab samples were collected once per day during the expected peak arrival period and less frequently over longer periods of time. Due to this infrequent sampling schedule the highest measured concentrations were likely to be less than the actual peak concentrations at the spring sites. Predicted

peaks are compared with the maximum observed concentrations for all eleven traces in Figure 4a and separately for the nine traces captured at Barton Springs in Figure 4b.

For traces detected at Barton Springs all the observed peaks are lower than the predicted ones. This is expected since the grab data was sparse and the peak would typically be missed. It also indicates that equation (1) is conservative and could be used to predict peak concentrations of toxins for spills where underestimating concentrations is a more serious error than overestimating the actual concentration. The high  $R^2$  between predicted and observed maximums for all the traces (Fig. 4a) is due to the substantially higher concentrations observed from traces A and A' than any other traces, while the lack of significance for the regression of Barton Springs traces may be because the observed maximums underestimate the true peak concentration. In any case, grab sample data indicates that salamander recovery based on equation (1) is supported by dye study data and will result in response measures that will be conservative and protect salamanders from spill impacts.

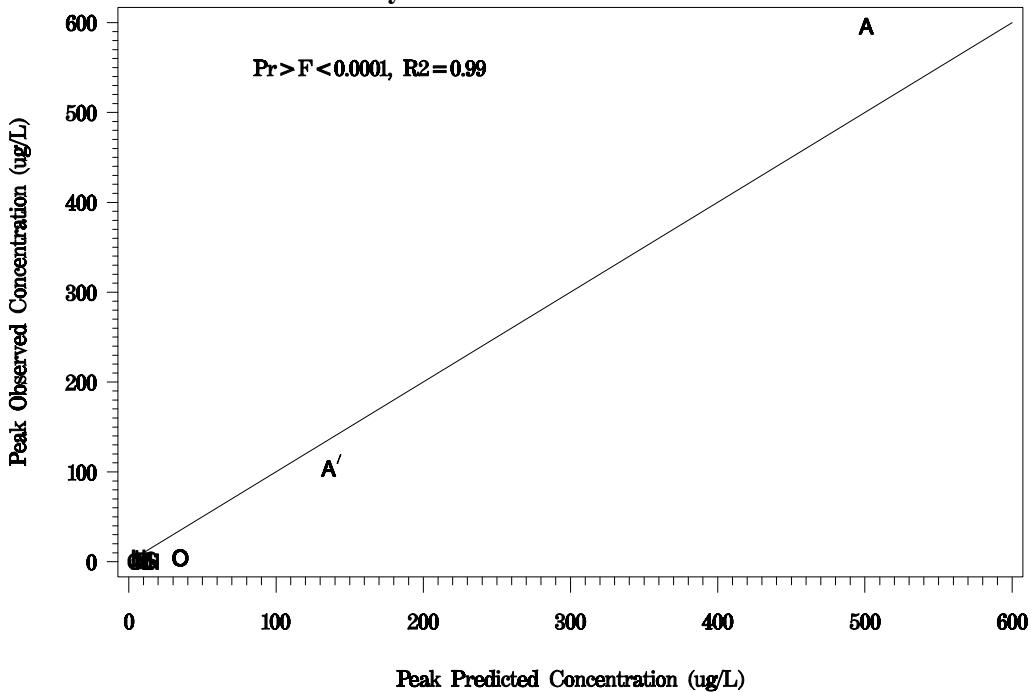
**Figure 3**  
**Map of Groundwater Traces for Barton Springs (BSEACD, 2004)**



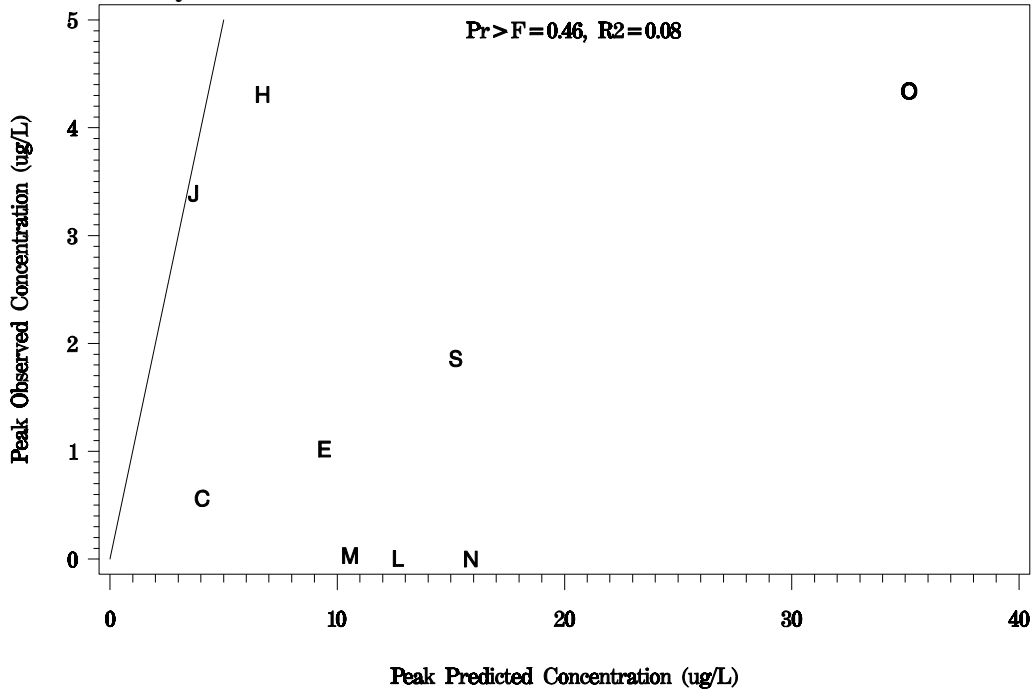
**Table 4**  
**Trace Data – Grab Water Samples**

<b>Trace</b>	<b>Injected Mass</b>	<b>Spring Flow</b>	<b>Distance From Injection Site To Recovery Site</b>	<b>Predicted Peak Spring Concentration</b>	<b>Maximum Recovery Concentration Observed</b>	<b>Spring With Maximum Concentration</b>
<b>Units</b>	<b>g</b>	<b>cms</b>	<b>m</b>	<b>ug/L</b>	<b>ug/L</b>	<b>ug/L</b>
Trace A	4535	0.116	5471	500.87	596.00	Cold
Trace A'	2268	0.207	5471	135.65	104.00	Cold
Trace C	1361	2.860	7723	4.06	0.56	Upper Barton
Trace E	907	1.926	3218	9.43	1.02	Barton
Trace H	3175	2.351	13837	6.72	4.31	Old Mill
Trace J	2268	2.351	17699	3.69	3.39	Barton
Trace L	4536	1.048	23974	12.67	0.01	Barton
Trace M''	11340	2.804	28158	10.58	0.03	Barton
Trace N	4536	0.793	25261	15.89	<0.0005	Barton
Trace O	11340	0.793	29927	35.18	4.34	Barton
Trace S	15876	2.775	28158	15.22	1.86	Old Mill

**Figure 4a**  
**Observed Peak Dye Concentrations vs. Predicted Peaks For All Traces**



**Figure 4b**  
**Observed Peak Dye Concentrations vs. the Predicted Peaks For Traces Detected At Barton Springs**



**Comparison to Cumulative Receptor Data**

The charcoal packet receptor data provides a cumulative record of the amount of dye passing a site during the time period the packet is in the water. Thus the receptor data can be used to estimate the relative load at the receiving spring over time. The charcoal receptor eluted concentrations cannot be compared to water concentrations directly and are used instead to determine relative loads. Traces conducted thus far fall into two categories, those with the highest receptor concentrations lasting one or two days and those with an extended period of high concentrations. Traces A, A', C, E, H, and J fall into the first category and traces L, M, N, and O into the second. It is unclear which category trace S belongs in due to the timing of the grab and receptor samples. For this discussion S has been placed in the second category. Trace receptor data is shown in Table 5. The total concentration is the sum of the per/day concentrations multiplied by the number of days of exposure. To compare a weekly total to a grand total the weekly concentration in ug/L/day must be multiplied by seven. Equation (1) cannot be compared directly to cumulative receptor data given that only the predicted peak concentration is estimated. However, within these groupings of traces, the period of extended high concentrations can be compared to time period for criteria development to determine whether equation (1) would result in protective salamander recovery.

**Table 5**  
**Trace Charcoal Packet Receptor Data**

Trace	Recovery Site	Cumulative Concentration in ug/L per day			Total [(ug/L)/day]*days
		Maximum day	2nd highest day	3rd highest day	
A	Cold Spring	39400	31400	907	76025
A'	Cold Spring	5200	5200	379	11370
C	Barton Spring	529	44	7	605
C	Upper Barton Spring	3169	3169	61	6777
E	Barton Spring	52	22	5	93
E	Old Mill Spring	44	10	7	107
H	Barton Spring	577	54	20	751
H	Eliza Spring	85	35	17	146
H	Old Mill Spring	457	313	25	857
J	Barton Spring	941	806	92	1928
J	Eliza Spring	38	4.2	3.6	48
J	Old Mill Spring	633	98	41	845
M''	Barton Spring	15.2	13.3	12.3	834
S	Barton Spring	39.2	19.7	10.1	1864
N	Barton Spring	1.64	1.26	1.18	23.17
N	Eliza Spring	0.37	0.34	0.24	2.31
Trace	Recovery Site	Max week	2nd highest week	3rd highest week	Total [(ug/L)/day]*days
L	Barton Spring	0.48	0.39	0.34	19.72
N	Barton Spring	0.77	0.61	0.44	23.17
N	Eliza Spring	0.12	0.11	0.1	2.31
O	Barton Spring	306	149	141	5437
O	Eliza Spring	29.12	10.44	9.27	498
O	Old Mill Spring	49.7	31.7	27.6	1010
S	Barton Spring	157	38.7	19.8	1864
S	Eliza Spring	20.9	17.1	0.64	277
S	Old Mill Spring	236	121	16	2839
S	Upper Barton Spring	4.86	4.01	3.68	132
M''	Barton Spring	51.7	25	11.5	834
M''	Eliza Spring	4.46	0.46	0.0592	35.2
M''	Old Mill Spring	22.8	15.2	6.99	449

**Comparison to Water Quality Criteria**

In order to determine if the predicted concentrations, which are conservative in comparison to dye tracing data, would also be conservative with respect to estimated acute and chronic water quality criteria that were selected from toxicity data, the tracing results were examined alongside the criteria assumptions. The averaging periods and peak/average ratios from dye tracing were compared to toxicity test durations used in criteria estimates. The following discussions indicate that the predicted concentrations as proposed for use in response tier specification are supported by the calculated water quality criteria assumptions.

### **Time Periods for Highest Concentrations, Traces Within 13 Miles of Barton Springs**

For traces A, A', C, E, H, and J the charcoal receptor packet data shows that more than 40% of the load arrived during a 24 hour period (Figure 5). Since the peak 24 hour period is not likely to coincide exactly with the 24 hour period that the packets were in place, the actual percent of mass passing through the springs during the peak 24 hour period will be higher than indicated by the data. Where the data indicated 2 days with approximately the same dye levels, the actual peak dye concentration probably occurred near the time the packet was replaced. On the day with the third highest concentration, less than 15% of the dye was recovered. In all cases, the highest 24-hour average would be above the highest 96-hour average. Thus for these traces, average concentrations estimated for a 24 hour period can be conservatively compared to the acute value based on the lowest 96-hour LC50.

### **Relationship Between Peak Concentration and Highest Daily Average**

As stated previously, equation (1) predicts a peak concentration rather than an average. Grab data from Traces A and E were used to determine the relationship between peak concentrations and the peak 24-hour period average. There were 5 samples taken during one day for Trace A and their average is 392 ug/l, which is 66% of the maximum grab concentration of 596 ug/L. The data set for Trace E is more complete with hourly samples (Figure 6). The average concentration for the peak 24-hour period is 0.595 ug/L, which is 58% of the observed peak of 1.02 ug/L. Thus predicted averages can be estimated by multiplying the predicted peaks by 0.67, or since the 0.67 factor is based on only two traces, by conservatively setting the predicted average equal to the predicted peak.

### **Mortality Occurring During Very Short Time Periods**

Concentrations at which mortality occurs very quickly, in a few minutes or hours were needed for comparison to predicted peak concentrations. However data in this response time range is limited, often unpredictable, and has an extremely high standard deviation. Some Xylene LC50 data for Fathead minnows and Bluegill is available for several different test durations from 1 hour to 96 hours (Figure 7). These data indicate that the one-hour LC50 concentration is approximately twice the mean 96-hour LC50 concentration and approximately three times the minimum 96-hour LC50 concentration. Thus the safety factors built into the procedure should be adequate to cover acute toxicity during very short time periods and compensate for the high variability in toxicity testing available in this range of testing.

### **Comparisons to Chronic Values**

In addition to comparing concentrations from these traces to the acute values, comparison of receptor data to the chronic values is necessary to choose the limiting criteria for concentration estimates. If comparing the peak 7-day median to the chronic value is more conservative than comparing the peak concentration to the acute value then the chronic value should be applied. The median dye trace data over seven days was used rather than the average over seven days to compare with the chronic value because a single high value can have a dramatic effect on a mean, but will not impact the median value. Also, the single high values have already been considered in the comparison to the acute value. The ratios of the peak seven day charcoal packet means and medians to the maximum observed receptor values are listed in Table 6. The average ratio of the median to the maximum is 5%. Referring back to Table 1, the ratio of the lowest chronic value of 130 ug/L to the lowest acute value of 990 ug/L is 13%. Therefore, applying the chronic value would result in choosing a concentration less protective of the salamander than applying the acute

**Figure 5**  
**Percent of Total Mass Captured on the Three Days with the Highest Charcoal Packet Concentrations for Traces A, A', C, E, H, and J**

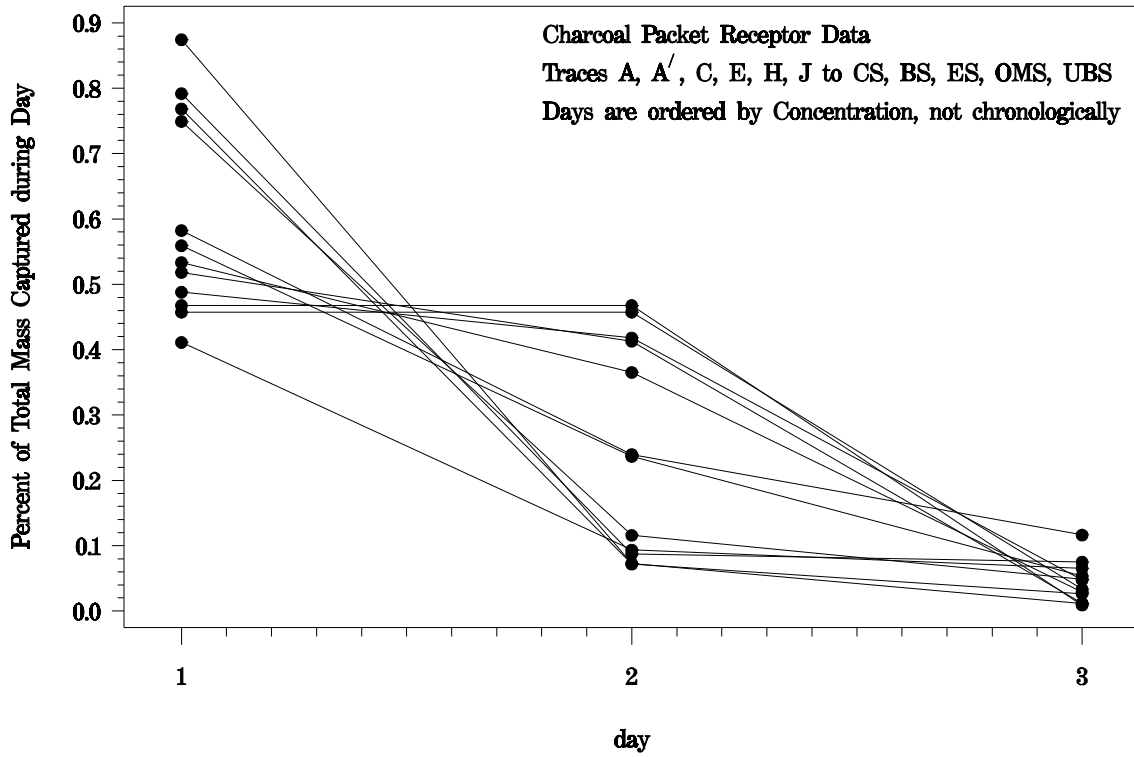
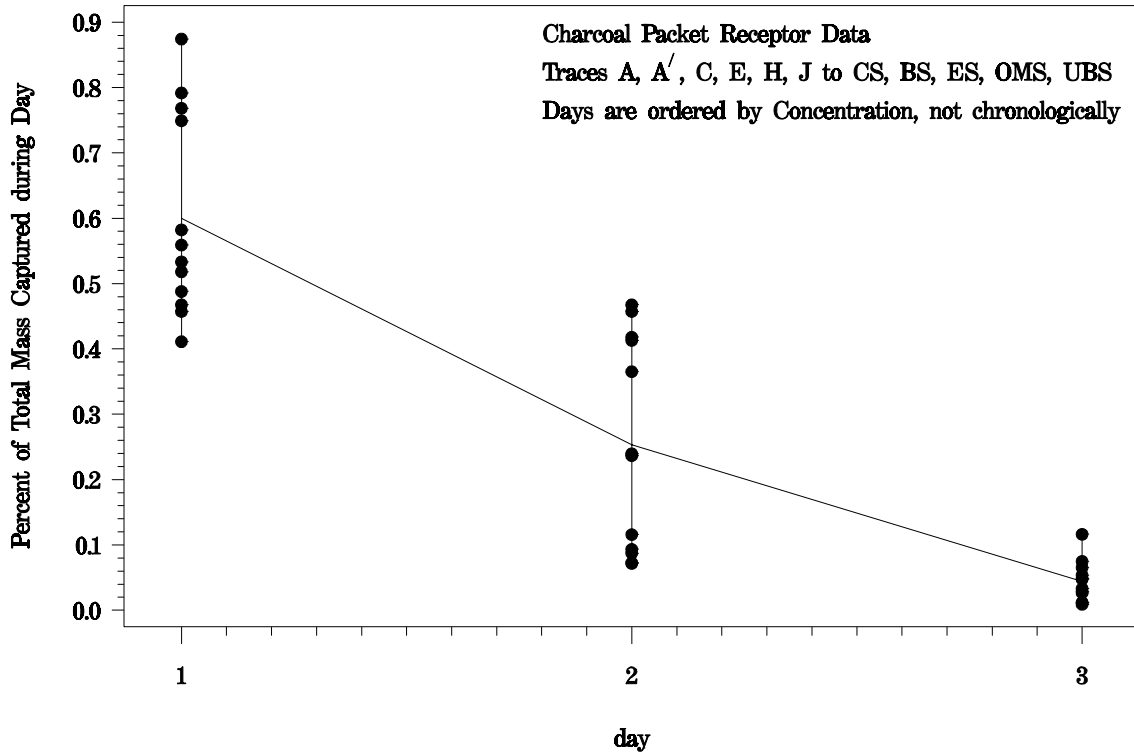


Figure 6  
Hourly Water Grab Data for Trace E

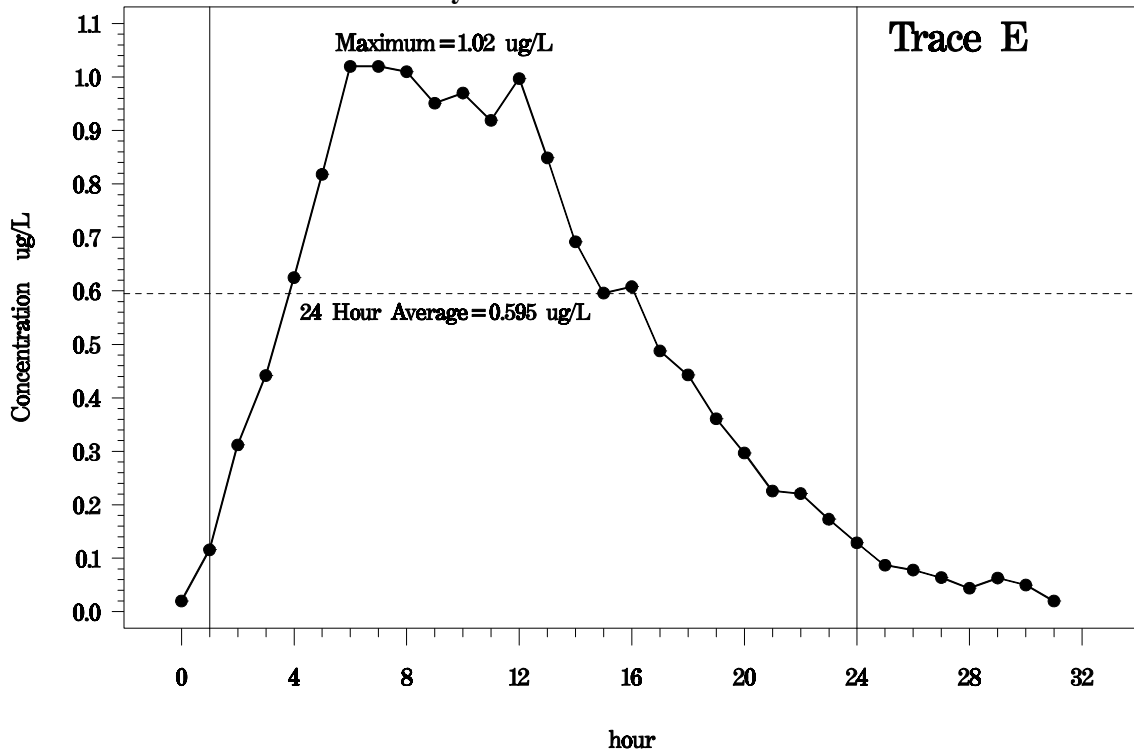


Figure 7  
LC50 Concentrations for Bluegill and Fathead Minnows Exposed to Xylene

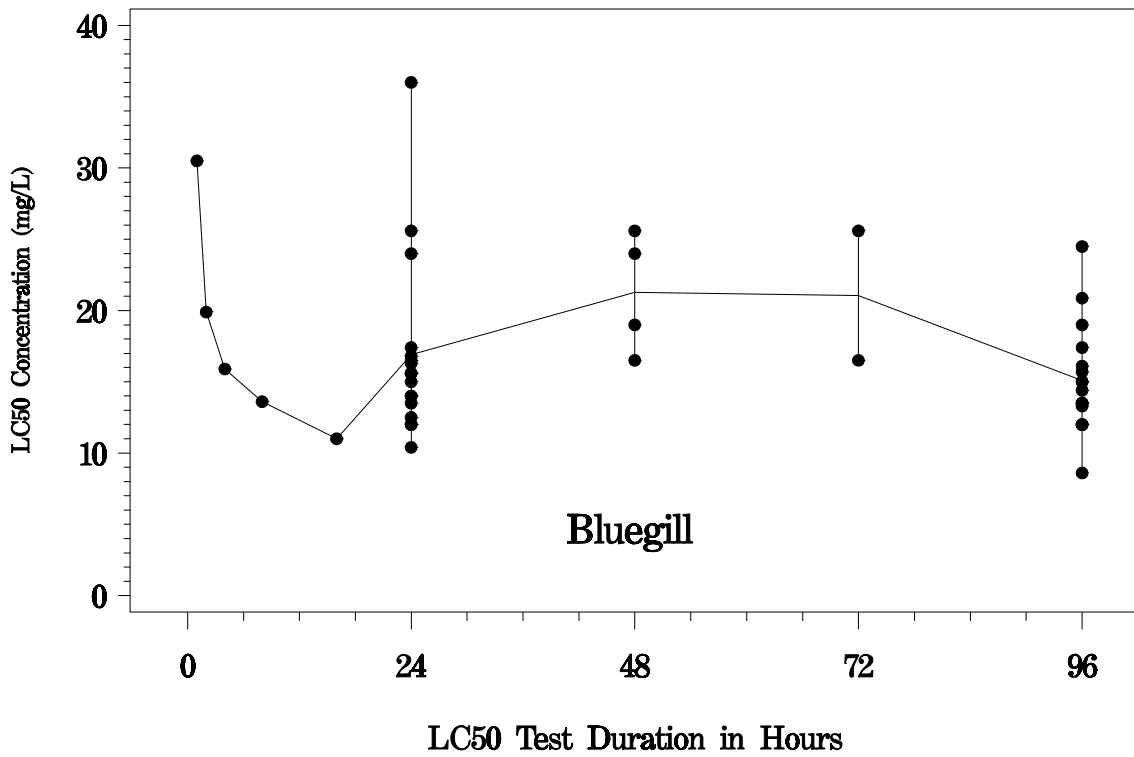


Figure 7 (continued).

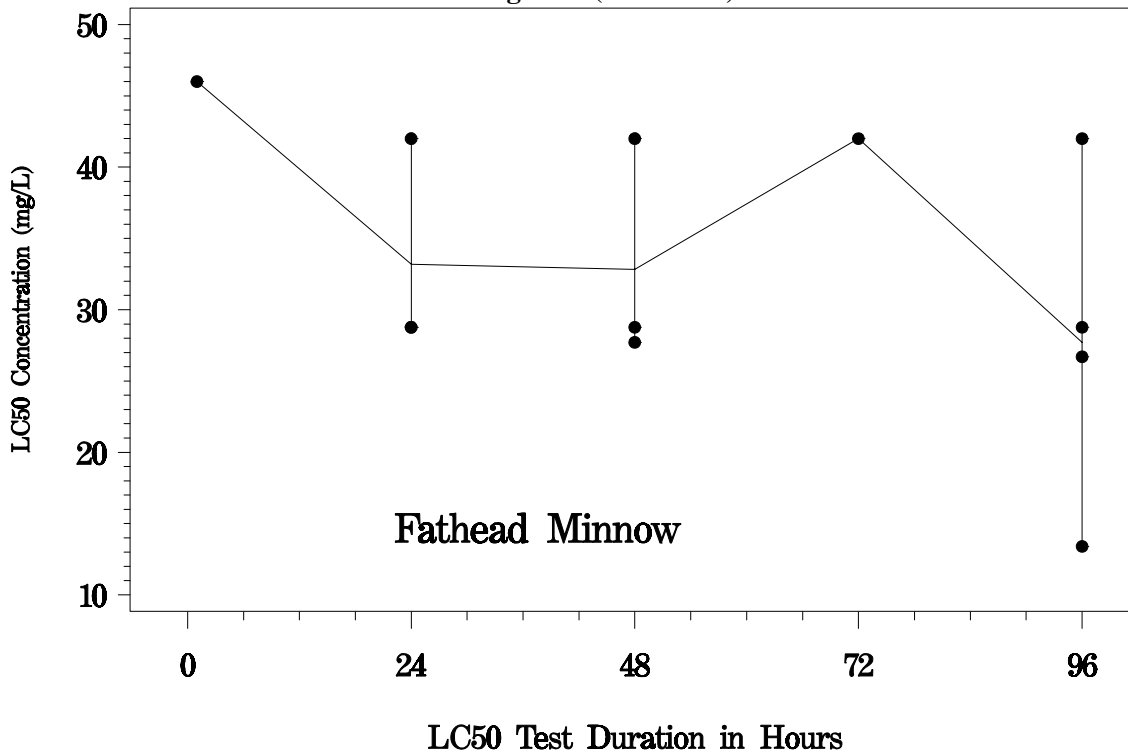


Table 6  
Comparison of Peak Receptor Concentrations (per/day) to Weekly Average and Median Concentrations (per/day)

Trace	Recovery Site	7-day ave./max.	7-day med./max.
A	Cold Spring	27%	2%
A'	Cold Spring	31%	3%
C	Barton Spring	16%	1%
C	Upper Barton Spring	29%	2%
E	Barton Spring	25%	8%
E	Old Mill Spring	29%	18%
H	Barton Spring	17%	2%
H	Eliza Spring	23%	1%
H	Old Mill Spring	26%	2%
J	Barton Spring	29%	4%
J	Eliza Spring	18%	5%
J	Old Mill Spring	19%	6%
	<b>Average</b>	<b>24%</b>	<b>5%</b>

value. However, as stated previously, the minimum chronic value was used to estimate when there should be no observed effects on the salamanders from a BTEX spill (Tier 4 threshold).

**Time Periods for Highest Concentrations, Traces more than 13 miles from Barton Springs**

For traces L, M', N, O, and S the charcoal receptor packet data shows that less of the load arrives during a week than arrived during one day for Traces A – J (Figure 8). For these traces the chronic value, which applies for time periods of at least seven days, is more pertinent than the acute one. Average

concentrations during the peak 7-day period could be compared to chronic value for the aquatic species at the springs. However the predicted peak for these traces was more than 8 times the measured peak. Since the acute value for Xylene is 7.6 times the chronic value for Benzene, it is reasonable to use the concentration estimates generated for the acute value threshold and compare them to the response of the extended period traces as well as to the shorter response traces A-J.

As was mentioned earlier, the Worthington equation only predicts a peak concentration. Grab data from Traces M'' at Barton Springs, O at Barton Springs, and O at Eliza Springs were used to estimate the relationship between peak concentrations and the peak 7 day period average (Table 7). It appears that using the predicted peak in place of an average is a reasonable and conservative approach since the average was at least ¾ of the peak. Grab data from trace S was not included in the analysis since the arrival of the trace at the springs was missed, with the first sample having the highest concentration observed.

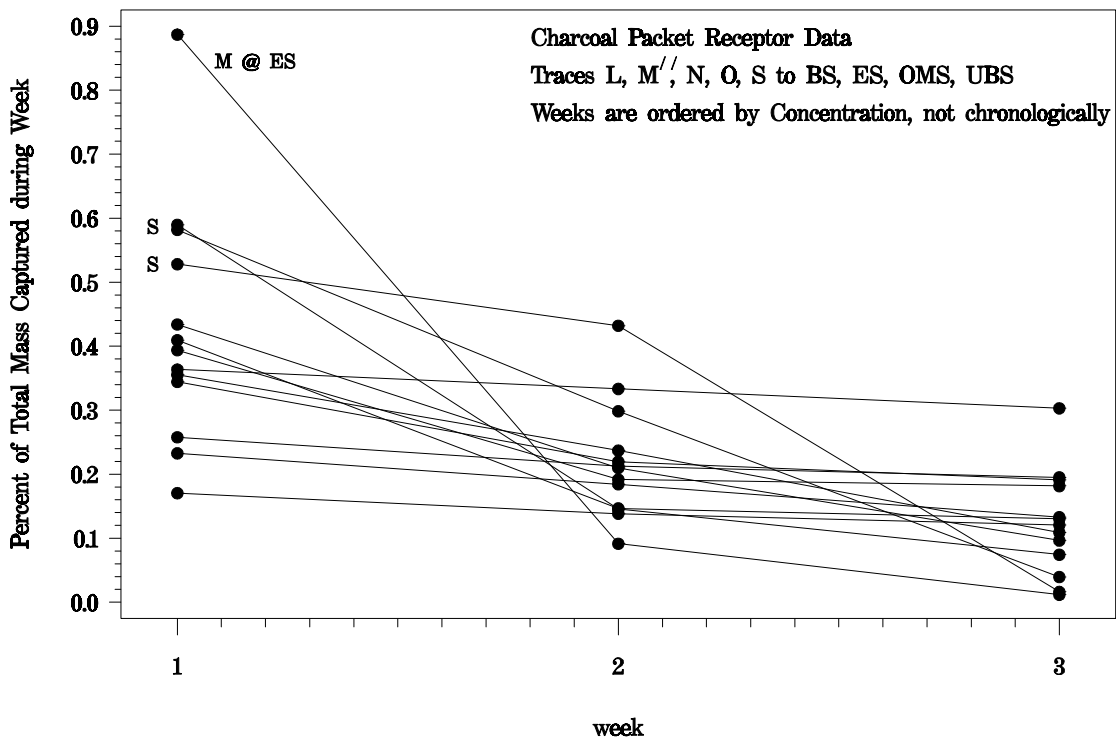
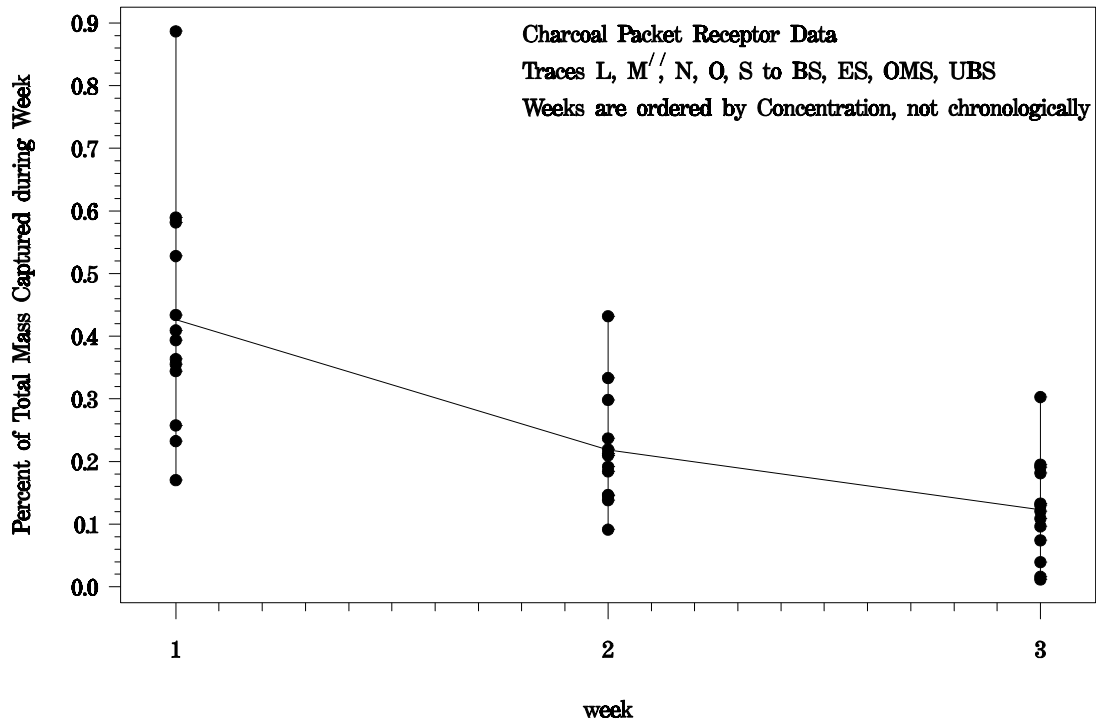
**Table 7**  
**Relationship between Peak and Weekly Average Concentrations for Traces M'' and O**

<b>Trace</b>	<b>Recovery Site</b>	<b>Weekly Average (ug/L)</b>	<b>Peak Concentration (ug/L)</b>	<b>Ratio of Average to Peak</b>
<b>M''</b>	Barton	0.023	0.028	.83
<b>O</b>	Barton	3.775	4.34	.95
<b>O</b>	Eliza	3.755	5.01	.75

### **CATASTROPHIC SPILL RESPONSE (TIER 1 THRESHOLD)**

Each of the assumptions supported by either toxicological or hydrogeological examination of response tiers resulted in safety factors that would result in protective salamander recovery. The safety factors that were included in the above discussion are quantified where possible and summarized in Table 8. The final multiplicative factor is 3.3. Thus when a concentration of 990 ug/L is predicted (the concentration that is the dividing line between Tier 2 (possible acute effects) and Tier 3 (possible chronic effects), the actual impact could be overestimated by a factor of 3.3 (predicted = actual\*3.3). Removing those safety factors results (a predicted concentration of 3,300 ug/L =990\*3.3) indicates a Tier 1 response is warranted where more certainty exists that the concentrations are actually at the acute levels. The resulting concentration (3.3 mg/L) is equal to the lowest xylene LC50 value reported for rainbow trout in the EPA ECOTOX database (Table 1). It is also roughly the same as one-third of the lowest BTEX LC50 values for the fathead minnow (Table 1), a common toxicological test organism that is found in Texas. Given the sensitivity of the salamander and its prey base, the potential for synergistic and additive effects from other toxic compounds in gasoline, and the potential for UV radiation to exacerbate toxic effects, the xylene concentrations of 3.3 mg/L or more for 96 hours or longer could reasonably pose a catastrophic threat.

**Figure 8**  
**Percent of Total Mass Captured on the Three Days with the Highest Charcoal Packet Concentrations for Traces L, M'', N, O, and S**



**Table 8**  
**Cumulative Safety Factors in Response Tier Determination**

Safety Factor Description	Factor	Notes from data
<b>Predicted</b> vs. Observed	1	Some predicted > observed, but daily sampling probably missed peaks, so predicted is assumed equal to observed
<b>Peak</b> is predicted - not daily average (daily average is compared to 24-hr LC50)	1.5	Peak = 1.5 times the average
<b>96-hr LC50</b> vs. 24-hr LC50 (for xylene)	1.1	The 96-hr LC50 is slightly lower than the 24-hr LC50. The 24-hr LC50 would be more applicable due to the shape of the dye curves at the springs
<b>Minimum LC50</b> vs. geometric mean LC50	2	For the 96-hr LC50 the geometric mean is approximately twice the minimum LC50.
<b>Rainbow Trout vs. Barton Springs Salamander</b>	Unknown	Data are minimal but indicate that the trout is more sensitive than the salamander. Documented ratio is not available.
<b>Multiplicative Factor</b>	3.3	$1 * 1.5 * 1.1 * 2 = 3.3$

## CONSTRUCTION AND USE OF RESPONSE TIER GRAPHS

Using the information from the above evaluations, specific concentrations were assigned to response tier thresholds as follows:

- **Tier 1** – A spill predicted to result in xylene concentrations of 3.3 mg/L or more could be catastrophic and would warrant full-scale salamander rescue.
- **Tier 2** – A spill predicted to result in concentrations between 0.99 mg/L (calculated acute value for xylene) and 3.3 mg/L xylene could result in some lethality. This level would warrant salamander rescue but on a smaller scale, with fewer personnel and more slow and careful collections.
- **Tier 3** – A spill predicted to result in concentrations between the calculated acute value for xylene (0.99 mg/L) and the chronic RBEL for benzene (0.13 mg/L) could result in some harmful effects. This level would warrant close surveillance to determine whether and to what extent to undertake salamander collections.
- **Tier 4** - Below the chronic RBEL for benzene (0.13 mg/L), no salamander rescue would be warranted.

Graphs were then constructed using equation (3) solved at the threshold concentrations delineating response tiers. These response levels assume an exposure period of 96 hours or less. If the exposure period lasts longer than 96 hours, the effects are expected to be more severe. Sets of graphs were constructed for the five flowrates (10,25,50,75, and 100 cfs) at Barton Springs. The graphs in Figures 9-23 plot Tiers 1-4 based on the estimated volume of gasoline *entering the aquifer* under various flow scenarios that are predicted to result in the calculated acute concentrations of xylene (0.99 mg/L), the calculated acute concentrations times the 3.3 overestimate factor, and the chronic RBEL for benzene (0.130 mg/L). The estimated spill volumes increase with increasing flow and distance from Barton Springs.

In order to determine the appropriate response tier for a spill event, the responder needs to have an estimate of the volume of gasoline spilled, the straight line distance from the location of the spill to Barton Springs, and the current flowrate out of the Springs. The volume can be estimated from the container volume and number of containers for motor vehicle spills or pumping rate and duration of

unchecked pumping for pipeline spills. The distance can be measured directly from any available scale maps of the Austin area in the units of miles (5,280 ft = 1 mile). The flowrate from Barton Springs in cubic feet per second (cfs) can be obtained from the USGS Austin Office at (512) 927-3500, the USGS web site at [http://waterdata.usgs.gov/tx/nwis/uv?format=gif&period=7&site\\_no=08155500](http://waterdata.usgs.gov/tx/nwis/uv?format=gif&period=7&site_no=08155500), or from WPDRD geologists.

Although fifteen (15) graphs are provided on the following pages, they are essentially the result of one equation and selected toxicity thresholds with spill volume and distance scales varied to allow easier viewing. Five sets of three (3) scaled graphs are provided representing five (5) levels of Barton Springs flowrates (10, 25, 50, 75, and 100 cfs). Responders should use the set of graphs at the level below the actual flowrate determined for the spill event. For example, if the current Barton Springs flow rate is 45 cfs, it would be more protective of the Barton Springs salamander to select the set of graphs corresponding to 25 cfs rather than 50 cfs in determining the appropriate response tier. For all Barton Springs flows below 10 cfs, the responder should use the set of graphs for the 10 cfs level.

After selecting the set of graphs for the level of Barton Springs flow, the responder needs to find the point on the graph corresponding to the distance of the spill from Barton Springs on the x-axis (horizontal) and the volume of the spill on the y-axis (vertical). Each of the three graphs has exactly the same lines. The first scale only covers the first 10 miles of horizontal distance from Barton Springs. On the second graph the horizontal scale has been extended to cover the distance from 10 to 20 miles from Barton Springs and the vertical scale has been expanded to consider spill volumes in a wider range. The third graph in each set covers the lower volume spills in more detail, but provides the lines for the entire range of 0-20 miles horizontal distance from Barton Springs. Once the appropriate graph and point on the graph is found, the responder only need read the tier level listed for the appropriate response and turn to the response description for the actions to take.

As an example of how to determine what level of response would be warranted using the graphs under average flow conditions (50 cfs), a spill 3 miles from Barton Springs that releases 500 gallons of gasoline into the aquifer is predicted to result in concentrations of 0.99 mg/L or more of xylene and thus could result in acute lethal effects. Allowing for the 3.3 overestimation potential, the spill volume that could be catastrophic based on the inherent assumptions is 1650 gallons. If less than 75 gallons of gasoline enter the aquifer under the same flow conditions (50 cfs), concentrations of benzene are predicted to be less than the chronic RBEL of 0.130 mg/L. Thus, under normal flow conditions (50 cfs), a gasoline spill 3 miles from Barton Springs could be catastrophic if more than 1650 gallons are released into the aquifer (Tier 1). A release of 500 to 1650 gallons of gasoline into the aquifer could result in acute mortality (Tier 2). A release of between 75 to 500 gallons of gasoline into the aquifer could result in sublethal effects and should be monitored closely (Tier 3). Gasoline spills of less than 75 gallons would not be expected to have an impact and would not require any action beyond normal spill protocols (Tier 4).

In contrast, spills under low flow conditions (10 cfs) are predicted to have an impact at much smaller volumes. At the same distance (3 miles), a gasoline spill of 360 gallons or more entering the aquifer could be catastrophic (Tier 1). A spill between 100 and 360 gallons could result in acute mortality of some percentage of the salamander population (Tier 2). A spill of between 15 and 100 gallons could have some impacts and should be monitored closely (Tier 3). A spill of less than 15 gallons is not expected to have an impact (Tier 4).

## **DEVELOPMENT OF SEWAGE RESPONSE TIERS**

According to City of Austin historical spill data, sewage spills represent the most common type of spill occurring within the Barton Springs watershed. Sewage generally includes microorganisms (bacteria, amoebae, etc.), nutrients (ammonia, nitrates, phosphorus), and other organic and inorganic compounds (such as PAHs, metals, pesticides, pharmaceuticals, etc.). High levels of fecal coliform bacteria and algal blooms are common following sewage contamination. Fecal coliform bacteria indicate the presence of other microorganisms that could be pathogenic to aquatic life, including the salamanders and their prey base. Increased nutrients promote eutrophication of aquatic ecosystems and algal blooms that lower dissolved oxygen levels needed to sustain the salamanders and other aquatic life. A variety of other compounds could also be flushed into the sewer system that may be toxic to aquatic life.

The large majority of sewage spills are more likely to contribute to chronic degradation of Barton Springs as opposed to rapid mortality of salamanders and other aquatic organisms. However, a large spill that causes rapid water quality degradation at the springs could present a catastrophic threat to the salamander. In that case, full-scale or partial salamander rescue or possibly other mitigative measures such as aeration to increase dissolved oxygen levels may need to be implemented.

Ammonia and reduction in available dissolved oxygen are the most likely impacts of a sewage spill that could cause rapid mortality of large numbers of salamanders. Thus, nitrate is also identified as appropriate for close monitoring for potential acute toxic effects.

*Dissolved oxygen* - The Barton Springs-Edwards Aquifer Conservation District is currently funding a study in coordination with the City of Austin to look at effects of hypoxia on the Barton Springs salamander and closely related *Eurycea* salamanders. Until that study has been completed, the response tiers for dissolved oxygen (D.O.) are based primarily on observed concentrations at Barton Springs, which are typically around 6 mg/L under baseflow conditions but have been as low as 2.5 mg/L (City of Austin data). TCEQ has identified a “freshwater in spring minimum” for limited aquatic life use as 3.0 mg/L. No pertinent acute D.O. toxicity data for the Barton Springs salamander were available to assist with deriving the tier levels. Chronic toxicity data for juvenile amphipods (*Hyallela azteca*), a prey item for the salamander, found no observed effects at concentrations of 2.9 mg/L over a 10-day period and highest observed effects, including mortality, at 1.2 mg/L. Significant behavioral changes were observed in chironomid larvae (*Chironomus tentans*) at 2.0 mg/L or less for the same 10-day exposure period<sup>28</sup>.

Because the salamanders have evolved under very stable environmental conditions, the magnitude of a decline in D.O. and the rate at which the decline occurs should be considered in evaluating whether a sewage spill could potentially be catastrophic. For example, a drop of 1 mg/L or more within a period of hours could pose serious consequences regardless of the initial level of D.O..

Based on the above information, the following tiers are suggested triggers for salamander rescue and/or other mitigative responses in the event that a sewage spill results in a significant drop in dissolved oxygen (D.O.) at the springs. Volumes of sewage at which D.O. is predicted to reach these tiers, based on travel time, spring flow rate, and spill flow rate, are presented in Table 8.

- Tier 1: D.O. < 2 mg/L
- Tier 2: D.O. between 2 - 2.5 mg/L
- Tier 3: D.O. between 2.5 - 3 mg/L
- Tier 4: D.O. > 3 mg/L

Hydrolab datasondes equipped with D.O. probes are deployed at all four springsites, and real-time data are available at [http://waterdata.usgs.gov/nwis/uv?dd\\_cd=18&format=gif&period=7&site\\_no=08155500](http://waterdata.usgs.gov/nwis/uv?dd_cd=18&format=gif&period=7&site_no=08155500).

**Table 9. Dissolved Oxygen Response Tier Table**

Flow at Barton Springs in cfs	Time of Travel Region	Sewage Flow Rate (gal/hr)	Time of travel to springs (days)	Predicted DO (mg/L) at Barton Springs	Tier
<b>10</b>	<12 hrs	>= 11000	0.25	1.99	Tier 1
	<24 hrs	>= 12000	0.75	1.99	Tier 1
	<48 hrs	>= 14000	1.5	1.97	Tier 1
	<72 hrs	>= 16000	2.5	1.98	Tier 1
	>72 hrs	>= 18000	3.5	1.99	Tier 1
<b>20</b>	<12 hrs	>= 41000	0.25	2.99	Tier 3
		>= 67000	0.25	2.49	Tier 2
		>= 92000	0.25	2	Tier 2
	<24 hrs	>= 45000	0.75	2.98	Tier 3
		>= 73000	0.75	2.49	Tier 2
		>= 101000	0.75	1.98	Tier 1
	<48 hrs	>= 50000 <b>max flow rate = 62,000</b>	1.5	3 <b>no DO &lt; 2.5</b>	Tier 3 <b>None</b>
	<72 hrs	>= 59000 <b>max flow rate = 62,000</b>	2.5	2.99 <b>no DO &lt; 2.5</b>	Tier 3 <b>None</b>
	>72 hrs		3.5	<b>no DO &lt; 3.0</b>	<b>None</b>
	<b>30</b>	<12 hrs		0.25	<b>no DO &lt; 3.0</b>
<24 hrs		>= 133000	0.75	2.99	Tier 3
		>= 174000	0.75	2.49	Tier 2
		>= 214000	0.75	2	Tier 2
<48 hrs			1.5	<b>no DO &lt; 3.0</b>	<b>None</b>
<72 hrs			2.5	<b>no DO &lt; 3.0</b>	<b>None</b>
>72 hrs		3.5	<b>no DO &lt; 3.0</b>	<b>None</b>	
<b>40</b>	<12 hrs		0.25	<b>no DO &lt; 3.0</b>	<b>None</b>
	<24 hrs	>= 237000	0.75	2.99	Tier 3
		>= 291000	0.75	2.49	Tier 2
		<b>max flow rate =334,000</b>	0.75	<b>no DO &lt; 2.0</b>	<b>None</b>
	< 48 hrs		1.5	<b>no DO &lt; 3.0</b>	<b>None</b>
	< 72 hrs		2.5	<b>no DO &lt; 3.0</b>	<b>None</b>
> 72 hrs		3.5	<b>no DO &lt; 3.0</b>	<b>None</b>	
<b>flow &gt; 50</b>	<b>all regions</b>			<b>no DO &lt; 3.0</b>	<b>None</b>

**Notes:**

Tier 1 = D.O.< 2.0, Tier 2 = 2.0 <D.O.< 2.5, Tier 3 = 2.5 <D.O.< 3.0

At spring flow of 10 CFS springwater D.O. is 2.0 mg/L due to low water flow, thus all sewage impacts are listed as Tier 1 since base condition is Tier 2.

Max. flow rate is the highest flow rate that can occur in that region based on existing pipe size in that particular region.

**IMPORTANT:** Table uses flow rate, not total spill volume.

## Method for Estimating Spring Dissolved Oxygen Concentrations

The dissolved oxygen concentrations in Table 9 were predicted using an empirical regression equation which estimates ammonia and BOD dilution within the aquifer, the Modified Streeter-Phelps Equation which models a dissolved oxygen deficit as a function of time within the aquifer, time of travel estimates from City of Austin dye studies, and sewer pipe size, location and flow rates from the City of Austin Wastewater Utility.

### Empirical Regression Equation

The following empirical regression equation, which relates peak concentrations to input mass, spring flow and the time of travel between injection and recovery sites, was derived from approximately 185 tracer tests in carbonate aquifers (Worthington and Smart, 2003<sup>28</sup>).

$$m = 0.73 (tQc)^{0.97} \quad (1)$$

where:

- m is the mass of dye injected in grams,
- t is the time elapsed between injection and peak recovery in seconds,
- Q is the output discharge in m<sup>3</sup>/s, and
- c is the peak recovery dye concentration in g/m<sup>3</sup>

Solving for concentration the equation becomes:

$$c = 1.38 m^{1.03093} / tQ \quad (2)$$

Equation 2 was used to estimate the dilution of ammonia and oxygen demanding material between the location that the spill enters the aquifer and Barton Springs. Then the Modified Streeter-Phelps Equation was applied to the diluted concentrations to predict the dissolved oxygen sag at Barton Springs using the time of travel from the entry point to the springs.

### Modified Streeter-Phelps Equation<sup>29</sup>

The Modified Streeter-Phelps Equation mathematically defines the relationship between carbonaceous oxygen demand, nitrogenous oxygen demand, natural stream reaeration and the dissolved oxygen deficit as a function of time:

$$D = \frac{K_c L_{ac}}{K_2 - K_c} \left( e^{-K_c t} - e^{-K_2 t} \right) + \frac{K_n L_{an}}{K_2 - K_n} \left( e^{-K_n(t-t_0)} - e^{-K_2(t-t_0)} \right) + D_a e^{-K_2 t}$$

Definition and discussion of terms:

- a) D = Dissolved oxygen deficit; units = mg/l; defined as the difference between the dissolved oxygen concentration at saturation and the actual instantaneous dissolved oxygen concentration at time t,
- b) K<sub>c</sub> = carbonaceous decay constant; units = 1/day;

- c)  $L_{ac}$  = ultimate carbonaceous demand; units = mg/l; this term may be calculated once the BOD<sub>5</sub> and  $K_c$  are known by use of the following equation:

$$L_{ac} = \frac{E_f}{1 - e^{-5K_c}}$$

In this equation,  $E_f$  is the treatment works effluent BOD<sub>5</sub>.

- d)  $K_2$  = stream reaeration constant; units = 1/day
- f)  $t$  = time; units = days.
- g)  $K_n$  = nitrogenous decay constant; units = 1/day;
- h)  $L_{an}$  = ultimate nitrogenous demand; units = mg/l; this term may be calculated, once the initial ammonia nitrogen concentration is established, by use of the following formula:

$$L_{an} = 4.57 (\text{Amm-N concentration in mg/l}).$$

- i)  $t_0$  = nitrogenous lag time; units = days;
- j)  $D_a$  = initial dissolved oxygen deficit; units = mg/l.

Parameter values which were used in the Modified Streeter-Phelps Equation included::

- BOD5 concentration of 220 mg/L for untreated domestic waste (Metcalf and Eddy, 1979<sup>30</sup>)
- NH4 concentration of 25 mg/L for untreated domestic waste (Metcalf and Eddy, 1979<sup>31</sup>)
- Reaeration Constant = zero since portions of the aquifer are confined.
- $K_c$  = carbonaceous decay = 0.39/day (EPA 1985<sup>32</sup>)
- $K_n$  = nitrogenous decay = 0.3/day (EPA 1985<sup>33</sup>)
- The nitrogenous time lag = zero.
- The initial DO deficit = zero.

### **Time of Travel and Sewer Pipe Sizes, Locations and Flow Rates**

Dye trace flow times of < 12, <24, <48, <72 and >72 hours for 5 regions are shown in Figure 2, and in more detail in Figure 24. Travel times of 6, 18, 36, 60 and 84 hours were used in the regression and modeling equations for these 5 regions. The largest sewer lines in the recharge zone are located in three watersheds: Barton Creek (box 1), Williamson Creek (box 2) and Slaughter Creek (box 3) and are shown in Figure 24 and in more detail in Figures 25, 26, and 27 respectively. These are the only sewer lines in the recharge zone which carry enough sewage to depress the DO at Barton springs below levels of concern during a sewage spill. The average dry flow (sewage during periods with no rainfall) in the various sections of these sewer lines is detailed in Table 10. An upper bound on peak dry flow in gallons/hour was estimated by multiplying the average dry flow by 1.6.<sup>34</sup> The maximum spill sizes listed in Table 9 were taken from Table 10.

**Table 10**  
**Wastewater Lines 36-inches or greater in the Barton Springs Segment of the Edwards Aquifer**  
**Recharge Zone**

Map Section	Pipe Diameter	Start Line Number	End Line Number	Start Line Elev	End Line Elev	Start Manhole	End Manhole	Flow Dry Average mgd	Flow Wet Peak mgd	Flow Wet Peak gal/hr	Flow Dry Average mgd*1.4	Flow Dry Average gal/hr*1.4	Flow Dry Average mgd*1.6	Time of Travel Region
1	36"	192285	192252	443.88	440.03	17345	28456	1.3	4.8	200,000	1.82	75833	86667	<12 hrs
1	42"	186859	165668	440.03	439.22	28456	29127	1.4	5.2	216,667	1.96	81667	93333	<12 hrs
2	36"	188200	170395	746.76	717.63	4193	4527	2.5	14	583,333	3.5	145833	166667	ColdSpring
2	42"	170396	188339	717.63	636.22	4527	8246	5	30	1,250,000	7	291667	333333	<24 hrs
2	36"	171573	171562	663.55	651.74	7830	8238	4.6	29	1,208,333	6.44	268333	306667	< 24 hrs
3	36"	173628	176425	849.49	750.79	121178	1438	0.55	1.6	66,667	0.77	32083	36667	<48,<72,>72 hrs
3	42"	176442	176442	750.79	747.65	1438	1441	0.55	1.6	66,667	0.77	32083	36667	<48,<72,>72 hrs
3	48"	176443	178504	747.65	664.15	1441	2644	0.93	4.6	191,667	1.302	54250	62000	<48,<72,>72 hrs

Ammonia - Ammonia is highly toxic and typically very low at Barton Springs. NH<sub>3</sub>-N averages about 0.02 mg/L (City of Austin data). Ammonia toxicity is complicated because its most toxic form, un-ionized ammonia (NH<sub>3</sub>), varies as a function of temperature and pH. However, in a simplified attempt to identify levels of ammonia that could be acutely toxic, 96-hour LC50 data for the orangethroat darter (*Etheostoma spectabile*), a freshwater fish species that has been found at Barton Springs, were used to develop preliminary response tiers. The LC50 data were obtained from the EPA Ecotox database ([www.epa.gov/ecotox](http://www.epa.gov/ecotox)). Since the primary reference for this data was not available, an additional effort should be made to obtain a copy of the original report, determine what the pH and temperature values were for the toxicity studies using the orangethroat darter, and adjust the response tiers if needed.

NH<sub>3</sub>-N concentrations in the most urban Jollyville Plateau watersheds have exceeded some of the tier thresholds, but these sites also tend to have very low or declining Jollyville Plateau salamander populations or populations with deformities or disease.<sup>35</sup> For example, NH<sub>3</sub>-N concentrations are highest at Barrow Springs and tributary, where the maximum concentrations have reached 0.74 mg/L. Coincidentally, this is the same level as the NH<sub>3</sub>-N LC50 for orangethroat darters and the trigger for Tier 1. At Spicewood Springs, dead and sluggish salamanders were found on October 14, 1998; NH<sub>3</sub>-N levels were reported as 0.81 mg/L the following day, October 15, 1998.

As with all suggested spill response tiers, they should be used in conjunction with monitoring the response of the salamanders and other aquatic organisms to determine whether full or partial rescue is warranted:

Tier 1: NH<sub>3</sub> >0.74 mg/L

Tier 2: NH<sub>3</sub> between 0.22 - 0.74 mg/L

Tier 3: NH<sub>3</sub> between 0.074 – 0.22 mg/L

Tier 4: NH<sub>3</sub> less than 0.074 mg/L

Nitrates - Since ammonia rapidly converts to nitrate in the aquifer, spill responders should monitor nitrate levels and potential adverse effects to the salamanders and other biota following a sewage spill. The limited data on acute toxicity of nitrate to aquatic life indicate that toxic effects tend to occur at high levels (i.e., reported acute toxicity for fish is generally in the range of 100 to 1000 mg/L), but salamanders and other amphibians appear to be one of the most sensitive taxonomic groups.<sup>36, 37</sup> In one study, reported median 96-hour LC50s for nitrate-nitrogen for four species of anuran tadpoles ranged from 13.6

to 39.3 mg/L<sup>38</sup> In a separate study using one salamander and four anuran larvae, the northwestern salamander (*Ambystoma gracile*) exhibited the strongest acute effects to nitrate-nitrogen and a 15-day LC50 of 23.39 mg/L. The lowest 15-day LC50 was 16.45 mg/L for Oregon spotted frog (*Rana pretiosa*). In addition to mortality, both studies reported sublethal effects including disequilibrium, paralysis, and developmental abnormalities (including edemas and bent tails).<sup>39</sup> Some newly hatched *A. gracile* larvae stopped feeding and decreased activity at nitrate concentrations of 6.25 and 3 mg/L after 4 days of exposure.<sup>40</sup> These sublethal effects could be the equivalent of or result in mortality in the wild.

Average nitrate-nitrogen levels at Barton Springs generally range from 1 to 2 mg/L for the perennial springs and 3 mg/L for Upper Barton Springs. Higher nitrate levels have been found in other portions the Barton Springs watershed, particularly in the Sunset Valley region.<sup>41</sup> Nitrate-nitrogen levels at a couple of springs in the northern segment of the Edwards Aquifer have been as high as 10 mg/L with a mean of 6.5 mg/L.<sup>42</sup> Jollyville Plateau salamanders with curved spines have been found at these two springs, although no studies to determine whether a relationship exists between the nitrate and the deformities has been conducted.

Because of the limited toxicity data and wide range of responses of test organisms, no tiers were developed for nitrate. Until additional data become available, it is recommended that nitrate levels be closely monitored following a sewage spill that is cause for concern (for example, predicted to result in a significant drop in D.O., is within one mile of the springs, etc.).

Spill response staff, hydrogeologists, and salamander biologists should assist with monitoring nitrate and ammonia levels using standard in-house methods. Should levels of ammonia begin to increase according to one of the tier levels or nitrate begins to rise above highest concentrations that have been observed at Barton Springs (2 mg/L for Barton Springs Pool, Old Mill, and Eliza; 3 mg/L for Upper Barton), salamander populations should be closely monitored to determine if and when any adverse effects occur. Salamander biologists should be prepared to implement partial or full-scale rescue efforts if necessary.

## CONCLUSIONS AND RECOMMENDATIONS

Conclusions from the above analyses include the following:

- Limited toxicity data for representative aquatic species does not allow direct application to determining thresholds for appropriate spill response levels.
- Conservative assumptions from available toxicity data can be used to outline initial spill response thresholds.
- Hydrogeological data and pollutant transport modeling are not sufficient to explicitly predict magnitude, timing, and duration of concentrations of toxic materials at Barton Springs from spills in the contributing or recharge zones.
- An empirical model of peak concentration and travel time is supported by dye study results and can be used as a screening level estimate in comparison to toxicity data in order to define spill response levels.

Recommendations from this study include the following:

- During periodic reviews of the BS Catastrophic Spill Plan, additional research into available toxicity testing should be undertaken and the response tier thresholds revised accordingly.
- To avoid the uncertainties of using relatively small dye injections to predict peak concentrations under much larger volume spills, additional tracer studies have been recommended. These studies would incorporate larger volume dye injection in a critical area of recharge where previous results indicate variable recoveries may have been influenced by local sequestering of dye.

- Further development of hydrological and hydrogeological models of the aquifer are also needed for more reliable concentration estimates to be made. The BS/EACD has completed initial modeling for its sustainable yield determination; however, a revision of this model or development of a new model with more emphasis on conduit flow patterns prevalent in karst aquifers would be needed to improve accuracy over the empirical model used in this project.
- Additional dye traces have also been recommended to further define boundaries of subwatersheds contributing to Barton Springs and their relative time of travel.

Figure 9. Response Tiers at 10 cfs Barton Springs Flow for Spills Within 10 miles of Barton Springs.

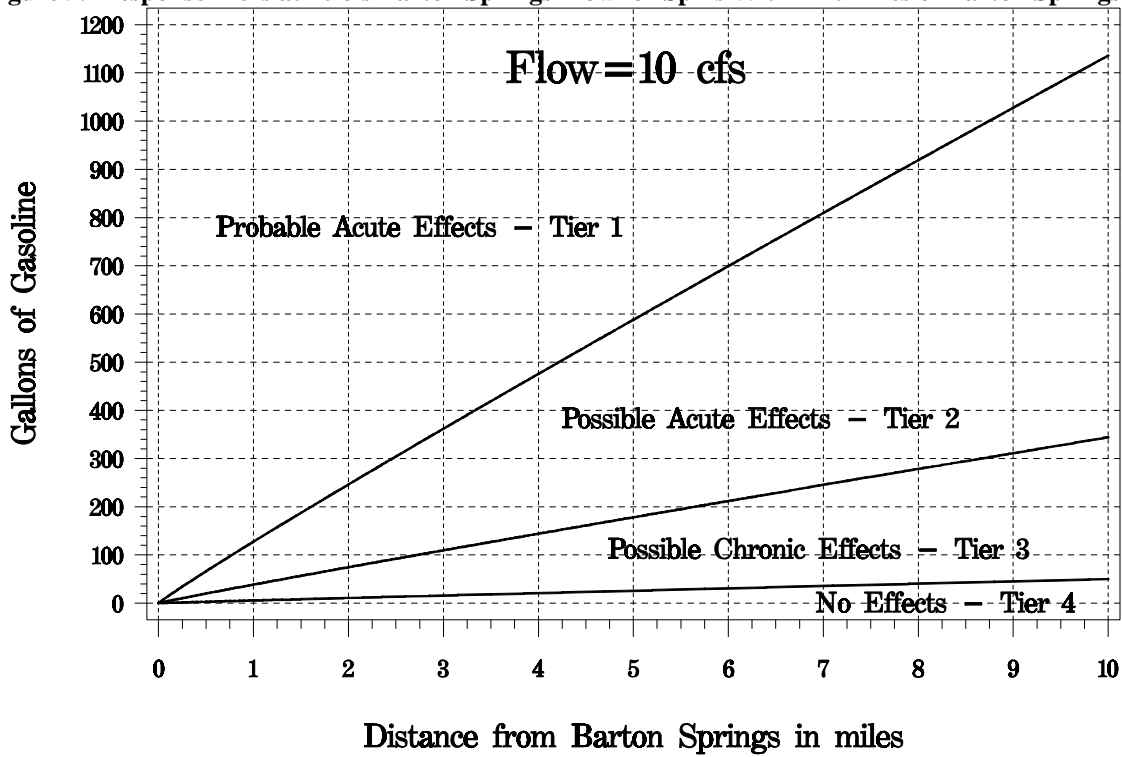


Figure 10. Response Tiers at 10 cfs Barton Springs Flow for Spills 10-20 miles from Barton Springs.

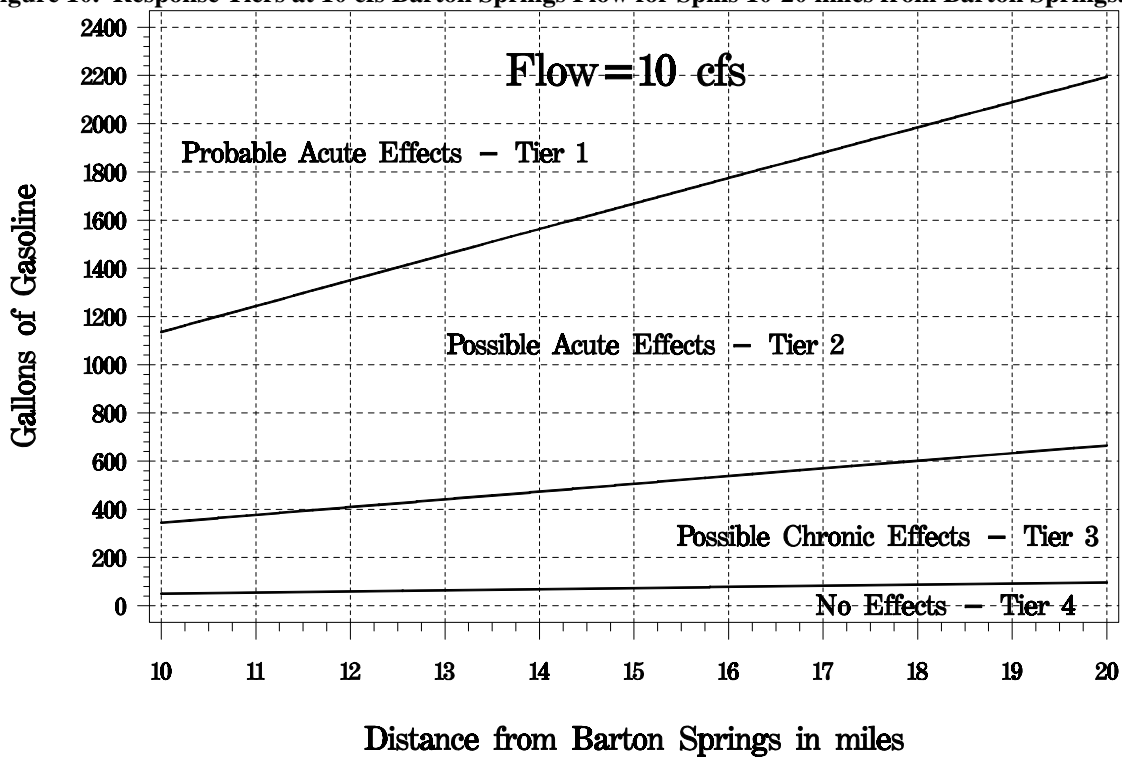


Figure 11. Response Tiers at 10 cfs Barton Springs Flow for Small Spills

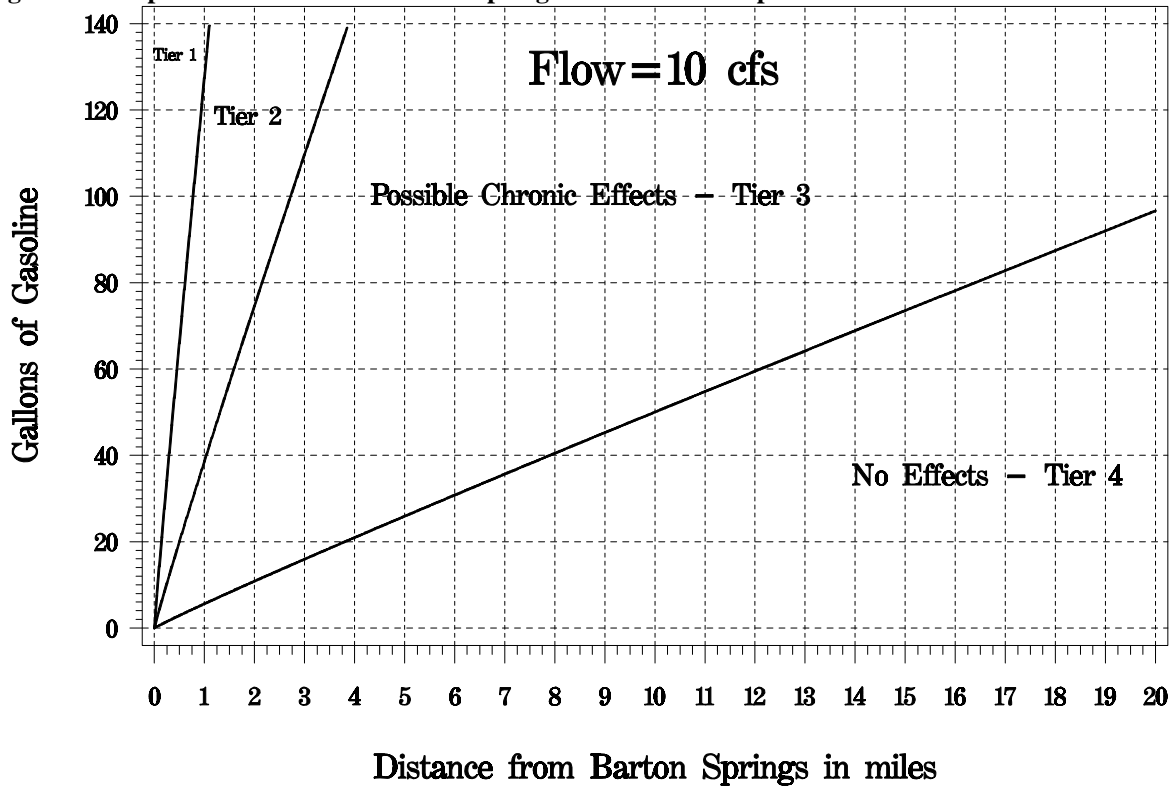


Figure 12. Response Tiers at 25 cfs Barton Springs Flow for Spills Within 10 miles of Barton Springs.

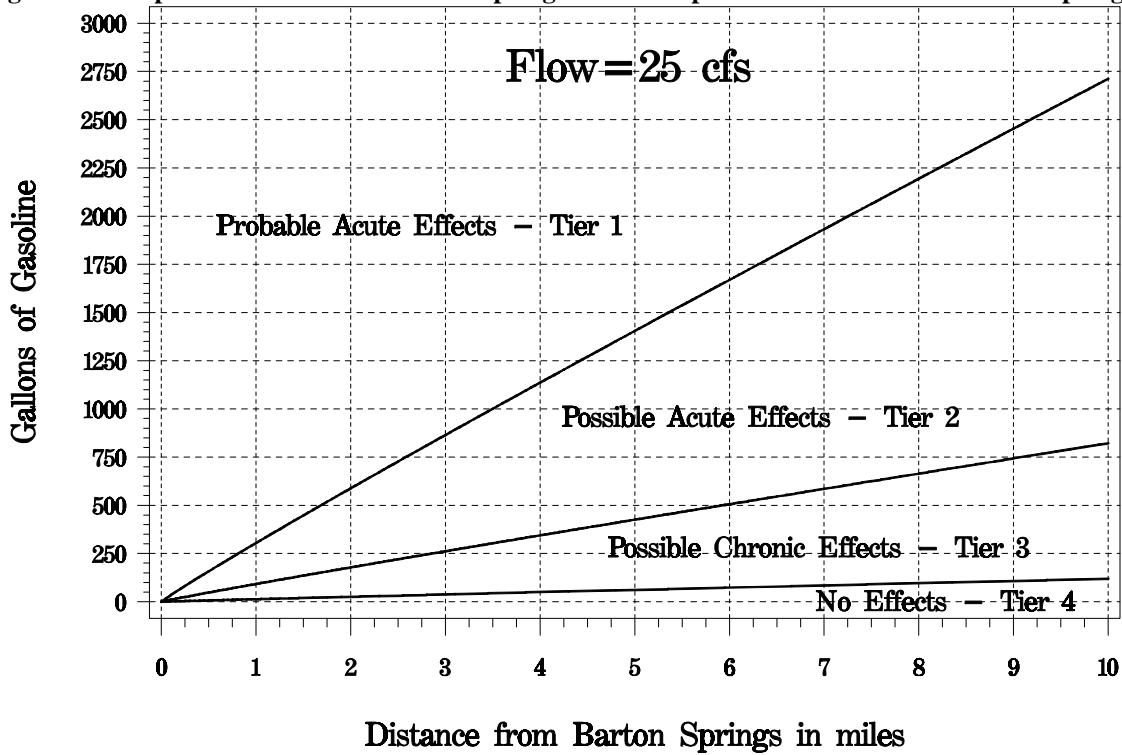


Figure 13. Response Tiers at 25 cfs Barton Springs Flow for Spills 10-20 miles from Barton Springs.

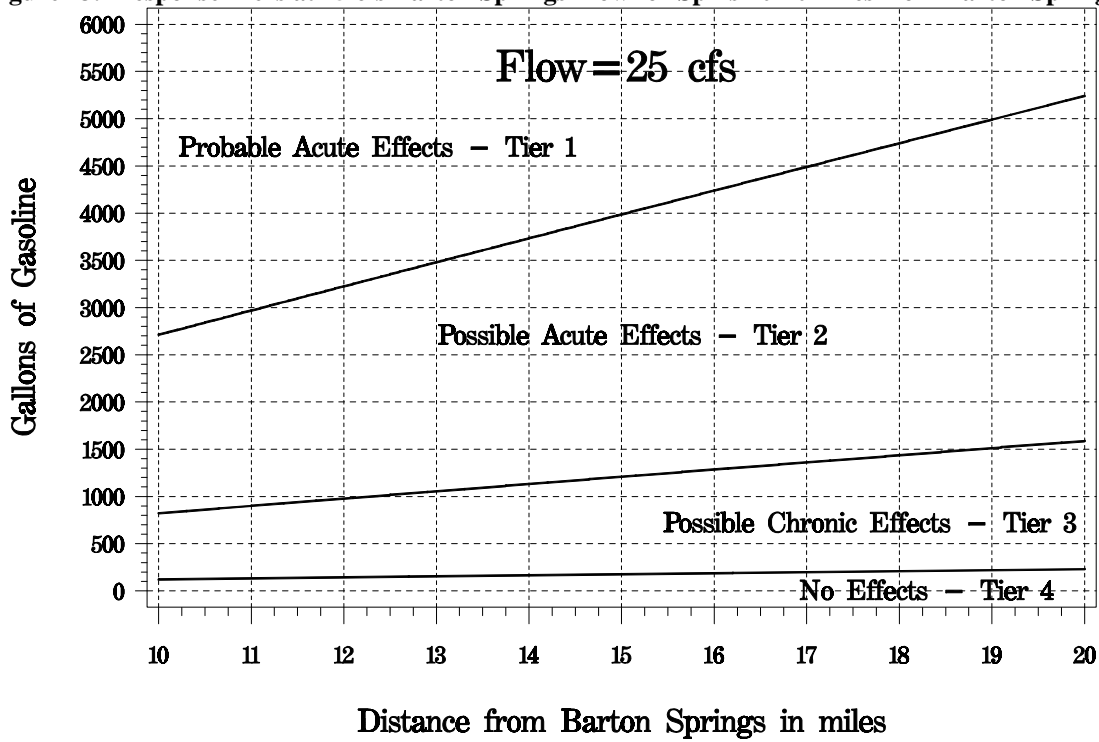


Figure 14. Response Tiers at 25 cfs Barton Springs Flow for Small Spills

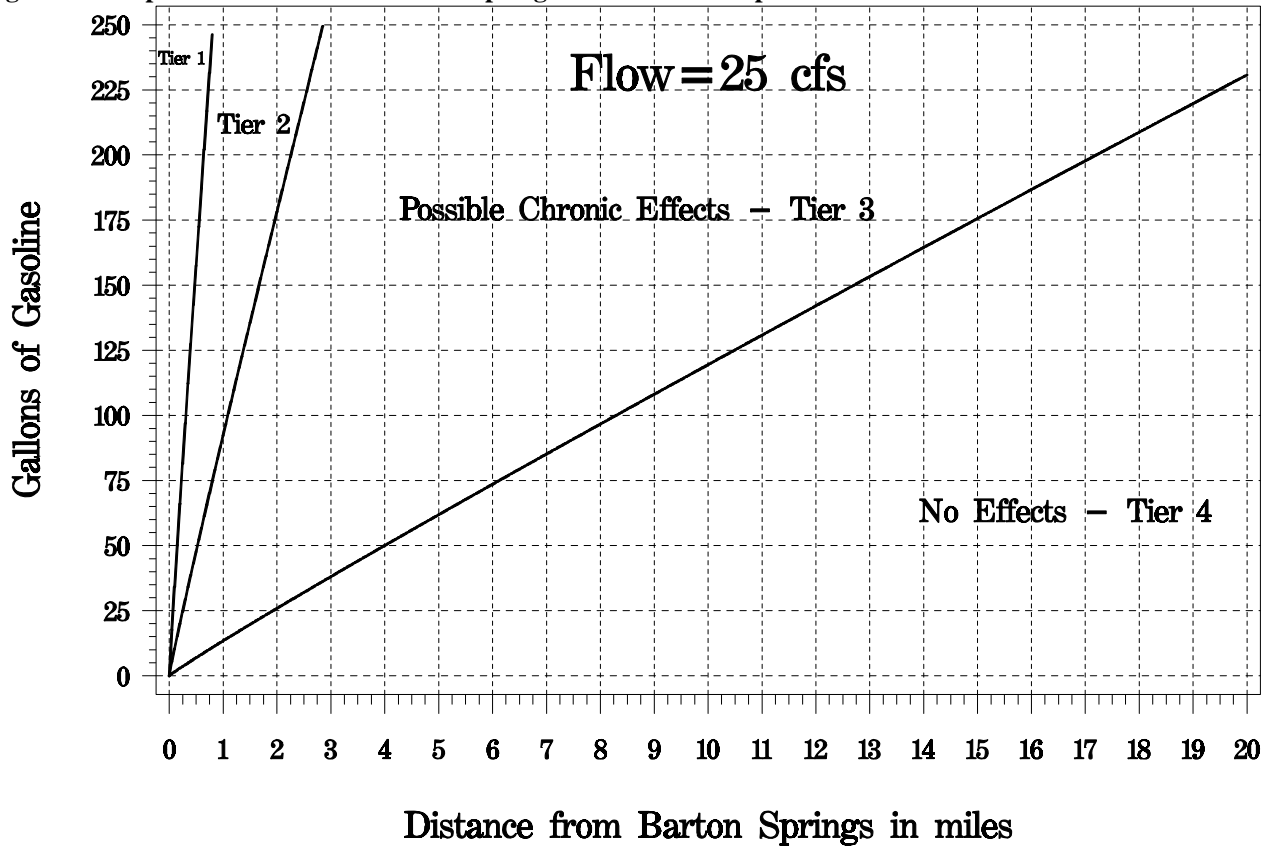


Figure 15. Response Tiers at 50 cfs Barton Springs Flow for Spills Within 10 miles of Barton Springs.

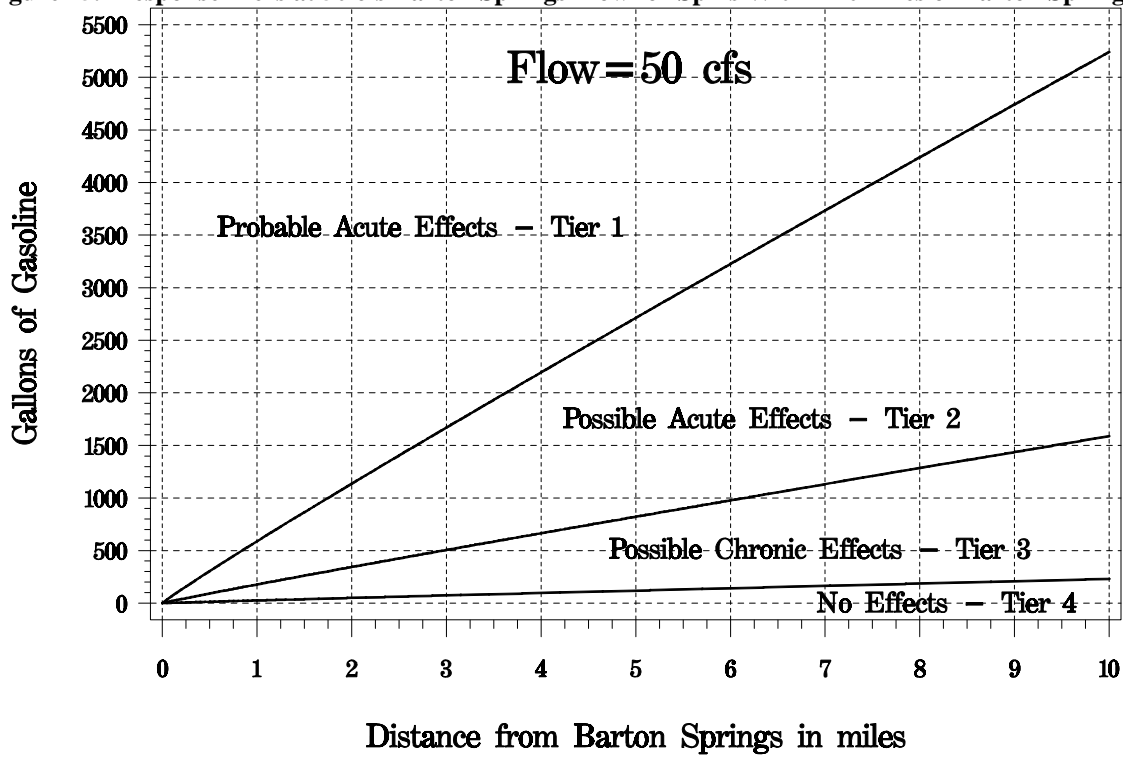


Figure 16. Response Tiers at 50 cfs Barton Springs Flow for Spills 10-20 miles from Barton Springs.

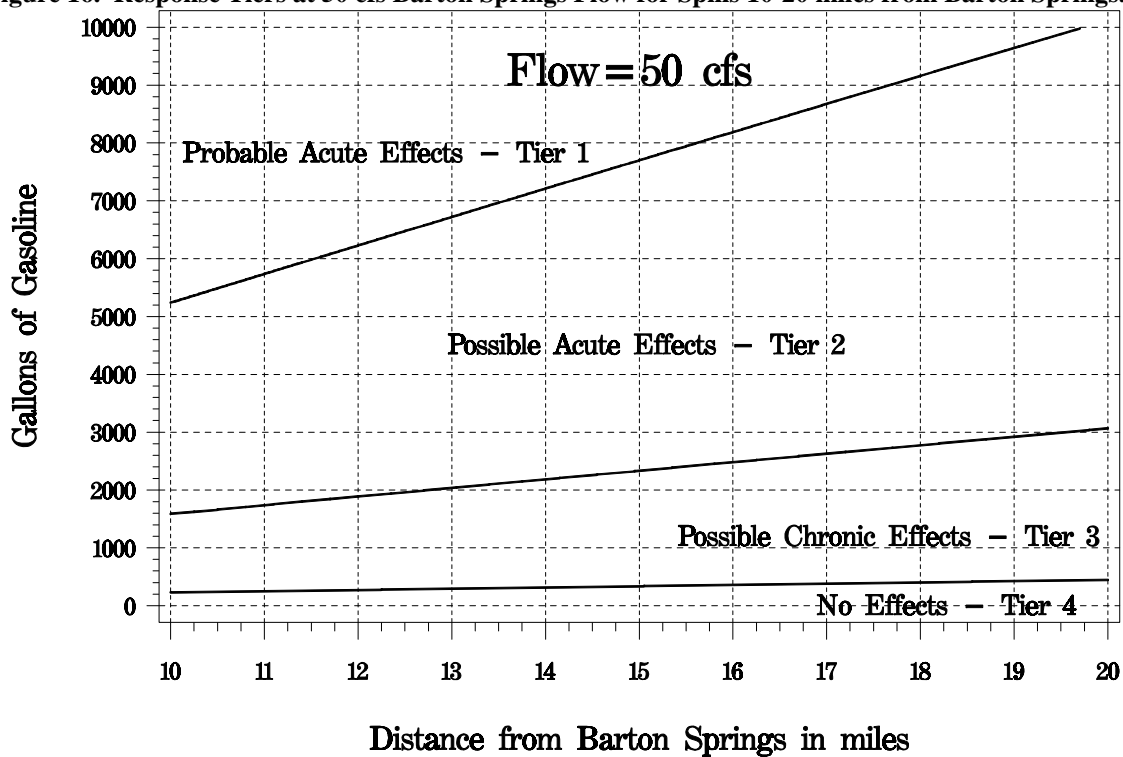


Figure 17. Response Tiers at 50 cfs Barton Springs Flow for Small Spills

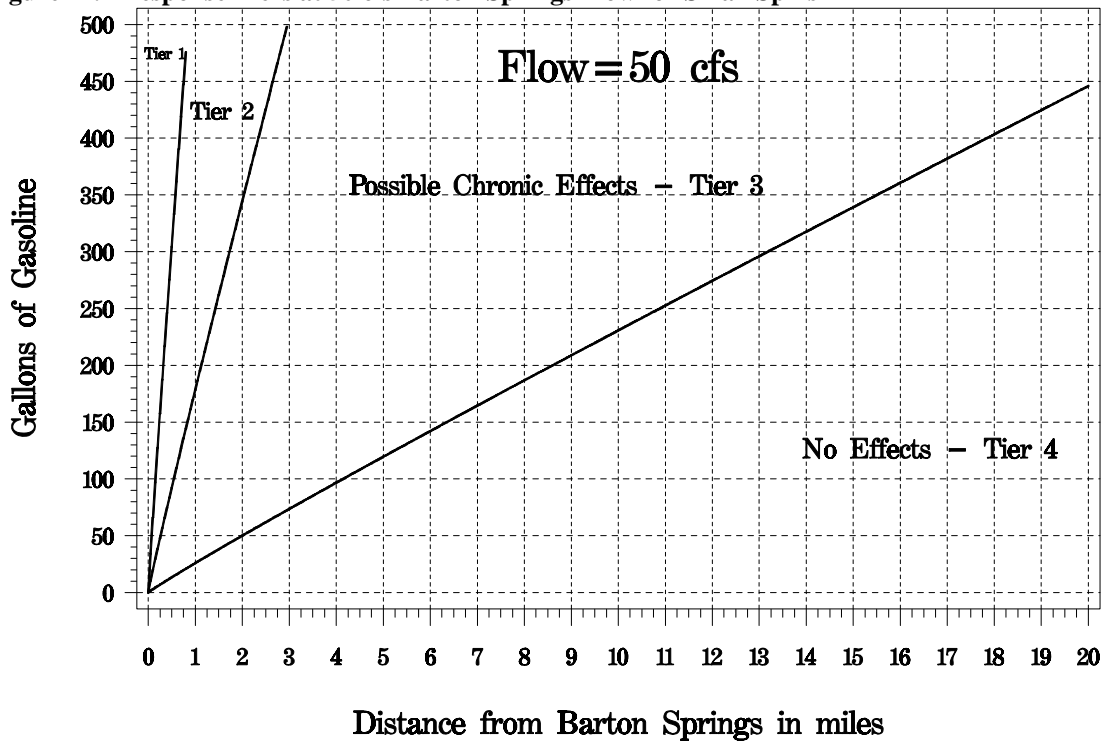


Figure 18. Response Tiers at 75 cfs Barton Springs Flow for Spills Within 10 miles of Barton Springs.

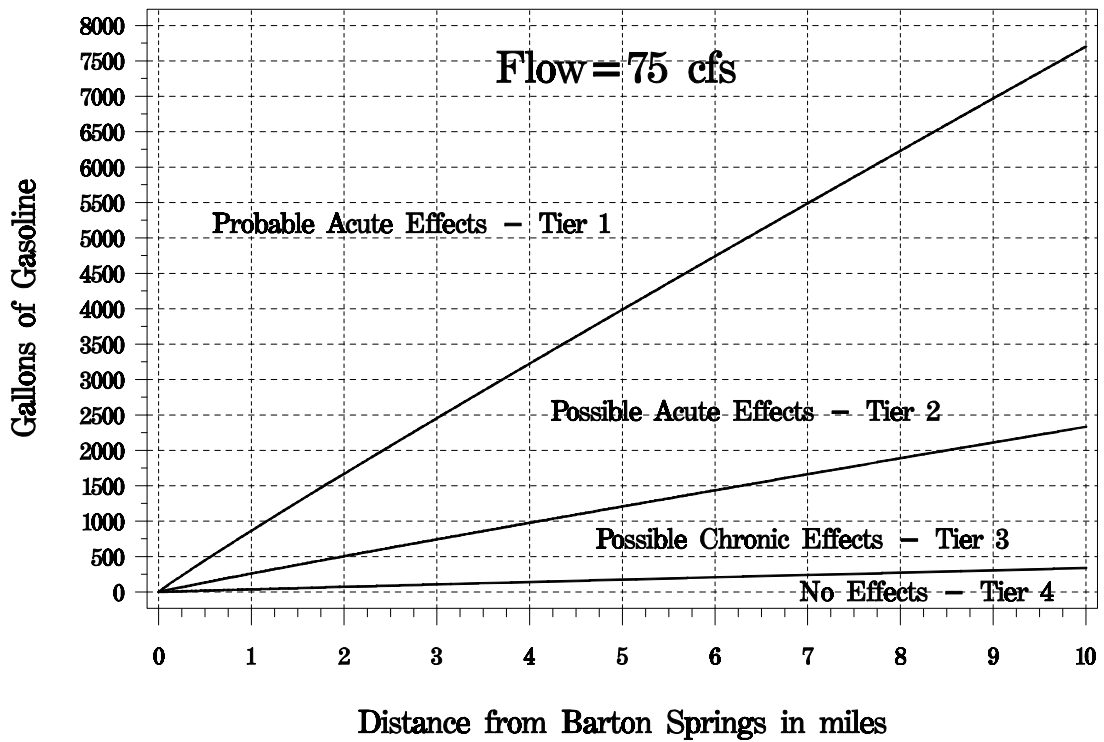


Figure 19. Response Tiers at 75 cfs Barton Springs Flow for Spills 10-20 miles from Barton Springs.

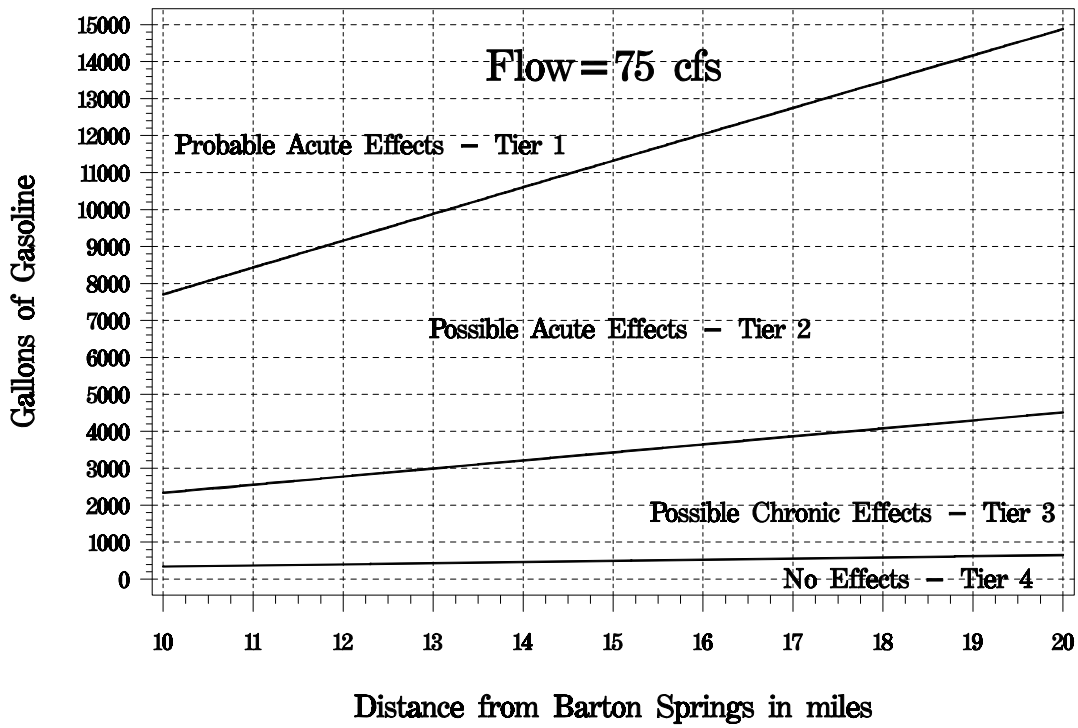


Figure 20. Response Tiers at 75 cfs Barton Springs Flow for Small Spills

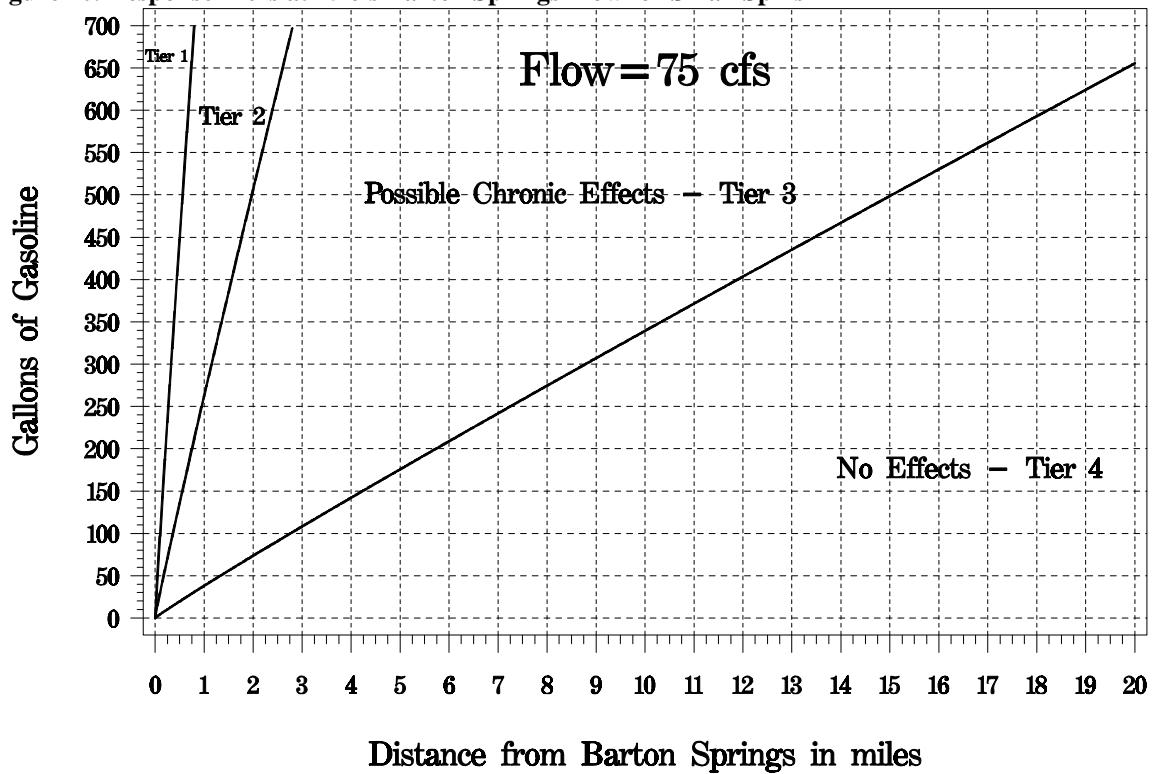


Figure 21. Response Tiers at 100 cfs Barton Springs Flow for Spills Within 10 miles of Barton Springs.

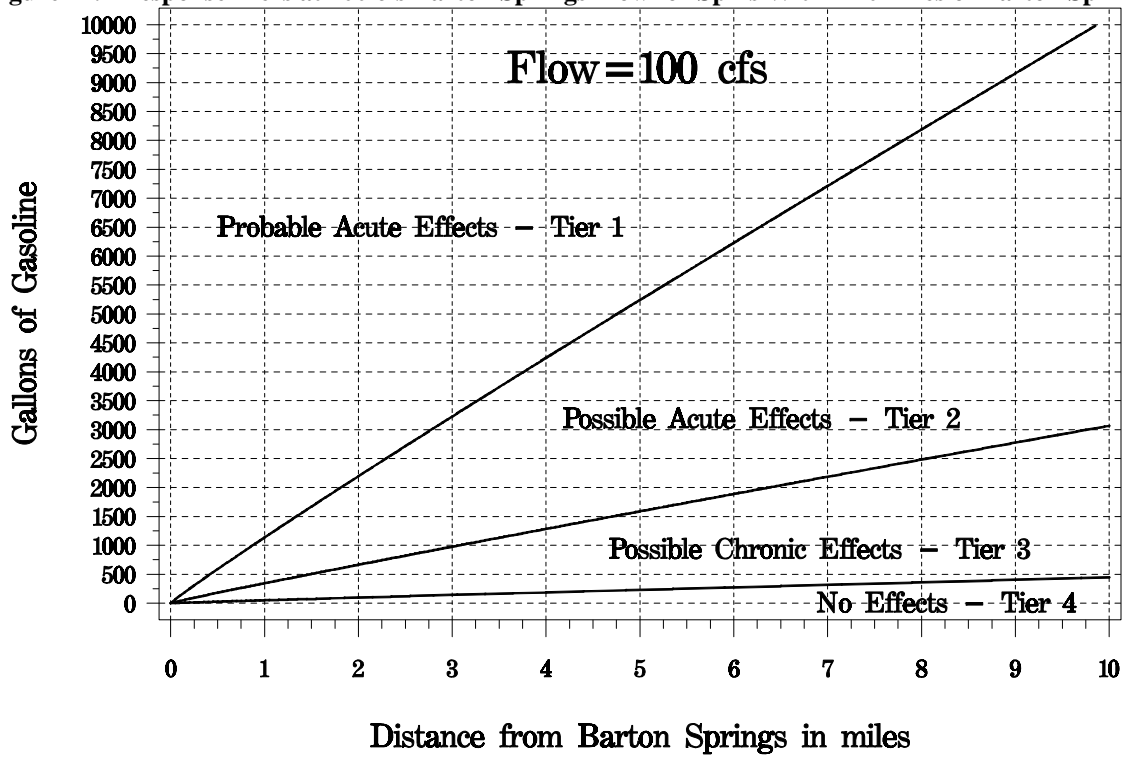


Figure 22 Response Tiers at 100 cfs Barton Springs Flow for Spills 10-20 miles from Barton Springs.

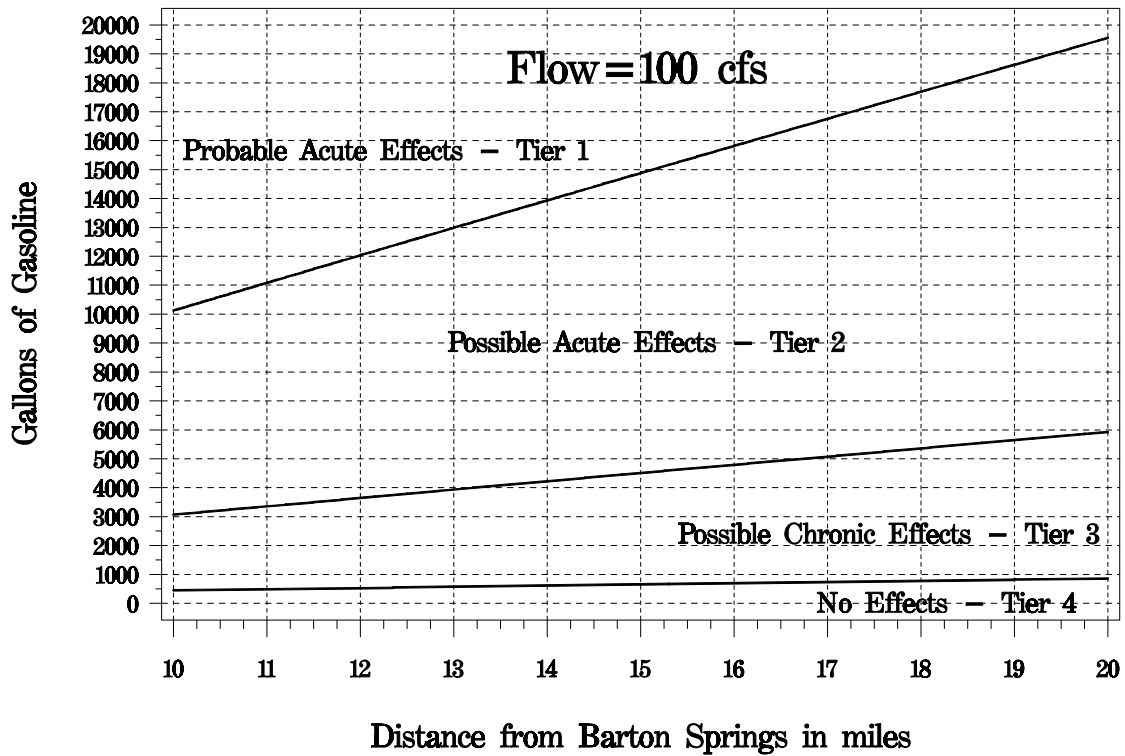


Figure 23 Response Tiers at 100 cfs Barton Springs Flow for Small Spills

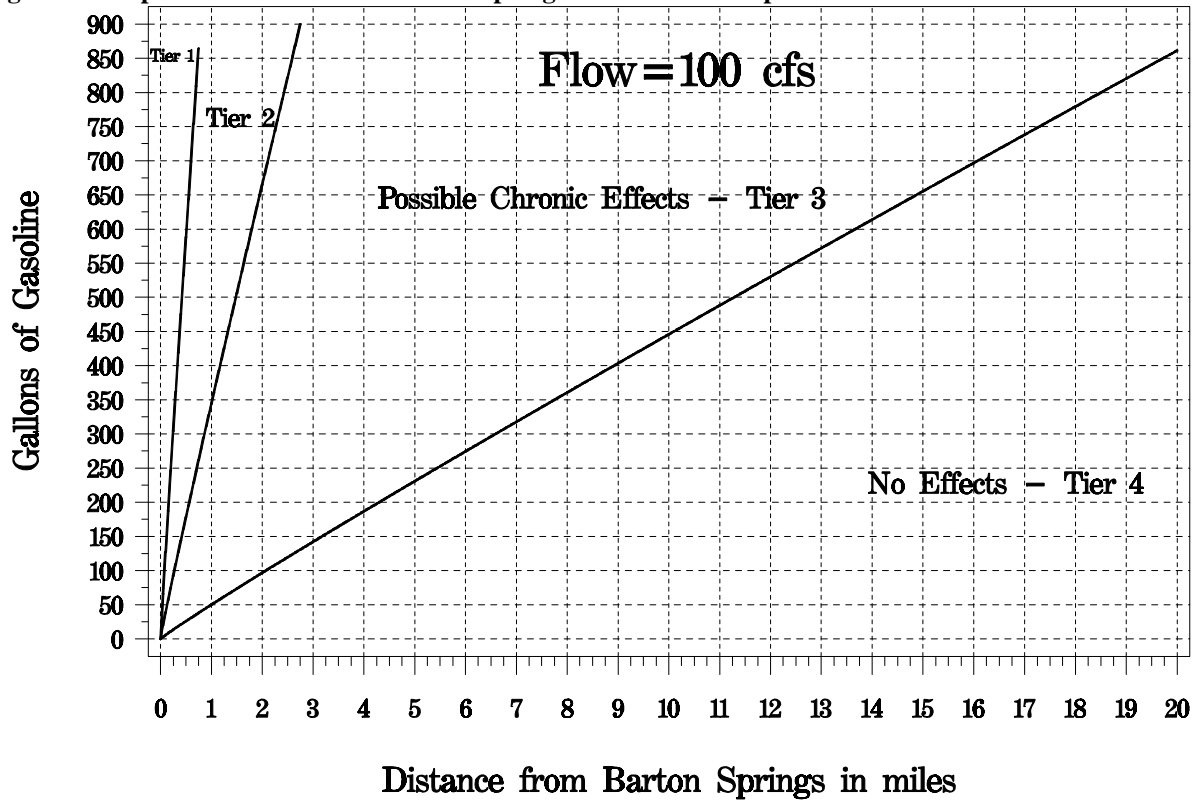
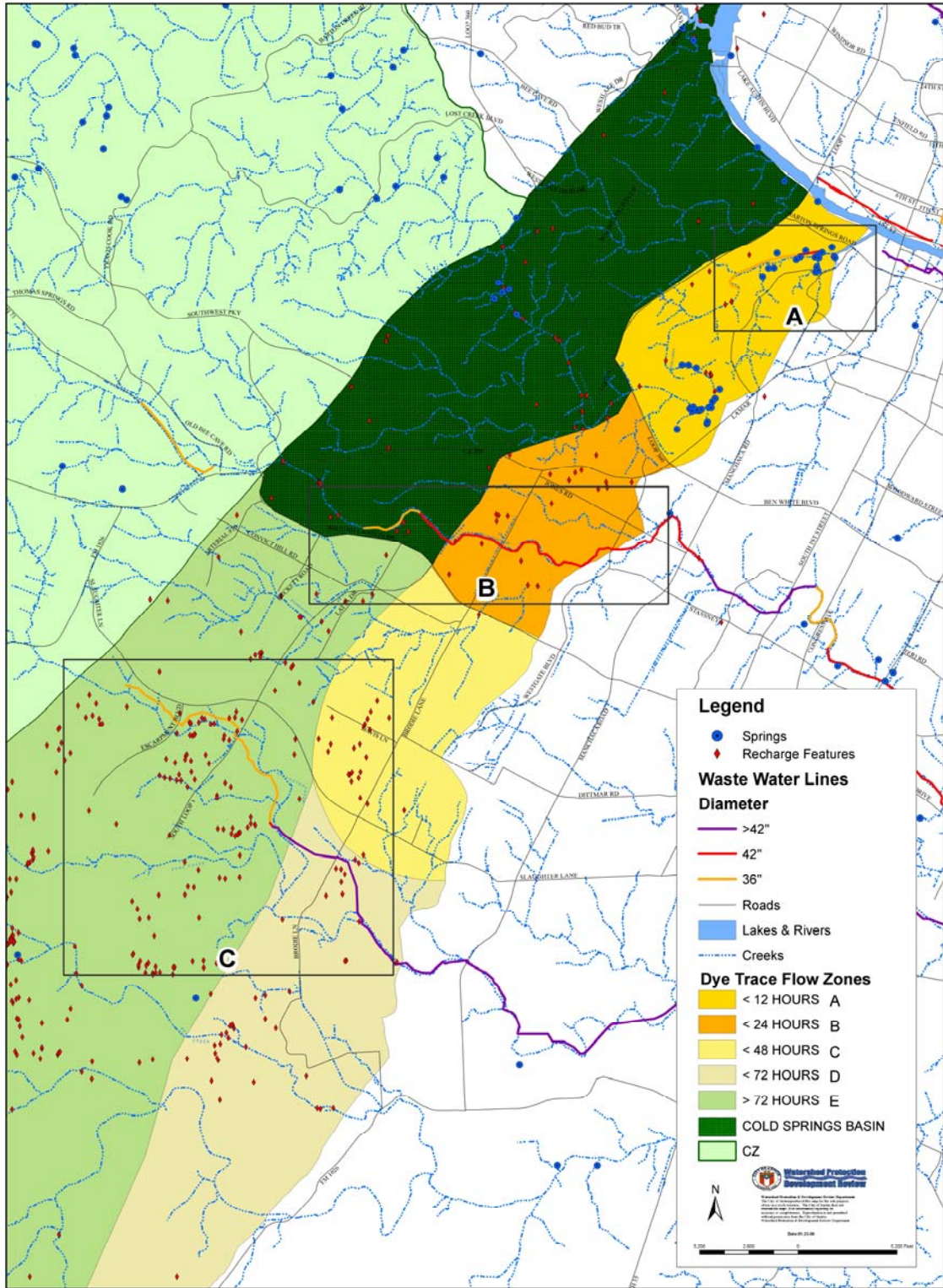
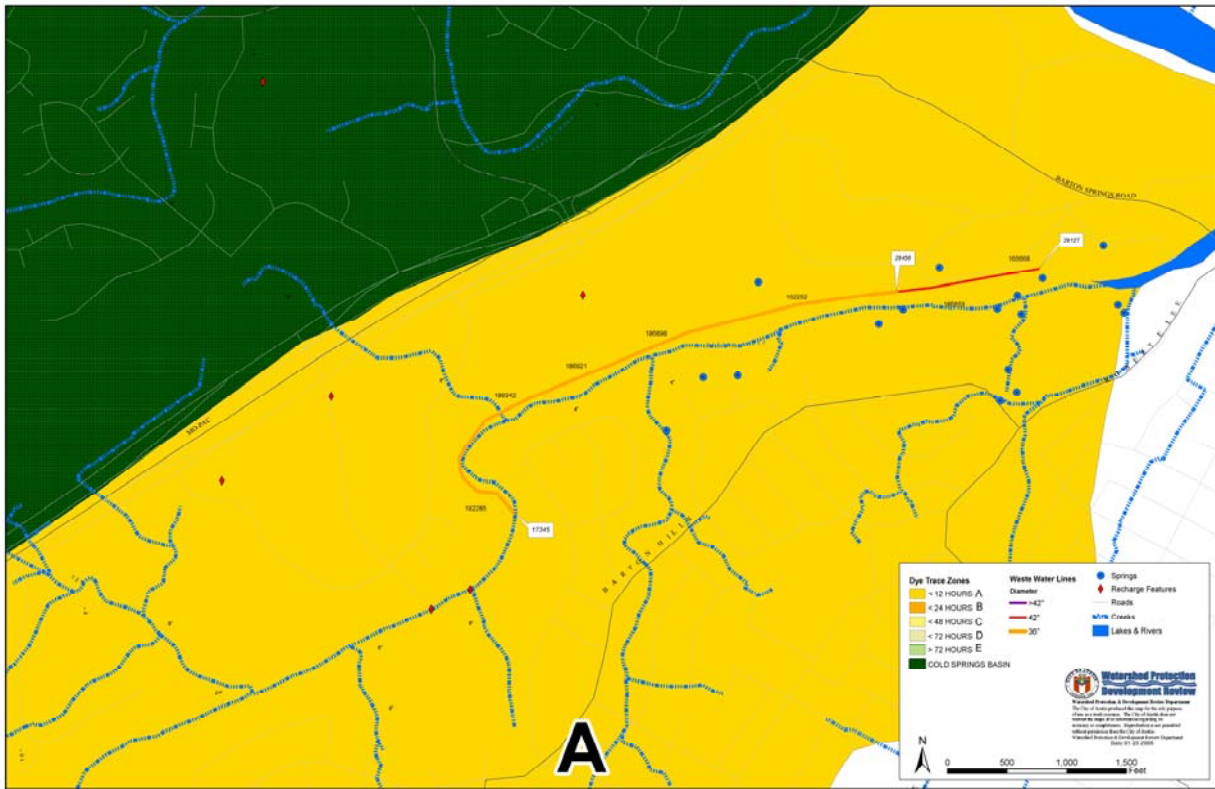


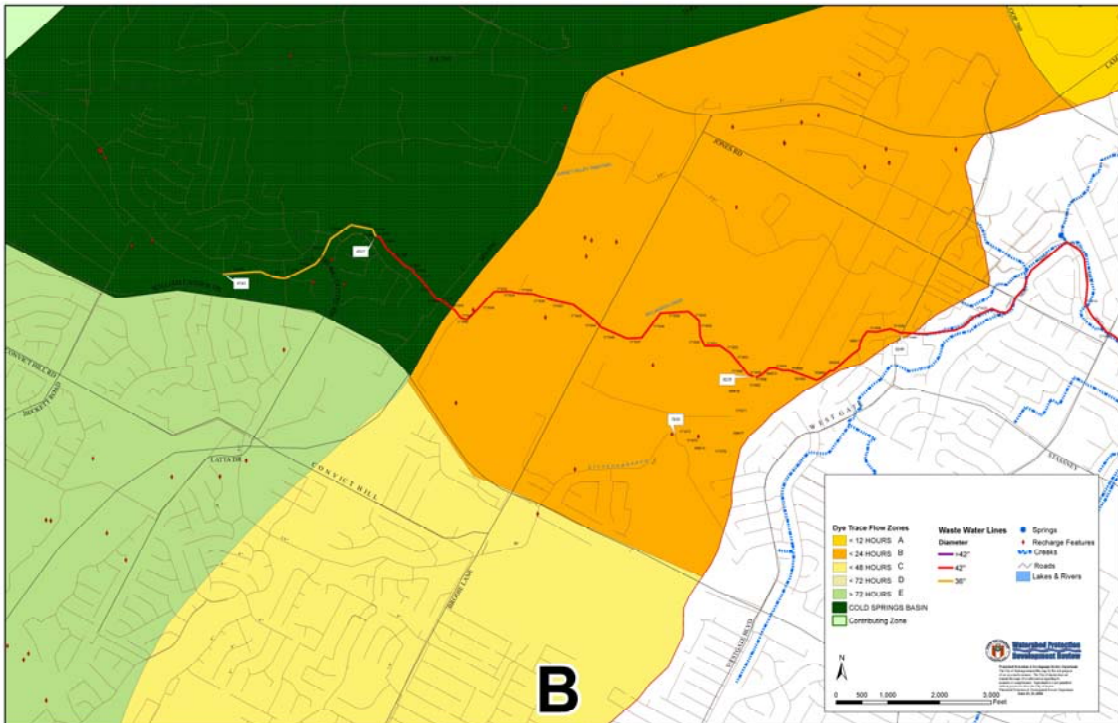
Figure 24 Barton Springs Zone Sewer Lines and Groundwater Flow Regions



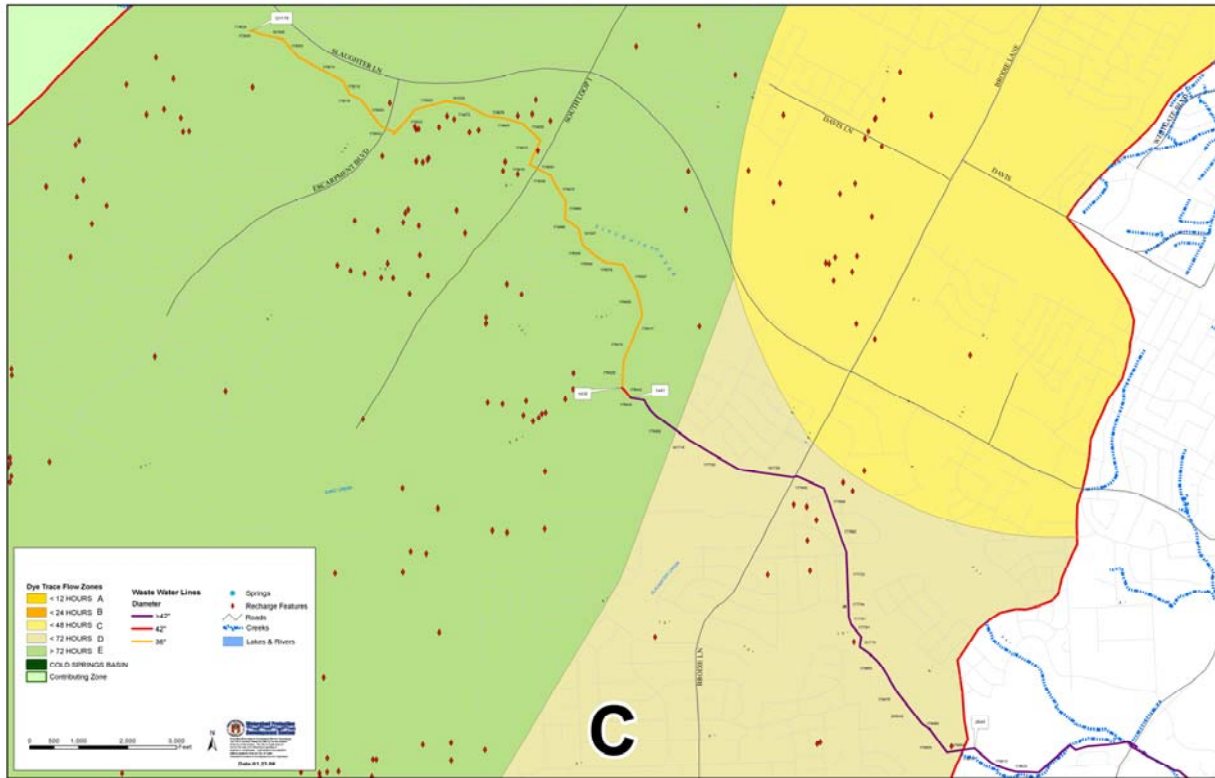
**Figure 25 Barton Springs Zone Sewer Line Map A**



**Figure 26 Barton Springs Zone Sewer Line Map B**



**Figure 27 Barton Springs Zone Sewer Line Map C**



**Endnotes:**

<sup>1</sup> URS Corporation. 2000. Environmental Assessment of the proposed Longhorn Pipeline system. Prepared for U.S. Environmental Protection Agency, Region VI, and U.S. Department of Transportation, Office of Pipeline Safety. Austin, Texas.

<sup>2</sup> American Petroleum Institute. 1994. Transport and fate of non-BTEX petroleum chemicals in soils and groundwater. API Publication Number 4593.

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<sup>4</sup> Horizon Environmental Services, Inc. 2000. Biotoxicological analysis of a potential Longhorn Pipeline product release over the Edwards Aquifer recharge zone, Barton Springs segment. Prepared for Jenkins and Gilchrist, L.L.P. Austin, Texas.

<sup>5</sup> Table A-8 in American Petroleum Institute. 1994. Transport and fate of non-BTEX petroleum chemicals in soils and groundwater. API Publication Number 4593.

<sup>6</sup> Ibid.

<sup>7</sup> Hedtko, S. and F. Puglisi. 1982. Short-term toxicity of five oils to four freshwater species. Environmental Contamination and Toxicology 11:425-430. Cited in Sparling et al. 2000.

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- <sup>10</sup> Fernandez, M. and J. l'Haridan. 1994. Effects of light on the cytotoxicology and genotoxicity of benzo(a)pyrene and an oil refinery effluent in the newt. *Environ Mol Mutagen* 24:124-136. *Cited in* Sparling et al. 2000.
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- <sup>14</sup> Sparling, D., G. Linder, and C. Bishop (eds). 2000. *Ecotoxicology of amphibians and reptiles*. Society of Env Toxicology and Chemistry (SETAC) press. Pensacola, Florida.
- <sup>15</sup> City of Austin. 2001. Jollyville Plateau Water Quality and Salamander Assessment. Watershed Protection Department, Environmental Resource Management Division. Water Quality Report Series COA-ERM 1999-01.
- <sup>16</sup> White, J., F. Dwyer, E. Materna, D. Hardesty, and D. Whites. 2003. Water and sediment quality in habitat springs of Edwards Aquifer salamanders. U.S. Fish and Wildlife Service, Environmental Contaminants Program. Austin, Texas.
- <sup>17</sup> 30 Texas Administrative Code Chapter 307.6 (c)(7).
- <sup>18</sup> Ibid.
- <sup>19</sup> TNRCC. 2001. Guidance for conducting ecological risk assessments at remediation sites in Texas. Prepared by Toxicology and Risk Assessment Section. RG-263 (revised). Austin, Texas.
- <sup>20</sup> Texas Commission on Environmental Quality. 2002. Determining PCLs for surface water and sediment. RG-336/TRRP-24. Austin, Texas.
- <sup>21</sup> Texas Natural Resource Conservation Commission. 2001. Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas. RG-263 (revised). Austin, Texas.
- <sup>22</sup> Page 1 in Environmental Protection Agency. Guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses. PB85-227049. National Technical Information Service, Springfield, Va.
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- <sup>29</sup> State of Illinois, Joint Committee on Administrative Rules. Title 35: Environmental Protection Subtitle C: Water Pollution Chapter II: Environmental Protection Agency Part 373 Third Stage Treatment Lagoon Exemptions Appendix B Modified Streeter-Phelps Equation. Amended at 8 Ill. Reg. 3286, effective March 7, 1984

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- <sup>30</sup> Metcalf and Eddy . 1979. Wastewater Engineering: Treatment, Disposal, Reuse. McGraw-Hill Boston
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- <sup>33</sup> Ibid.
- <sup>34</sup> Personal communication (e-mail) from Tom Ellison, P.E. Austin Water Utility to Martha Turner, WPDRD, December 2005.
- <sup>35</sup> City of Austin. 2001. Jollyville Plateau water quality and salamander assessment. Watershed Protection Department, Environmental Resource Management. Water Quality Report Series COA-ERM-1999-01
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- <sup>39</sup> Hecnar, S. 1995. Acute and chronic toxicity of ammonium nitrate fertilizer to amphibians from southern Ontario. Environmental Toxicology and Chemistry 14:2131-2137.
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Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year	
1	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24h		94440	ug/L	S	79620	110080	F	728	Pickering, O.H., and C. Henderson	1966	
2	Ethylbenzene	Vertebrate	Ictalurus punctatus	Channel catfish	LC50	MOR		24h		210000	ug/L	S	134000	330000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
3	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		35080	ug/L	S	26740	43670	F	728	Pickering, O.H., and C. Henderson	1966	
4	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		169000	ug/L	S	NR	NR	F	5590	Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc	1981	
5	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		90000	ug/L	S	65000	124000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
6	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		100000	ug/L	S	70000	149000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
7	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		160000	ug/L	S	113000	226000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
8	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		135000	ug/L	S	66000	276000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
9	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		220000	ug/L	S	129000	376000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
10	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		285000	ug/L	S	189000	431000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
11	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		198000	ug/L	S	142000	277000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
12	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		134000	ug/L	S	112000	170000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
13	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		80000	ug/L	S	64000	101000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
14	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24h		135000	ug/L	S	113000	162000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
15	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		24h		14000	ug/L	S	11000	18000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
16	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		24h		48510	ug/L	S	38900	62830	F	728	Pickering, O.H., and C. Henderson	1966	
17	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		24h		42330	ug/L	S	33520	53470	F	728	Pickering, O.H., and C. Henderson	1966	
18	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		24h		97100	ug/L	S	81450	114580	F	728	Pickering, O.H., and C. Henderson	1966	
19	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		48h		94440	ug/L	S	79620	110080	F	728	Pickering, O.H., and C. Henderson	1966	
20	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		48h		32000	ug/L	S	NR	NR	F	728	Pickering, O.H., and C. Henderson	1966	
21	Ethylbenzene	Vertebrate	Leuciscus idus melanotus	Carp	LC50	MOR		48h		44000	ug/L	NR	NR	NR	F	547	Juhnke, I., and D. Luedemann	1978	
22	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		48h		48510	ug/L	S	38900	62830	F	728	Pickering, O.H., and C. Henderson	1966	
23	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		48h		42330	ug/L	S	33520	53470	F	728	Pickering, O.H., and C. Henderson	1966	
24	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		48h		97100	ug/L	S	81450	114580	F	728	Pickering, O.H., and C. Henderson	1966	
25	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		96h		94440	ug/L	S	79620	110080	F	728	Pickering, O.H., and C. Henderson	1966	
26	Ethylbenzene	Vertebrate	Ictalurus punctatus	Channel catfish	LC50	MOR		96h		210000	ug/L	S	134000	330000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
27	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		32000	ug/L	S	NR	NR	F	728	Pickering, O.H., and C. Henderson	1966	
28	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		150000	ug/L	S	130000	200000	F	5590	Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc	1981	
29	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		88000	ug/L	S	63000	122000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
30	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		84000	ug/L	S	57000	124000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
31	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		140000	ug/L	S	93000	211000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
32	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		56000	ug/L	S	40000	78000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
33	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		86000	ug/L	S	55000	134000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
34	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		285000	ug/L	S	189000	431000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
35	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		135000	ug/L	S	113000	162000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
36	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		134000	ug/L	S	112000	170000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
37	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		80000	ug/L	S	64000	101000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
38	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96h		135000	ug/L	S	113000	162000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
39	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		96h		4200	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Viganò, D. Cesareo, and f	1988	
40	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		96h		14000	ug/L	S	11000	18000	F	6797	Mayer, F.L.J., and M.R. Ethersieck	1986	
41	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		9.09E+03	ug/L	F	7.55E+03	1.10E+04	A	3217	Geiger, D.L., L.T. Brooke, and D.J. Call	1990	
42	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		48510	ug/L	S	38900	62830	F	728	Pickering, O.H., and C. Henderson	1966	
43	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		42330	ug/L	S	33520	53470	F	728	Pickering, O.H., and C. Henderson	1966	
44	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		12100	ug/L	F	11500	12700	A	12858	Geiger, D.L., S.H. Poirier, L.T. Brooke, and D.J. Call	1986	
45	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		11900	ug/L	S	9100	15600	A	14339	Brooke, L.	1987	
46	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96h		9100	ug/L	F	7500	11000	A	14339	Brooke, L.	1987	
47	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		96h		97100	ug/L	S	81450	114580	F	728	Pickering, O.H., and C. Henderson	1966	
48	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		96h		9600	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Viganò, D. Cesareo, and f	1988	
49	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		24h		77000	ug/L	S	F	57000	100000	F	5184	LeBlanc, G.A.	1980
50	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		24h		190000	ug/L	S	F	NR	NR	F	5718	Bringmann, G., and R. Kuhn	1977
51	Ethylbenzene	Invertebrate	Artemia sp.	Brine shrimp	LC50	MOR		48h		8780	ug/L	S	F	3910	13700	F	7069	MacLean, M.M., and K.G. Doe	1989
52	Ethylbenzene	Invertebrate	Artemia sp.	Brine shrimp	LC50	MOR		48h		13300	ug/L	S	F	8630	18100	F	7069	MacLean, M.M., and K.G. Doe	1989
53	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48h		75000	ug/L	S	F	50000	120000	F	5184	LeBlanc, G.A.	1980
54	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48h		18400	ug/L	S	F	11500	25400	F	7069	MacLean, M.M., and K.G. Doe	1989
55	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48h		13900	ug/L	S	F	10600	17200	F	7069	MacLean, M.M., and K.G. Doe	1989
56	Ethylbenzene	Invertebrate	Gammarus pseudolimninaeus	Scud	LC50	MOR		96h		1940	ug/L	F	A	1260	2990	F	14339	Brooke, L.	1987
57	Benzene	Vertebrate	Salmo trutta	Brown trout	LC50	MOR		1h		12000	ug/L	NR	NR	NR	F	448	Woodiwiss, F.S., and G. Fretwell	1974	
58	Benzene	Vertebrate	Amblystoma mexicanum	Mexican axolotl	LC50	MOR		24h		NR	ug/L	NR	320000	560000	F	14863	Stoff, W.	1982	
59	Benzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24h		34420	ug/L	S	26100	42830	F	728	Pickering, O.H., and C. Henderson	1966	
60	Benzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24h		46000	ug/L	S	NR	NR	A	623	Bridie, A.L., C.J.M. Wolff, and M. Winter	1966	
61	Benzene	Vertebrate	Gambusia affinis	Western mosquitofish	LC50*	MOR		24h		395000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957	

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov.ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year
62	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24h		425000	ug/L	S	357000	505000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
63	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		22490	ug/L	S	17500	28370	F	728	Pickering, Q.H., and C. Henderson	1966
64	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		20000	ug/L	S	NR	NR	F	922	Tumbull, H., J.G. Demann, and R.F. Weston	1954
65	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		400000	ug/L	S	285000	570000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
66	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		140000	ug/L	S	107000	183000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
67	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		910000	ug/L	S	654000	1267000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
68	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		740000	ug/L	S	584000	937000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
69	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		580000	ug/L	S	343000	981000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
70	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		370000	ug/L	S	285000	481000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
71	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		260000	ug/L	S	213000	311000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
72	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		102000	ug/L	S	86000	120000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
73	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		165000	ug/L	S	116000	234000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
74	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		24h		9200	ug/L	S	7200	11700	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
75	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		74000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
76	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		70000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
77	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		54000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
78	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		35560	ug/L	S	25810	45830	F	728	Pickering, Q.H., and C. Henderson	1966
79	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		34420	ug/L	S	24100	42830	F	728	Pickering, Q.H., and C. Henderson	1966
80	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		NR	ug/L	NR	56000	100000	F	14863	Slooff, W.	1982
81	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		36600	ug/L	S	28630	54430	F	728	Pickering, Q.H., and C. Henderson	1966
82	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		24h		NR	ug/L	NR	180000	320000	F	14863	Slooff, W.	1982
83	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48h		370000	ug/L	S	NR	NR	F	9740	Slooff, W., and R. Baerselman	1980
84	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48h		770000	ug/L	NR	NR	NR	F	14863	Slooff, W.	1982
85	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		34420	ug/L	S	26100	42830	F	728	Pickering, Q.H., and C. Henderson	1966
86	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48h		395000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957
87	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		22490	ug/L	S	17500	28370	F	728	Pickering, Q.H., and C. Henderson	1966
88	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		20000	ug/L	S	NR	NR	F	922	Tumbull, H., J.G. Demann, and R.F. Weston	1954
89	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		33000	ug/L		NR	NR	F	547	Juhnke, I., and D. Luedemann	1978
90	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		62000	ug/L		NR	NR	F	547	Juhnke, I., and D. Luedemann	1978
91	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		48h		56000*	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
92	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		250000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
93	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		74000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
94	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		70000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
95	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		54000	ug/L	S	NR	NR	F	12497	Tsuji, S., Y. Tonogai, Y. Ito, and S. Kanoh	1986
96	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		35080	ug/L	S	26740	43670	F	728	Pickering, Q.H., and C. Henderson	1966
97	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		32000	ug/L	S	22330	41160	F	728	Pickering, Q.H., and C. Henderson	1966
98	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		84000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
99	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		84000	ug/L	NR	NR	NR	F	14863	Slooff, W.	1982
100	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		36600	ug/L	S	28630	54430	F	728	Pickering, Q.H., and C. Henderson	1966
101	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	S	NR	NR	F	9740	Slooff, W., and R. Baerselman	1980
102	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	S	NR	NR	F	12152	De Zwart, D., and W. Slooff	1987
103	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	NR	NR	NR	F	14863	Slooff, W.	1982
104	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		34420	ug/L	S	26100	42830	F	728	Pickering, Q.H., and C. Henderson	1966
105	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96h		386000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957
106	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96h		425000	ug/L	S	357000	505000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
107	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		22490	ug/L	S	17500	28370	F	728	Pickering, Q.H., and C. Henderson	1966
108	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		230000	ug/L	S	191000	291000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
109	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		100000	ug/L	S	70000	142000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
110	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		600000	ug/L	S	481000	748000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
111	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		450000	ug/L	S	349000	580000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
112	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		290000	ug/L	S	178000	473000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
113	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		370000	ug/L	S	285000	481000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
114	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		260000	ug/L	S	213000	311000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
115	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		102000	ug/L	S	86000	120000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
116	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		165000	ug/L	S	116000	234000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
117	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		5900	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Vignano, D. Cesareo, and	1985

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year
118	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		5300	ug/L	F	NR	NR	A	17889	DeGraeve, G.M., R.G. Eider, D.C. Woods, and H.L. Ber	1982
119	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		9200	ug/L	S	7200	11700	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
120	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		2.46E+04	ug/L	F	2.14E+04	2.81E+04	A	3217	Geiger, D.L., L.T. Brooke, and D.J. Call	1990
121	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		1.26E+04	ug/L	F	1.07E+04	1.47E+04	A	3217	Geiger, D.L., L.T. Brooke, and D.J. Call	1990
122	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		33470	ug/L	S	25190	41660	F	728	Pickering, Q.H., and C. Henderson	1966
123	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		32000	ug/L	S	22330	41160	F	728	Pickering, Q.H., and C. Henderson	1966
124	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		15590	ug/L	F	14040	17300	A	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Harn	1992
125	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		24600	ug/L	F	21400	28100	A	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Harn	1992
126	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		12500	ug/L	F	10700	14700	A	14339	Brooke, L.	1987
127	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		35700	ug/L	S	28900	44200	A	14339	Brooke, L.	1987
128	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		36600	ug/L	S	28630	54330	F	728	Pickering, Q.H., and C. Henderson	1966
129	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		28600	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Viganò, D. Cesareo, and	1988
130	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		14010	ug/L	F	12370	15860	A	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Harn	1992
131	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		57890	ug/L	S	48870	68760	F	728	Pickering, Q.H., and C. Henderson	1966
132	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		58000	ug/L	S	NR	NR	A	623	Bridie, A.L., C.J.M. Wolff, and M. Winter	1979
133	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		130000	ug/L	S	NR	NR	F	5773	Jensen, R.A.	1978
134	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		41590	ug/L	F	31990	71720	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
135	Toluene	Vertebrates	<i>Citrias lazera</i>	Catfish	LC50*	MOR		24h		36600	ug/L	R	NR	NR	F	3997	Ghazaly, K.S.	1991
136	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		24h		1340000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957
137	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24h		240000	ug/L	S	187000	309000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
138	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		24000	ug/L	S	18880	30510	F	728	Pickering, Q.H., and C. Henderson	1966
139	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		17000	ug/L	S	NR	NR	F	5590	Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc	1981
140	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		195000	ug/L	S	144000	265000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
141	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		116000	ug/L	S	94000	143000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
142	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		540000	ug/L	S	375000	777000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
143	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		600000	ug/L	S	314000	1145000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
144	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		510000	ug/L	S	323000	805000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
145	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		305000	ug/L	S	257000	362000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
146	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		153000	ug/L	S	116000	201000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
147	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		100000	ug/L	S	74000	134000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
148	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		170000	ug/L	S	142000	203000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
149	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		7250	ug/L	F	6260	8400	A	17137	Brooke, L.T., D.J. Call, S.H. Poirier, and S.L. Harting	1986
150	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		24000	ug/L	S	17600	32600	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
151	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		24h		80000	ug/L	S	NR	NR	F	5580	Stoss, F.W., and T.A. Haines	1979
152	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		46310	ug/L	S	37030	59400	F	728	Pickering, Q.H., and C. Henderson	1966
153	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		56000	ug/L	S	44730	67110	F	728	Pickering, Q.H., and C. Henderson	1966
154	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		16000	ug/L	F	14300	17900	A	4283	Lawry, R.S.	1985
155	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		62810	ug/L	S	54990	73690	F	728	Pickering, Q.H., and C. Henderson	1966
156	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		57890	ug/L	S	48870	68760	F	728	Pickering, Q.H., and C. Henderson	1966
157	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		27620	ug/L	F	21590	36010	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
158	Toluene	Vertebrates	<i>Citrias lazera</i>	Catfish	LC50*	MOR		48h		31400	ug/L	R	NR	NR	F	3997	Ghazaly, K.S.	1991
159	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48h		1260000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957
160	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		24000	ug/L	S	18880	30510	F	728	Pickering, Q.H., and C. Henderson	1966
161	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		70000	ug/L		NR	NR	F	547	Juhnke, I., and D. Luedemann	1978
162	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		422000	ug/L		NR	NR	F	547	Juhnke, I., and D. Luedemann	1978
163	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		48h		6780	ug/L	F	4890	7810	A	17137	Brooke, L.T., D.J. Call, S.H. Poirier, and S.L. Harting	1986
164	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		48h		63000	ug/L	S	NR	NR	F	5580	Stoss, F.W., and T.A. Haines	1979
165	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		46310	ug/L	S	37030	59400	F	728	Pickering, Q.H., and C. Henderson	1966
166	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		56000	ug/L	S	46730	67110	F	728	Pickering, Q.H., and C. Henderson	1966
167	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		60950	ug/L	S	52840	71930	F	728	Pickering, Q.H., and C. Henderson	1966
168	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		72h		25330	ug/L	F	20130	31850	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
169	Toluene	Vertebrates	<i>Citrias lazera</i>	Catfish	LC50*	MOR		72h		29500	ug/L	R	NR	NR	F	3997	Ghazaly, K.S.	1991
170	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		57890	ug/L	S	48870	68760	F	728	Pickering, Q.H., and C. Henderson	1966
171	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		22800	ug/L	F	17070	29950	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
172	Toluene	Vertebrates	<i>Citrias lazera</i>	Catfish	LC50*	MOR		96h		26200	ug/L	R	NR	NR	F	3997	Ghazaly, K.S.	1991
173	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96h		1180000	ug/L	S	NR	NR	F	508	Wallen, I.E., W.C. Greer, and R. Lasater	1957
174	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96h		240000	ug/L	S	187000	309000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
175	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		24000	ug/L	S	18880	30510	F	728	Pickering, Q.H., and C. Henderson	1966
176	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		13000	ug/L	S	11000	15000	F	5590	Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc	1981
177	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		170000	ug/L	S	139000	208000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986

Appendix A  
EPA ACQUIRE Database (3/10/04)  
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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year
178	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		84000	ug/L	S	57000	124000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
179	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		340000	ug/L	S	279000	415000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
180	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		320000	ug/L	S	273000	375000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
181	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		300000	ug/L	S	245000	367000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
182	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		240000	ug/L	S	201000	287000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
183	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		135000	ug/L	S	113000	162000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
184	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		74000	ug/L	S	62000	89000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
185	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		135000	ug/L	S	113000	162000	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
186	Toluene	Vertebrates	<i>Melanoides tuberculata</i>	Snail	LC50	MOR		96 h		1100000	ug/L	NR	1000000	1300000	F	18198	Panigrahi, A.K., and S.K. Konar	1989
187	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96 h		8110'	ug/L	F	NR	NR	A	477	Moles, A.	1980
188	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96 h		5500'	ug/L	F	NR	NR	A	15191	Moles, A., S. Bates, S.D. Rice, and S. Korn	1981
189	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96 h		>333000	ug/L	R	NR	NR	A	196	Korn, S., and S. Rice	1981
190	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96 h		9360	ug/L	R	NR	NR	A	196	Korn, S., and S. Rice	1981
191	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96 h		5800	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Viganò, D. Cesareo, and F.	1988
192	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96 h		6780	ug/L	F	5890	7810	A	17137	Brooke, L.T., D.J. Call, S.H. Poirier, and S.L. Harting	1986
193	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96 h		15530	ug/L	S	14100	17160	F	14398	Home, J.D., and B.R. Oblad	1983
194	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96 h		15530	ug/L	S	14100	17160	F	45758	Birge, W.J., J.A. Black, S.T. Ballard, and W.E. McDonnell	1982
195	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96 h		24000	ug/L	S	17600	32600	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
196	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		96 h		54000	ug/L	S	NR	NR	F	5580	Stoss, F.W., and T.A. Haines	1979
197	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		3.17E+04	ug/L	F	NR	NR	A	3217	Geiger, D.L., L.T. Brooke, and D.J. Call	1990
198	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		34270	ug/L	S	22830	45860	F	728	Pickering, Q.H., and C. Henderson	1966
199	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		42330	ug/L	S	33520	53470	F	728	Pickering, Q.H., and C. Henderson	1966
200	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		12600	ug/L	S	NR	NR	F	5087	Pearson, J.G., J.P. Glennon, J.J. Barkley, and J.W. High	1979
201	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	F	18000	30000	F	12405	Devin, E.W.	1982
202	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	F	25000	36000	F	12405	Devin, E.W.	1982
203	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	F	55000	72000	F	12405	Devin, E.W.	1982
204	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		30000	ug/L	F	23000	42000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
205	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		31000	ug/L	F	24000	44000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
206	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		26000	ug/L	F	21000	33000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
207	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		18000	ug/L	F	16000	20000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
208	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36000	ug/L	F	29000	44000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
209	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		25000	ug/L	F	21000	29000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
210	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		27000	ug/L	F	23000	32000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
211	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		28000	ug/L	F	21000	34000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
212	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		72000	ug/L	F	55000	107000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
213	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		66000	ug/L	F	56000	78000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
214	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		59000	ug/L	F	51000	68000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
215	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		55000	ug/L	F	46000	66000	A	15560	Devin, E.W., J.D. Brammer, and R.L. Puyear	1982
216	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		56400	ug/L	S	50900	63600	F	10432	Mayer, M.A., H.C. Alexander, and D.C. Dill	1983
217	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		77400	ug/L	S	71700	82800	F	10432	Mayer, M.A., H.C. Alexander, and D.C. Dill	1983
218	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		54000	ug/L	S	48800	61200	F	10432	Mayer, M.A., H.C. Alexander, and D.C. Dill	1983
219	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36200	ug/L	F	29400	44600	A	12858	Geiger, D.L., S.H. Poirier, L.T. Brooke, and D.J. Call	1986
220	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		17030	ug/L	F	15220	19050	F	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Ham	1992
221	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36200	ug/L	F	29400	44600	A	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Ham	1992
222	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		22100	ug/L	S	20500	23800	A	14339	Brooke, L.	1987
223	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		59300	ug/L	S	50870	70340	F	728	Pickering, Q.H., and C. Henderson	1966
224	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		28200	ug/L	R	NR	NR	A	13142	Galassi, S., M. Mingazzini, L. Viganò, D. Cesareo, and F.	1988
225	Toluene	Vertebrates	<i>Tilapia mossambica</i>	Mozambique tilapia	LC50	MOR		96 h		90000	ug/L	NR	NR	NR	F	12052	Dange, A.D.	1998
226	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cs	96 h		179000	ug/L	R	174000	183000	F	17856	Kononen, D.W., and R.A. Gorski	1997
227	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cs	96 h		181000	ug/L	R	180000	185000	F	17856	Kononen, D.W., and R.A. Gorski	1997
228	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cs	96 h		193000	ug/L	R	190000	197000	F	17856	Kononen, D.W., and R.A. Gorski	1997
229	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cs	96 h		186000	ug/L	R	184000	188000	F	17856	Kononen, D.W., and R.A. Gorski	1997
230	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cs	96 h		191000	ug/L	R	185000	197000	F	17856	Kononen, D.W., and R.A. Gorski	1997
231	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		9390	ug/L	F	8050	10940	A	3910	Marchini, S., M.L. Tosato, T.J. Norberg-King, D.E. Ham	1992
232	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24 h		53600	ug/L	S	42800	63800	F	7069	MacLean, M.M., and K.G. Doe	1989
233	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24 h		61200	ug/L	S	28600	91800	F	7069	MacLean, M.M., and K.G. Doe	1989

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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc. Mean	Conc. Units	Exposure Type	Conc. Min	Conc. Max	Conc. Type	Ref #	Author	Year
234	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113000	ug/L	S	77000	170000	F	9385	Snell, T.W., B.D. Moffat, C. Janssen, and G. Persoone	1991
235	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113000	ug/L	S	94500	132100	F	6002	Ferrando, M.D., and E. Andreu-Moliner	1992
236	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113000	ug/L	NR	NR	NR	F	17689	Snell, T.W.	1991
237	Toluene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24h		9000	ug/L	S	7600	10600	A	4343	Marchini, S., M.D. Hoglund, S.J. Borderius, and M.L. To	1993
238	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		310000	ug/L	S	240000	420000	F	5184	LeBlanc, G.A.	1980
239	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		470000	ug/L	S	NR	NR	F	5718	Bringmann, G., and R. Kuhn	1977
240	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		47000	ug/L	S	32000	50000	A	4072	Roghair, C.J., A. Buijze, E.S.E. Yedema, and J.L.M. He	1994
241	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		106660	ug/L	S	94910	125780	F	14396	Home, J.D., and B.R. Oblad	1983
242	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		25000	ug/L	F	NR	NR	F	5938	Slooff, W.	1979
243	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		27000	ug/L	F	NR	NR	F	17278	Slooff, W.	1978
244	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		310000	ug/L	S	240000	420000	F	5184	LeBlanc, G.A.	1980
245	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		86300	ug/L	S	54600	174700	F	7069	MacLean, M.M., and K.G. Doe	1989
246	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		97700	ug/L	S	54600	174700	F	7069	MacLean, M.M., and K.G. Doe	1989
247	Toluene	Invertebrates	<i>Chironomidae</i>	Midge family	LC50	MOR		96h		860000	ug/L	NR	790000	940000	F	18198	Panigrahi, A.K., and S.K. Konar	1989
248	Toluene	Invertebrates	<i>Cyclops viridis</i>	Cyclopoid copepod	LC50	MOR		96h		215000	ug/L	NR	175000	260000	F	18198	Panigrahi, A.K., and S.K. Konar	1989
249	Toluene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		447000	ug/L	S	NR	NR	F	11282	Saha, M.K., and S.K. Konar	1983
250	Toluene	Invertebrates	<i>Gammarus minus</i>	Scud	LC50	MOR		96h		58000	ug/L	S	54700	61500	F	14396	Home, J.D., and B.R. Oblad	1983
251	Toluene	Invertebrates	<i>Physa heterostropha</i>	Pond snail, pulmonate snail	LC50	MOR		96h		55600	ug/L	S	NR	NR	F	14396	Home, J.D., and B.R. Oblad	1983
252	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		24h		NR	ug/L	NR	180000	320000	F	14863	Slooff, W.	1982
253	Benzene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24h		18400	ug/L	S	15400	21900	A	4343	Marchini, S., M.D. Hoglund, S.J. Borderius, and M.L. To	1993
254	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		250000	ug/L	S	200000	310000	F	5184	LeBlanc, G.A.	1980
255	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		1130000	ug/L	S	NR	NR	F	5718	Bringmann, G., and R. Kuhn	1977
256	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		24h		NR	ug/L	NR	320000	560000	F	14863	Slooff, W.	1982
257	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48h		200000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
258	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48h		200000	ug/L	NR	NR	NR	F	14863	Slooff, W.	1982
259	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		97800	ug/L	S	71500	124000	F	7069	MacLean, M.M., and K.G. Doe	1989
260	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		139000	ug/L	S	90600	187000	F	7069	MacLean, M.M., and K.G. Doe	1989
261	Benzene	Invertebrates	<i>Asellus aquaticus</i>	Aquatic sowbug	LC50	MOR		48h		120000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
262	Benzene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		100000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
263	Benzene	Invertebrates	<i>Cloeon dipterum</i>	Mayfly	LC50	MOR		48h		34000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
264	Benzene	Invertebrates	<i>Corixa punctata</i>	Water boatman	LC50	MOR		48h		48000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
265	Benzene	Invertebrates	<i>Culex pipiens</i>	Northern house mosquito	LC50	MOR		48h		71000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
266	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48h		356000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
267	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48h		390000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
268	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		200000	ug/L	S	140000	320000	F	5184	LeBlanc, G.A.	1980
269	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		400000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
270	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		620000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
271	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		412000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
272	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		356000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
273	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		682000	ug/L	S	608000	752000	F	10060	Eastmond, D.A., G.M. Booth, and M.L. Lee	1984
274	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		412000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
275	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		356000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
276	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		96200	ug/L	S	58500	134100	F	7069	MacLean, M.M., and K.G. Doe	1989
277	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		99200	ug/L	S	75700	122600	F	7069	MacLean, M.M., and K.G. Doe	1989
278	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		76900	ug/L	S	39900	114100	F	7069	MacLean, M.M., and K.G. Doe	1989
279	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		59600	ug/L	S	38500	80700	F	7069	MacLean, M.M., and K.G. Doe	1989
280	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		156600	ug/L	S	102700	210900	F	7069	MacLean, M.M., and K.G. Doe	1989
281	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		135700	ug/L	S	102200	168800	F	7069	MacLean, M.M., and K.G. Doe	1989
282	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48h		345000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
283	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48h		265000	ug/L	S	NR	NR	F	2017	Canton, J.H., and D.M.M. Adema	1978
284	Benzene	Invertebrates	<i>Dugesia lugubris</i>	Planarian, Vortex worm	LC50	MOR		48h		74000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
285	Benzene	Invertebrates	<i>Eubdella octoculata</i>	Leech	LC50	MOR		48h		>320000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983

Appendix A  
EPA ACQUIRE Database (3/10/04)  
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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year
286	Benzene	Invertebrates	<i>Gammarus pulex</i>	Scud	LC50	MOR		48h		42000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
287	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48h		34000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
288	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48h		34000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
289	Benzene	Invertebrates	<i>Ischnura elegans</i>	Damselfly	LC50	MOR		48h		10000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
290	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	NR	NR	NR	F	10574	Slooff, W., J.H. Canton, and J.L.M. Hermens	1983
291	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
292	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	NR	NR	NR	F	14863	Slooff, W.	1982
293	Benzene	Invertebrates	<i>Nemoura cinerea</i>	Stonefly	LC50	MOR		48h		130000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
294	Benzene	Invertebrates	Tubificidae	Oligochaete family	LC50	MOR		48h		>320000	ug/L	S	NR	NR	F	15788	Slooff, W.	1983
295	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		96h		15000	ug/L	S	NR	NR	A	15337	Trucco, R.G., F.R. Engelhardt, and B. Stacey	1983
296	Benzene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		710000	ug/L	S	NR	NR	F	11282	Saha, M.K., and S.K. Konar	1983
297	Benzene	Invertebrates	<i>Gammarus pseudolimnaeus</i>	Scud	LC50	MOR		96h		12100	ug/L	F	6700	22000	A	14339	Brooke, L.	1987
298	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		253000	ug/L	S	156000	348000	F	9385	Snell, T.W., B.D. Moffat, C. Janssen, and G. Persoona	1991
299	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		252700	ug/L	S	203900	301500	F	6002	Ferrando, M.D., and E. Andreu-Moliner	1992
300	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		253000	ug/L	NR	NR	NR	F	17689	Snell, T.W.	1991
301	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		24h		1080000	ug/L	R	NR	NR	A	2077	Rao, T.S., M.S. Rao, and S.B.S. Prasad	1979
302	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		150000	ug/L	S	NR	NR	F	5718	Bringmann, G., and R. Kuhn	1977
303	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		NR	ug/L	S	>100000	<1000000	F	915	Dowden, B.F., and H.J. Bennett	1965
304	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48h		253000	ug/L	S	NR	NR	F	3963	Snell, T.W., and B.D. Moffat	1992
305	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48h		253000	ug/L	NR	NR	NR	F	17689	Snell, T.W.	1991
306	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		48h		950000	ug/L	R	NR	NR	A	2077	Rao, T.S., M.S. Rao, and S.B.S. Prasad	1979
307	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		20000	ug/L	F	NR	NR	F	5938	Slooff, W.	1979
308	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		20000	ug/L	F	NR	NR	F	17278	Slooff, W.	1978
309	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		96h		780000	ug/L	R	NR	NR	A	2077	Rao, T.S., M.S. Rao, and S.B.S. Prasad	1979
310	Xylene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		99500	ug/L	S	NR	NR	F	11282	Saha, M.K., and S.K. Konar	1983
311	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		1h		30500	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
312	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		1h		46000	ug/L	S	NR	NR	F	719	Mattson, V.R., J.W. Arthur, and C.T. Walbridge	1976
313	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		2h		19900	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
314	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		2h		15900	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
315	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		8h		13600	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
316	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		16h		11000	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
317	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		75000	ug/L	S	NR	NR	F	5773	Jensen, R.A.	1978
318	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		30550	ug/L	F	26420	37260	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
319	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		36810	ug/L	S	32640	42690	F	728	Pickering, Q.H., and C. Henderson	1966
320	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		25600	ug/L	S	25100	26100	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
321	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16800	ug/L	F	16200	17500	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
322	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		10400	ug/L	F	NR	NR	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
323	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		24000	ug/L	S	18880	30510	F	728	Pickering, Q.H., and C. Henderson	1966
324	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		36000	ug/L	NR	NR	NR	F	2871	Cope, O.B.	1965
325	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		14000	ug/L	S	12651	15492	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
326	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12500	ug/L	S	10485	14903	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
327	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16500	ug/L	S	13965	19496	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
328	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		14000	ug/L	S	11068	17709	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
329	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12000	ug/L	S	10464	13762	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
330	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12000	ug/L	S	10464	13762	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
331	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16300	ug/L	S	14200	18700	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
332	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		17400	ug/L	S	14900	20300	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
333	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15000	ug/L	S	13000	17300	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
334	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15600	ug/L	S	13800	17700	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
335	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		13500	ug/L	S	11300	16100	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
336	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15600	ug/L	S	13700	17800	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
337	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		8300	ug/L	S	6673	10323	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
338	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		3300	ug/L	S	2661	4093	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
339	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		13500	ug/L	S	9540	19200	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
340	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		17300	ug/L	S	11990	25100	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
341	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		28770	ug/L	S	25620	32640	F	728	Pickering, Q.H., and C. Henderson	1966

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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Exposure Type	Conc Min	Conc Max	Conc Type	Ref #	Author	Year
342	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		28770	ug/L	S	25620	32640	F	728	Pickering, Q.H., and C. Henderson	1966
343	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		42000	ug/L	S	NR	NR	F	719	Mattson, V.R., J.W. Arthur, and C.T. Walbridge	1976
344	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		34730	ug/L	S	30260	40750	F	728	Pickering, Q.H., and C. Henderson	1966
345	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		25100	ug/L	F	19160	31010	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
346	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		36810	ug/L	S	32640	42690	F	728	Pickering, Q.H., and C. Henderson	1966
347	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		25600	ug/L	S	25100	26100	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
348	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		16500	ug/L	F	15900	17200	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
349	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		24000	ug/L	S	18880	30510	F	728	Pickering, Q.H., and C. Henderson	1966
350	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		19000	ug/L	NR	NR	NR	F	2871	Cope, O.B.	1965
351	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		27710	ug/L	S	24580	31250	F	728	Pickering, Q.H., and C. Henderson	1966
352	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		28770	ug/L	S	25620	32640	F	728	Pickering, Q.H., and C. Henderson	1966
353	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		42000	ug/L	S	NR	NR	F	719	Mattson, V.R., J.W. Arthur, and C.T. Walbridge	1976
354	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		34730	ug/L	S	30260	40750	F	728	Pickering, Q.H., and C. Henderson	1966
355	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		72h		20720	ug/L	F	12040	24950	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
356	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		72h		25600	ug/L	S	25100	26100	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
357	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		72h		16500	ug/L	F	15700	17200	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
358	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		72h		42000	ug/L	S	NR	NR	F	719	Mattson, V.R., J.W. Arthur, and C.T. Walbridge	1976
359	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		16940	ug/L	F	6850	21310	A	416	Brenniman, G., R. Hartung, and W.J. Weber Jr.	1976
360	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		36810	ug/L	S	32640	42690	F	728	Pickering, Q.H., and C. Henderson	1966
361	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		24500	ug/L	S	22900	26200	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
362	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		15700	ug/L	F	13100	16500	A	7398	Bailey, H.C., D.H.W. Liu, and H.A. Javitz	1985
363	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		20870	ug/L	S	15990	26180	F	728	Pickering, Q.H., and C. Henderson	1966
364	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		19000	ug/L	NR	NR	NR	F	2871	Cope, O.B.	1965
365	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		13500	ug/L	S	12122	15034	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
366	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		8600	ug/L	S	7711	9591	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
367	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		12000	ug/L	S	10464	13762	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
368	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		13300	ug/L	S	10977	16114	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
369	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		12000	ug/L	S	10464	13762	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
370	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		12000	ug/L	S	10464	16114	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
371	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		16100	ug/L	S	12700	20700	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
372	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		17400	ug/L	S	14900	20300	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
373	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		15000	ug/L	S	13000	17300	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
374	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		14400	ug/L	S	12300	16900	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
375	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		13500	ug/L	S	11300	16100	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
376	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		15000	ug/L	S	13100	17200	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
377	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		8200	ug/L	S	6702	10032	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
378	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		3300	ug/L	S	2661	4093	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
379	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		13500	ug/L	S	9540	19200	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
380	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		17300	ug/L	S	11900	25100	F	6797	Mayer, F.L.J., and M.R. Eilersieck	1986
381	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		1.34E+04	ug/L	F	NR	NR	A	3217	Geiger, D.L., L.T. Brooke, and D.J. Call	1990
382	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		26700	ug/L	S	23530	29970	F	728	Pickering, Q.H., and C. Henderson	1966
383	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		28770	ug/L	S	25620	32640	F	728	Pickering, Q.H., and C. Henderson	1966
384	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		42000	ug/L	S	NR	NR	F	719	Mattson, V.R., J.W. Arthur, and C.T. Walbridge	1976
385	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		34730	ug/L	S	30260	40750	F	728	Pickering, Q.H., and C. Henderson	1966
386	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		135000	ug/L	R	132000	138000	F	17856	Kononen, D.W., and R.A. Gorski	1997
387	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		76000	ug/L	R	NR	NR	F	17856	Kononen, D.W., and R.A. Gorski	1997
388	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		54000	ug/L	R	42000	60000	F	17856	Kononen, D.W., and R.A. Gorski	1997
389	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		78000	ug/L	R	NR	NR	F	17856	Kononen, D.W., and R.A. Gorski	1997
390	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		92000	ug/L	R	88000	95000	F	17856	Kononen, D.W., and R.A. Gorski	1997
391	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		68000	ug/L	R	64000	70000	F	17856	Kononen, D.W., and R.A. Gorski	1997
392	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		56000	ug/L	R	43000	61000	F	17856	Kononen, D.W., and R.A. Gorski	1997
393	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		87000	ug/L	R	84000	96000	F	17856	Kononen, D.W., and R.A. Gorski	1997
394	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96h		80000	ug/L	R	78000	83000	F	17856	Kononen, D.W., and R.A. Gorski	1997

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
1	Ethylbenzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		94440	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
2	Ethylbenzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24h		210000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
3	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		35080	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
4	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		169000	ug/L	Acute Toxicity of Priority Pollutants to Bluegill ( <i>Lepomis macrochirus</i> )
5	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		90000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
6	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		100000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
7	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		160000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
8	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
9	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		220000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
10	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		285000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
11	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		198000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
12	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		134000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
13	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		80000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
14	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
15	Ethylbenzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		14000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
16	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		48510	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
17	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		42330	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
18	Ethylbenzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		97100	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
19	Ethylbenzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		94440	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
20	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		32000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
21	Ethylbenzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Cap	LC50	MOR		48h		44000	ug/L	Results of the Investigation of 200 Chemical Compounds for Acute Fish Toxicity with the Golden Orfe Test
22	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		48510	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
23	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		42330	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
24	Ethylbenzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		97100	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
25	Ethylbenzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		94440	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
26	Ethylbenzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96h		210000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
27	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		32000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
28	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		150000	ug/L	Acute Toxicity of Priority Pollutants to Bluegill ( <i>Lepomis macrochirus</i> )
29	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		88000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
30	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		84000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
31	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		140000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
32	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		56000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
33	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		86000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
34	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		285000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
35	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
36	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		134000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
37	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		80000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
38	Ethylbenzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
39	Ethylbenzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		4200	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons
40	Ethylbenzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		14000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
41	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		9.09E+03	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows ( <i>Pimephales promelas</i> ), Vol. 5
42	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		48510	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
43	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		42330	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
44	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		12100	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows ( <i>Pimephales promelas</i> ), Vol. 3
45	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		11900	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
46	Ethylbenzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		9100	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
47	Ethylbenzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		97100	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
48	Ethylbenzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		9600	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons
49	Ethylbenzene	Invertebrate	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		77000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
50	Ethylbenzene	Invertebrate	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		190000	ug/L	The Effects of Water Pollutants on <i>Daphnia magna</i>
51	Ethylbenzene	Invertebrate	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		8780	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
52	Ethylbenzene	Invertebrate	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		13300	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
53	Ethylbenzene	Invertebrate	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		75000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
54	Ethylbenzene	Invertebrate	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		18400	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
55	Ethylbenzene	Invertebrate	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		13900	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
56	Ethylbenzene	Invertebrate	<i>Gammarus pseudolimnaceus</i>	Scud	LC50	MOR		96h		1940	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
57	Benzene	Vertebrate	<i>Salmo trutta</i>	Brown trout	LC50	MOR		1h		12000	ug/L	The Toxicities of Sewage Effluents, Industrial Discharges and Some Chemical Substances to Brown Trout ( <i>Salmo trutta</i> ) in the Trent River Authority Area
58	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		24h		NR	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
59	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		34420	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
60	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		46000	ug/L	The Acute Toxicity of Some Petrochemicals to Goldfish
61	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		24h		395000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov.ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
62	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24h		425000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
63	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		22490	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
64	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		20000	ug/L	Toxicity of Various Refinery Materials to Fresh Water Fish
65	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		400000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
66	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		140000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
67	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		910000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
68	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		740000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
69	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		580000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
70	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		370000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
71	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		260000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
72	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		102000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
73	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		165000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
74	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		9200	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
75	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		74000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
76	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		70000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
77	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24h		54000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
78	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		35560	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
79	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		34420	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
80	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		NR	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
81	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		36600	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
82	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		24h		NR	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
83	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48h		370000	ug/L	Comparison of the Usefulness of the Mexican Axolotl ( <i>Ambystoma mexicanum</i> ) and the Clawed Toad ( <i>Xenopus laevis</i> ) in Toxicological Bioassays
84	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48h		370000	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
85	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		34420	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
86	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48h		395000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters
87	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		22490	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
88	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		20000	ug/L	Toxicity of Various Refinery Materials to Fresh Water Fish
89	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		33000	ug/L	Results of the Investigation of 200 Chemical Compounds for Acute Fish Toxicity with the Golden Orfe Test
90	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		62000	ug/L	Results of the Investigation of 200 Chemical Compounds for Acute Fish Toxicity with the Golden Orfe Test
91	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		48h		56000*	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
92	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		250000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
93	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		74000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
94	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		70000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
95	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48h		54000	ug/L	The Influence of Rearing Temperatures on the Toxicity of Various Environmental Pollutants for Killifish ( <i>Oryzias latipes</i> )
96	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		35580	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
97	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		32000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
98	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		84000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
99	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		84000	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
100	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		36600	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
101	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	Comparison of the Usefulness of the Mexican Axolotl ( <i>Ambystoma mexicanum</i> ) and the Clawed Toad ( <i>Xenopus laevis</i> ) in Toxicological Bioassays
102	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	Toxicity of Mixtures of Heavy Metals and Petrochemicals to <i>Xenopus laevis</i>
103	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48h		190000	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
104	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		34420	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
105	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96h		386000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters
106	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96h		425000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
107	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		22490	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
108	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		230000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
109	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		100000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
110	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		600000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
111	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		450000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
112	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		290000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
113	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		370000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
114	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		260000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
115	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		102000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
116	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		165000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
117	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		5900	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
118	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		5300	ug/L	Effects of Naphthalene and Benzene on Fathead Minnows and Rainbow Trout
119	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96h		9200	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
120	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		2.46E+04	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales promelas), Vol. 5
121	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		1.26E+04	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales promelas), Vol. 5
122	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		33470	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
123	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		32000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
124	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		15590	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
125	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		24600	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
126	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		12500	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
127	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		35700	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
128	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		36800	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
129	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		28600	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons
130	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		14010	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
131	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		57680	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
132	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		58000	ug/L	The Acute Toxicity of Some Petrochemicals to Goldfish
133	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		130000	ug/L	A Simplified Bioassay Using Finfish for Estimating Potential Spill Damage
134	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		41590	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
135	Toluene	Vertebrates	<i>Clarias lazera</i>	Catfish	LC50*	MOR		24h		36600	ug/L	Physiological Alterations in <i>Clarias lazera</i> Induced by Two Different Pollutants
136	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		24h		1340000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters
137	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24h		240000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
138	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		24000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
139	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		17000	ug/L	Acute Toxicity of Priority Pollutants to Bluegill ( <i>Lepomis macrochirus</i> )
140	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		195000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
141	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		116000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
142	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		540000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
143	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		600000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
144	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		510000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
145	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		305000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
146	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		153000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
147	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		100000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
148	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		170000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
149	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		7250	ug/L	Toxicity of Toluene to Several Freshwater Species
150	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		24000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
151	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		24h		80000	ug/L	The Effects of Toluene on Embryos and Fry of the Japanese Medaka <i>Oryzias latipes</i> with a Proposal for Rapid Determination of Maximum Acceptable
152	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		46310	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
153	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		56000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
154	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		16000	ug/L	Normal Morphology and the Effect of Toluene on the Gill of the Fathead Minnow <i>Pimephales promelas</i> Raf
155	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24h		62810	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
156	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		57680	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
157	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48h		27620	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
158	Toluene	Vertebrates	<i>Clarias lazera</i>	Catfish	LC50*	MOR		48h		31400	ug/L	Physiological Alterations in <i>Clarias lazera</i> Induced by Two Different Pollutants
159	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48h		1260000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters
160	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48h		24000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
161	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		70000	ug/L	Results of the Investigation of 200 Chemical Compounds for Acute Fish Toxicity with the Golden Orfe Test
162	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48h		422000	ug/L	Results of the Investigation of 200 Chemical Compounds for Acute Fish Toxicity with the Golden Orfe Test
163	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		48h		6780	ug/L	Toxicity of Toluene to Several Freshwater Species
164	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		48h		63000	ug/L	The Effects of Toluene on Embryos and Fry of the Japanese Medaka <i>Oryzias latipes</i> with a Proposal for Rapid Determination of Maximum Acceptable
165	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		46310	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
166	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48h		56000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
167	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48h		60950	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
168	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		72h		25330	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
169	Toluene	Vertebrates	<i>Clarias lazera</i>	Catfish	LC50*	MOR		72h		29500	ug/L	Physiological Alterations in <i>Clarias lazera</i> Induced by Two Different Pollutants
170	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		57680	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
171	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96h		22800	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
172	Toluene	Vertebrates	<i>Clarias lazera</i>	Catfish	LC50*	MOR		96h		26200	ug/L	Physiological Alterations in <i>Clarias lazera</i> Induced by Two Different Pollutants
173	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96h		1180000	ug/L	Toxicity to <i>Gambusia affinis</i> of Certain Pure Chemicals in Turbid Waters
174	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96h		240000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
175	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		24000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
176	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		13000	ug/L	Acute Toxicity of Priority Pollutants to Bluegill ( <i>Lepomis macrochirus</i> )
177	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		170000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
178	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		84000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
179	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		340000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
180	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		320000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
181	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		300000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
182	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		240000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
183	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
184	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		74000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
185	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96h		135000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
186	Toluene	Vertebrates	<i>Melanoides tuberculata</i>	Snail	LC50	MOR		96h		1100000	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton, Fish and Benthic Organism
187	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96h		8110*	ug/L	Sensitivity of Parasitized Coho Salmon Fry to Crude Oil, Toluene, and Naphthalene
188	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96h		5500*	ug/L	Reduced Growth of Coho Salmon Fry Exposed to Two Petroleum Components, Toluene and Naphthalene, in Fresh Water
189	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96h		>333000	ug/L	Sensitivity to, and Accumulation and Depuration of, Aromatic Petroleum Components by Early Life Stages of Coho salmon ( <i>Oncorhynchus kisutch</i> )
190	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon, silver salmon	LC50	MOR		96h		9360	ug/L	Sensitivity to, and Accumulation and Depuration of, Aromatic Petroleum Components by Early Life Stages of Coho salmon ( <i>Oncorhynchus kisutch</i> )
191	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		5800	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons
192	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		6780	ug/L	Toxicity of Toluene to Several Freshwater Species
193	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		15530	ug/L	Aquatic Toxicity Studies of Six Priority Pollutants
194	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		15530	ug/L	Acute Toxicity Testing with Freshwater Fish
195	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout, donaldson trout	LC50	MOR		96h		24000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
196	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		96h		54000	ug/L	The Effects of Toluene on Embryos and Fry of the Japanese Medaka <i>Oryzias latipes</i> with a Proposal for Rapid Determination of Maximum Acceptable
197	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		3.17E+04	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows ( <i>Pimephales promelas</i> ). Vol. 5
198	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		34270	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
199	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		42330	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
200	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		12600	ug/L	An Approach to the Toxicological Evaluation of a Complex Industrial Wastewater
201	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		NR	ug/L	Developmental Studies on the Fathead Minnow ( <i>Pimephales promelas</i> Raf.): I. The Prehatching Development of Fathead Minnow. II. The Acute Effects of Toluene on Three Age Groups of Fathead Minnows. III. The Effect o
202	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		NR	ug/L	Developmental Studies on the Fathead Minnow ( <i>Pimephales promelas</i> Raf.): I. The Prehatching Development of Fathead Minnow. II. The Acute Effects of Toluene on Three Age Groups of Fathead Minnows. III. The Effect o
203	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		NR	ug/L	Developmental Studies on the Fathead Minnow ( <i>Pimephales promelas</i> Raf.): I. The Prehatching Development of Fathead Minnow. II. The Acute Effects of Toluene on Three Age Groups of Fathead Minnows. III. The Effect o
204	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		30000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
205	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		31000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
206	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		26000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
207	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		18000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
208	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		36000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
209	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		25000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
210	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		27000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
211	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		28000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
212	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		72000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
213	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		66000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
214	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		59000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
215	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		55000	ug/L	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows ( <i>Pimephales promelas</i> )
216	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		56400	ug/L	A Study to Assess the Influence of Age on the Response of Fathead Minnows in Static Acute Toxicity Tests
217	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		77400	ug/L	A Study to Assess the Influence of Age on the Response of Fathead Minnows in Static Acute Toxicity Tests
218	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		54000	ug/L	A Study to Assess the Influence of Age on the Response of Fathead Minnows in Static Acute Toxicity Tests
219	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		36200	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows ( <i>Pimephales promelas</i> ). Vol. 3
220	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		17030	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
221	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		36200	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
222	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96h		22100	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
223	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		59300	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
224	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96h		28200	ug/L	Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons
225	Toluene	Vertebrates	<i>Tilapia mossambica</i>	Mozambique tilapia	LC50	MOR		96h		90000	ug/L	Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish <i>Tilapia</i> , <i>Oreochromis mossambicus</i> ; Changes in
226	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cc	96h		179000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
227	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cc	96h		181000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
228	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cc	96h		193000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
229	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cc	96h		186000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
230	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	cc	96h		191000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
231	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		9390	ug/L	Lethal and Sublethal Toxicity of Benzene Derivatives to the Fathead Minnow, Using a Short-Term Test
232	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24h		53600	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
233	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24h		61200	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
234	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113000	ug/L	Acute Toxicity Tests Using Rotifers IV. Effects of Cyst Age, Temperature, and Salinity on the Sensitivity of <i>Brachionus calyciflorus</i>
235	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113300	ug/L	Acute Toxicity of Toluene, Hexane, Xylene, and Benzene to the Rotifers <i>Brachionus calyciflorus</i> and <i>Brachionus plicatilis</i>
236	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		113000	ug/L	New Rotifer Bioassays for Aquatic Toxicology
237	Toluene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24h		9000	ug/L	Comparison of the Susceptibility of Daphnids and Fish to Benzene Derivatives
238	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		310000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
239	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		470000	ug/L	The Effects of Water Pollutants on <i>Daphnia magna</i>
240	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		47000	ug/L	A QSAR for Base-Line Toxicity to the Midge <i>Chironomus riparius</i>
241	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		108660	ug/L	Aquatic Toxicity Studies of Six Priority Pollutants
242	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		25000	ug/L	Detection Limits of a Biological Monitoring System Based on Fish Respiration
243	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		27000	ug/L	Biological Monitoring Based on Fish Respiration for Continuous Water Quality Control
244	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		310000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
245	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		86300	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
246	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		97700	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
247	Toluene	Invertebrates	Chironomidae	Midge family	LC50	MOR		96h		860000	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton, Fish and Benthic Organism
248	Toluene	Invertebrates	<i>Cyclops virens</i>	Cyclopoid copepod	LC50	MOR		96h		215000	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton, Fish and Benthic Organism
249	Toluene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		447000	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton and Fish
250	Toluene	Invertebrates	<i>Gammarus minus</i>	Scud	LC50	MOR		96h		58000	ug/L	Aquatic Toxicity Studies of Six Priority Pollutants
251	Toluene	Invertebrates	<i>Physa heterostrophia</i>	Pond snail, pneumonate snail	LC50	MOR		96h		55600	ug/L	Aquatic Toxicity Studies of Six Priority Pollutants
252	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		24h		NR	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
253	Benzene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24h		18400	ug/L	Comparison of the Susceptibility of Daphnids and Fish to Benzene Derivatives
254	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		250000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
255	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		1130000	ug/L	The Effects of Water Pollutants on <i>Daphnia magna</i>
256	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		24h		NR	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
257	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48h		200000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
258	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48h		200000	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
259	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		97800	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
260	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48h		139000	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
261	Benzene	Invertebrates	<i>Asellus aquaticus</i>	Aquatic sowbug	LC50	MOR		48h		120000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
262	Benzene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48h		100000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
263	Benzene	Invertebrates	<i>Cloeon dipterum</i>	Mayfly	LC50	MOR		48h		34000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
264	Benzene	Invertebrates	<i>Corixa punctata</i>	Water boatman	LC50	MOR		48h		48000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
265	Benzene	Invertebrates	<i>Culex pipiens</i>	Northern house mosquito	LC50	MOR		48h		71000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
266	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48h		356000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
267	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48h		390000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
268	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		200000	ug/L	Acute Toxicity of Priority Pollutants to Water Flea ( <i>Daphnia magna</i> )
269	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		400000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
270	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		620000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
271	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		412000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
272	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		356000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
273	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		682000	ug/L	Toxicity, Accumulation, and Elimination of Polycyclic Aromatic Sulfur Heterocycles in <i>Daphnia magna</i>
274	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		412000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
275	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		356000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
276	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		96200	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
277	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		99200	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
278	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		76900	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
279	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		59600	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
280	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		156600	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
281	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48h		135700	ug/L	The Comparative Toxicity of Crude and Refined Oils to <i>Daphnia magna</i> and <i>Artemia</i>
282	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48h		345000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
283	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48h		265000	ug/L	Reproducibility of Short-Term and Reproduction Toxicity Experiments with <i>Daphnia magna</i> and Comparison of the Sensitivity of <i>Daphnia magna</i> with <i>Daphnia pulex</i> and <i>Daphnia cucullata</i> in Short-Term Experiments
284	Benzene	Invertebrates	<i>Dugesia lugubris</i>	Planarian, Vortex worm	LC50	MOR		48h		74000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
285	Benzene	Invertebrates	<i>Erpobdella octoculata</i>	Leech	LC50	MOR		48h		>320000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations

Appendix A  
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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
286	Benzene	Invertebrates	<i>Gammarus pulex</i>	Scud	LC50	MOR		48h		42000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
287	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48h		34000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
288	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48h		34000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
289	Benzene	Invertebrates	<i>Ischnura elegans</i>	Damselfly	LC50	MOR		48h		10000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
290	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	Comparison of the Susceptibility of 22 Freshwater Species to 15 Chemical Compounds. I.(Sub)Acute Toxicity Tests
291	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
292	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48h		230000	ug/L	A Comparative Study on the Short-Term Effects of 15 Chemicals on Fresh Water Organisms of Different Tropic Levels
293	Benzene	Invertebrates	<i>Nemoura cinerea</i>	Stonefly	LC50	MOR		48h		130000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
294	Benzene	Invertebrates	Tubificidae	Oligochaete family	LC50	MOR		48h		>320000	ug/L	Benthic Macroinvertebrates and Water Quality Assessment: Some Toxicological Considerations
295	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		96h		15000	ug/L	Toxicity, Accumulation and Clearance of Aromatic Hydrocarbons in <i>Daphnia pulex</i>
296	Benzene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		710000	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton and Fish
297	Benzene	Invertebrates	<i>Gammarus pseudolimnaeus</i>	Scud	LC50	MOR		96h		12100	ug/L	Report of the Flow-Through and Static Acute Test Comparisons with Fathead Minnows and Acute Tests with an Amphipod and a Cladoceran
298	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		253000	ug/L	Acute Toxicity Tests Using Rotifers IV. Effects of Cyst Age, Temperature, and Salinity on the Sensitivity of <i>Brachionus calyciflorus</i>
299	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		252700	ug/L	Acute Toxicity of Toluene, Hexane, Xylene, and Benzene to the Rotifers <i>Brachionus calyciflorus</i> and <i>Brachionus plicatilis</i>
300	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24h		253000	ug/L	New Rotifer Bioassays for Aquatic Toxicology
301	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		24h		1080000	ug/L	Median Tolerance Limits of Some Chemicals to the Fresh Water Fish " <i>Cyprinus carpio</i> "
302	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		150000	ug/L	The Effects of Water Pollutants on <i>Daphnia magna</i>
303	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24h		NR	ug/L	Toxicity of Selected Chemicals to Certain Animals
304	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48h		253000	ug/L	A 2-D Life Cycle Test with the Rotifer <i>Brachionus calyciflorus</i>
305	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48h		253000	ug/L	New Rotifer Bioassays for Aquatic Toxicology
306	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		48h		950000	ug/L	Median Tolerance Limits of Some Chemicals to the Fresh Water Fish " <i>Cyprinus carpio</i> "
307	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		2000	ug/L	Detection Limits of a Biological Monitoring System Based on Fish Respiration
308	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48h		20000	ug/L	Biological Monitoring Based on Fish Respiration for Continuous Water Quality Control
309	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		96h		780000	ug/L	Median Tolerance Limits of Some Chemicals to the Fresh Water Fish " <i>Cyprinus carpio</i> "
310	Xylene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96h		99500	ug/L	Acute Toxicity of Some Petroleum Pollutants to Plankton and Fish
311	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		1h		30500	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
312	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		1h		46000	ug/L	Acute Toxicity of Selected Organic Compounds to Fathead Minnows
313	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		2h		19900	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
314	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		4h		15900	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
315	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		8h		13600	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
316	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		16h		11000	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
317	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		75000	ug/L	A Simplified Bioassay Using Finfish for Estimating Potential Spill Damage
318	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		30550	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
319	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24h		36810	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
320	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		25600	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
321	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16800	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
322	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		10400	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
323	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		24000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
324	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		36000	ug/L	Sport Fishery Investigations
325	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		14000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
326	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
327	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
328	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		14000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
329	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
330	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		12000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
331	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		16300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
332	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		17400	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
333	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
334	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15600	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
335	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		13500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
336	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24h		15600	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
337	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		8300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
338	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		3300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
339	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		13500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
340	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24h		17300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
341	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24h		28770	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Title
342	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			24h	28770	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
343	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			24h	42000	ug/L	Acute Toxicity of Selected Organic Compounds to Fathead Minnows
344	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR			24h	34730	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
345	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR			48h	25100	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
346	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR			48h	36810	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
347	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			48h	25600	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
348	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			48h	16500	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
349	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			48h	24000	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
350	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			48h	19000	ug/L	Sport Fishery Investigations
351	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			48h	27710	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
352	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			48h	28770	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
353	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			48h	42000	ug/L	Acute Toxicity of Selected Organic Compounds to Fathead Minnows
354	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR			48h	34730	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
355	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR			72h	20720	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
356	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			72h	25600	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
357	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			72h	16500	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
358	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			72h	42000	ug/L	Acute Toxicity of Selected Organic Compounds to Fathead Minnows
359	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR			96h	16940	ug/L	A Continuous Flow Bioassay Method to Evaluate the Effects of Outboard Motor Exhausts and Selected Aromatic Toxicants on Fish
360	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR			96h	36810	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
361	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	24500	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
362	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	15700	ug/L	Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays
363	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	20870	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
364	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	19000	ug/L	Sport Fishery Investigations
365	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	13500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
366	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	8600	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
367	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	12000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
368	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	13300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
369	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	12000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
370	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	12000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
371	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	16100	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
372	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	17400	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
373	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	15000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
374	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	14400	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
375	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	13500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
376	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR			96h	15000	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
377	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR			96h	8200	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
378	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR			96h	3300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
379	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR			96h	13500	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
380	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR			96h	17300	ug/L	Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals
381	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			96h	1.34E+04	ug/L	Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales promelas), Vol. 5
382	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			96h	26700	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
383	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			96h	28770	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
384	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR			96h	42000	ug/L	Acute Toxicity of Selected Organic Compounds to Fathead Minnows
385	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR			96h	34730	ug/L	Acute Toxicity of Some Important Petrochemicals to Fish
386	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	135000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
387	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	76000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
388	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	54000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
389	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	78000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
390	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	92000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
391	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	68000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
392	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	56000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
393	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	87000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures
394	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=		96h	80000	ug/L	A Method for Evaluating the Toxicity of Industrial Solvent Mixtures

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
1	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24 h		94440	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
2	Ethylbenzene	Vertebrate	Ictalurus punctatus	Channel catfish	LC50	MOR		24 h		210000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
3	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		35080	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
4	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		169000	ug/L	Bull.Environ.Contam.Toxicol. 26(4):446-452 (OECDG Data File)
5	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		90000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
6	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		100000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
7	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		160000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
8	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
9	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		220000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
10	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		285000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
11	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		198000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
12	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		134000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
13	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		80000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
14	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		24 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
15	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		24 h		14000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
16	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		24 h		48510	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
17	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		24 h		42330	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
18	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		24 h		97100	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
19	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		48 h		94440	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
20	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		48 h		32000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
21	Ethylbenzene	Vertebrate	Leuciscus idus melanotus	Carp	LC50	MOR		48 h		44000	ug/L	Z.Wasser-Abwasser-Forsch. 11(6):161-164 (GER)(ENG TRANSL)(OECDG Data File)
22	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		48 h		48510	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
23	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		48 h		42330	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
24	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		48 h		97100	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
25	Ethylbenzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		96 h		94440	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
26	Ethylbenzene	Vertebrate	Ictalurus punctatus	Channel catfish	LC50	MOR		96 h		210000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
27	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		32000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
28	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		150000	ug/L	Bull.Environ.Contam.Toxicol. 26(4):446-452 (OECDG Data File)
29	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		88000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
30	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		84000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
31	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		140000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
32	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		56000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
33	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		86000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
34	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		285000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
35	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
36	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		134000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
37	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		80000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
38	Ethylbenzene	Vertebrate	Lepomis macrochirus	Bluegill	LC50	MOR		96 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
39	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		96 h		4200	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169
40	Ethylbenzene	Vertebrate	Oncorhynchus mykiss	Rainbow trout,donaldson trout	LC50	MOR		96 h		14000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
41	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		9.09E+03	ug/L	Center for Lake Superior Environmental Stud., Univ of Wisconsin-Superior, Superior, WI 1:332 p.
42	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		48510	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
43	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		42330	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
44	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		12100	ug/L	Center for Lake Superior Environmental Stud., Univ of Wisconsin-Superior, Superior, WI 1:328
45	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		11900	ug/L	Center for Lake Superior Environ.Stud., Univ of Wisconsin-Superior, Superior, WI :24
46	Ethylbenzene	Vertebrate	Pimephales promelas	Fathead minnow	LC50	MOR		96 h		9100	ug/L	Center for Lake Superior Environ.Stud., Univ of Wisconsin-Superior, Superior, WI :24
47	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		96 h		97100	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
48	Ethylbenzene	Vertebrate	Poecilia reticulata	Guppy	LC50	MOR		96 h		9800	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169
49	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		24 h		77000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
50	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		24 h		190000	ug/L	Wasser-Abwasser-Forsch. 10(5):161-166(ENG TRANSL)(OECDG Data File)(GER)(ENG ABS
51	Ethylbenzene	Invertebrate	Artemia sp.	Brine shrimp	LC50	MOR		48 h		8780	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
52	Ethylbenzene	Invertebrate	Artemia sp.	Brine shrimp	LC50	MOR		48 h		13300	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
53	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48 h		75000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
54	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48 h		18400	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
55	Ethylbenzene	Invertebrate	Daphnia magna	Water flea	LC50	MOR		48 h		13900	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
56	Ethylbenzene	Invertebrate	Gammarus pseudolimninaeus	Scud	LC50	MOR		96 h		1940	ug/L	Center for Lake Superior Environ.Stud., Univ of Wisconsin-Superior, Superior, WI :24
57	Benzene	Vertebrate	Salmo trutta	Brown trout	LC50	MOR		1 h		12000	ug/L	Water Pollut.Control 73:396-405
58	Benzene	Vertebrate	Ambystoma mexicanum	Mexican axolotl	LC50	MOR		24 h		NR	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT)(ENG ABS)(U.S.NTIS PB83-2003386)
59	Benzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24 h		34420	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
60	Benzene	Vertebrate	Carassius auratus	Goldfish	LC50	MOR		24 h		46000	ug/L	Water Res. 13(7):623-626 (OECDG Data File)
61	Benzene	Vertebrate	Gambusia affinis	Western mosquitofish	LC50*	MOR		24 h		395000	ug/L	Sewage Ind.Wastes 29(6):695-711

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
62	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24 h		425000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
63	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		22490	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
64	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		20000	ug/L	Ind.Eng.Chem. 46(2):324-333
65	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		400000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
66	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		140000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
67	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		910000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
68	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		740000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
69	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		580000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
70	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		370000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
71	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		280000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
72	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		102000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
73	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		165000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
74	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donakson trout	LC50	MOR		24 h		9200	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
75	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24 h		74000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
76	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24 h		70000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
77	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		24 h		54000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
78	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		35560	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
79	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		34420	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
80	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		NR	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
81	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24 h		36600	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
82	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		24 h		NR	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
83	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48 h		370000	ug/L	Bull.Environ.Contam.Toxicol. 24(3):439-443
84	Benzene	Vertebrate	<i>Ambystoma mexicanum</i>	Mexican axolotl	LC50	MOR		48 h		370000	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
85	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48 h		34420	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
86	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48 h		395000	ug/L	Sewage Ind.Wastes 29(6):695-711
87	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		22490	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
88	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		20000	ug/L	Ind.Eng.Chem. 46(2):324-333
89	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48 h		33000	ug/L	Z.Wasser-Abwasser-Forsch. 11(5):161-164 (GER) (ENG TRANSL) (OECDG Data File)
90	Benzene	Vertebrate	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48 h		62000	ug/L	Z.Wasser-Abwasser-Forsch. 11(5):161-164 (GER) (ENG TRANSL) (OECDG Data File)
91	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donakson trout	LC50	MOR		48 h		56000*	ug/L	Aquat.Toxicol. 4(2):113-128
92	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48 h		250000	ug/L	Aquat.Toxicol. 4(2):113-128
93	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48 h		74000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
94	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48 h		70000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
95	Benzene	Vertebrate	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50	MOR		48 h		54000	ug/L	J.Hyg.Chem./Eisei Kagaku 32(1):46-53 (JPN) (ENG ABS)
96	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		35080	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
97	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		32000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
98	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		84000	ug/L	Aquat.Toxicol. 4(2):113-128
99	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		84000	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
100	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48 h		36600	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
101	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48 h		190000	ug/L	Bull.Environ.Contam.Toxicol. 24(3):439-443
102	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48 h		190000	ug/L	Bull.Environ.Contam.Toxicol. 38:345-351
103	Benzene	Vertebrate	<i>Xenopus laevis</i>	Clawed toad	LC50	MOR		48 h		190000	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
104	Benzene	Vertebrate	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96 h		34420	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
105	Benzene	Vertebrate	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96 h		386000	ug/L	Sewage Ind.Wastes 29(6):695-711
106	Benzene	Vertebrate	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96 h		425000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
107	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		22490	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
108	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		230000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
109	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		100000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
110	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		600000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
111	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		450000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
112	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		290000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
113	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		370000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
114	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		260000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
115	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		102000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
116	Benzene	Vertebrate	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		165000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
117	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donakson trout	LC50	MOR		96 h		5900	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
118	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		5300	ug/L	Arch.Environ.Contam.Toxicol. 11(4):487-490 Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
119	Benzene	Vertebrate	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		9200	ug/L	
120	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		2.46E+04	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI 1332 p.
121	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		1.26E+04	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI 1332 p.
122	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		33470	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
123	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		32000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
124	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		15590	ug/L	Environ.Toxicol.Chem. 11(2):187-195
125	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		24600	ug/L	Environ.Toxicol.Chem. 11(2):187-195
126	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		12500	ug/L	Center for Lake Superior Environ.Stud., Univ. of Wisconsin-Superior, Superior, WI :24
127	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		35700	ug/L	Center for Lake Superior Environ.Stud., Univ. of Wisconsin-Superior, Superior, WI :24
128	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		36600	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
129	Benzene	Vertebrate	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		28600	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169
130	Benzene	Vertebrate	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		14010	ug/L	Environ.Toxicol.Chem. 11(2):187-195
131	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		57680	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
132	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		58000	ug/L	Water Res. 13(7):623-626 (OECDG Data File)
133	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		130000	ug/L	In: Proc.Control of Hazardous Material Spills, Rockville, MD :104-108
134	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		41590	ug/L	Water Res. 10(2):165-169
135	Toluene	Vertebrates	<i>Carras lazera</i>	Catfish	LC50*	MOR		24 h		36600	ug/L	Water Air Soil Pollut. 60(1/2):181-187
136	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		24 h		1340000	ug/L	Sewage Ind.Wastes 29(6):695-711
137	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		24 h		240000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
138	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		24000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
139	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		17000	ug/L	Bull.Environ.Contam.Toxicol. 26(4):446-452 (OECDG Data File)
140	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		195000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
141	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		116000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
142	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		540000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
143	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		600000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
144	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		510000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
145	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		305000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
146	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		153000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
147	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		100000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
148	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		170000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
149	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		7250	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI (Report to Battelle Memorial Research Institute, Columbus, OH) :10 p.
150	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		24000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
151	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		24 h		80000	ug/L	Environ.Pollut. 20(2):139-148
152	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		46310	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
153	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		56000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
154	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		16000	ug/L	M.S.Thesis, North Dakota State University of Agriculture and Applied Science, Fargo, N D:109
155	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24 h		62810	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
156	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48 h		57680	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
157	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48 h		27620	ug/L	Water Res. 10(2):165-169
158	Toluene	Vertebrates	<i>Carras lazera</i>	Catfish	LC50*	MOR		48 h		31400	ug/L	Water Air Soil Pollut. 60(1/2):181-187
159	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		48 h		1260000	ug/L	Sewage Ind.Wastes 29(6):695-711
160	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		24000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
161	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48 h		70000	ug/L	Z.Wasser-Abwasser-Forsch. 11(5):161-164 (GER) (ENG TRANSL) (OECDG Data File)
162	Toluene	Vertebrates	<i>Leuciscus idus melanotus</i>	Carp	LC50	MOR		48 h		422000	ug/L	Z.Wasser-Abwasser-Forsch. 11(5):161-164 (GER) (ENG TRANSL) (OECDG Data File)
163	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		48 h		6780	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI (Report to Battelle Memorial Research Institute, Columbus, OH) :10 p.
164	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		48 h		63000	ug/L	Environ.Pollut. 20(2):139-148
165	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		46310	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
166	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		56000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
167	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48 h		60950	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
168	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		72 h		25330	ug/L	Water Res. 10(2):165-169
169	Toluene	Vertebrates	<i>Carras lazera</i>	Catfish	LC50*	MOR		72 h		29500	ug/L	Water Air Soil Pollut. 60(1/2):181-187
170	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96 h		57680	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
171	Toluene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96 h		22800	ug/L	Water Res. 10(2):165-169
172	Toluene	Vertebrates	<i>Carras lazera</i>	Catfish	LC50*	MOR		96 h		26200	ug/L	Water Air Soil Pollut. 60(1/2):181-187
173	Toluene	Vertebrates	<i>Gambusia affinis</i>	Western mosquitofish	LC50*	MOR		96 h		1180000	ug/L	Sewage Ind.Wastes 29(6):695-711
174	Toluene	Vertebrates	<i>Ictalurus punctatus</i>	Channel catfish	LC50	MOR		96 h		240000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
175	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		24000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
176	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		13000	ug/L	Bull.Environ.Contam.Toxicol. 26(4):446-452 (OECDG Data File)
177	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		170000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
178	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		84000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
179	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		340000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
180	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		320000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
181	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		300000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
182	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		240000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
183	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
184	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		74000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
185	Toluene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		135000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
186	Toluene	Vertebrates	<i>Melanoides tuberculata</i>	Snail	LC50	MOR		96 h		1100000	ug/L	Environ.Ecol. 7(1):44-49
187	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon,silver salmon	LC50	MOR		96 h		8110*	ug/L	Trans.Am.Fish.Soc. 109(3):293-297
188	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon,silver salmon	LC50	MOR		96 h		5500*	ug/L	Trans.Am.Fish.Soc. 110(3):430-436
189	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon,silver salmon	LC50	MOR		96 h		>333000	ug/L	Rapp.P.-V.Reun.Cons.Int.Explor.Mer. 178:87-92
190	Toluene	Vertebrates	<i>Oncorhynchus kisutch</i>	Coho salmon,silver salmon	LC50	MOR		96 h		9360	ug/L	Rapp.P.-V.Reun.Cons.Int.Explor.Mer. 178:87-92
191	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		5800	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169
192	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		6780	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI (Report to Battelle Memorial Research Institute, Columbus, OH) :10 p.
193	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		15530	ug/L	Rep.No.4380, NUS Corp., Houston Environ.Center, Houston, TX:99 p / Appendix A, J.D.Home M.A.Swirsky, T.A.Hollister, B.R.Oblad, and J.H.Kennedy (Eds.), Acute Toxicity Studies of Five Priority Pollutants, NUS Corp.Rep.No.4398, Houston, TX :47 p.
194	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		15530	ug/L	Int. J.D.Home, M.A.Swirsky, T.A.Hollister, B.R.Oblad, and J.H.Kennedy (Eds.), Aquatic Toxicity Studies of Five Priority Pollutants, Rep.No.4398, NUS Corp., Houston, TX :47p.
195	Toluene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		24000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
196	Toluene	Vertebrates	<i>Oryzias latipes</i>	Medaka, high-eyes	LC50*	MOR		96 h		54000	ug/L	Environ.Pollut. 20(2):139-148
197	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		3.17E+04	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI 1332 p.
198	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		34270	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
199	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		42330	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
200	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		12600	ug/L	In: L.L.Marking and R.A.Kimerle (Eds.), Aquatic Toxicology and Hazard Assessment, 2nd Symposium, ASTM STP 667, Philadelphia, PA :284-301 (Author Communication Used)
201	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	Dis.Abst.Int.B.Sci.Eng.43(11):3502 / Ph.D.Thesis, North Dakota State University, Fargo, ND :138 p.
202	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	Dis.Abst.Int.B.Sci.Eng.43(11):3502 / Ph.D.Thesis, North Dakota State University, Fargo, ND :138 p.
203	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		NR	ug/L	Dis.Abst.Int.B.Sci.Eng.43(11):3502 / Ph.D.Thesis, North Dakota State University, Fargo, ND :138 p.
204	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		30000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
205	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		31000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
206	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		26000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
207	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		18000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
208	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
209	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		25000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
210	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		27000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
211	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		28000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
212	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		72000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
213	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		65000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
214	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		59000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
215	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		55000	ug/L	Bull.Environ.Contam.Toxicol. 29(1):12-17
216	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		56400	ug/L	Bull.Environ.Contam.Toxicol. 31(2):139-147
217	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		77400	ug/L	Bull.Environ.Contam.Toxicol. 31(2):139-147
218	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		54000	ug/L	Bull.Environ.Contam.Toxicol. 31(2):139-147
219	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36200	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI 1328
220	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		17030	ug/L	Environ.Toxicol.Chem. 11(2):187-195
221	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		36200	ug/L	Environ.Toxicol.Chem. 11(2):187-195
222	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		22100	ug/L	Center for Lake Superior Environ.Stud., Univ. of Wisconsin-Superior, Superior, WI :24
223	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		58300	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
224	Toluene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		28200	ug/L	Ecotoxicol.Environ.Saf. 16(2):158-169
225	Toluene	Vertebrates	<i>Tilapia mossambica</i>	Mozambique tilapia	LC50	MOR		96 h		90000	ug/L	Environ.Pollut.Ser.A Ecol.Biol. 42(4):311-323
226	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	ca	96 h		179000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
227	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	ca	96 h		181000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
228	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	ca	96 h		193000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
229	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	ca	96 h		186000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
230	Toluene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	ca	96 h		191000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
231	Toluene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		7 d		9390	ug/L	Environ.Toxicol.Chem. 11(2):187-195
232	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24 h		53600	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
233	Toluene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		24 h		61200	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
234	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		113000	ug/L	Ecotoxicol.Environ.Saf. 21(3):308-317 (OECDG Data File)
235	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		113000	ug/L	Bull.Environ.Contam.Toxicol. 49(2):266-271
236	Toluene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		113000	ug/L	Final Report, U.S.Army Medical Research and Development Command, Ft.Detrick, Frederick, MD :29 p.(U.S.NTIS AD-A258002)
237	Toluene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24 h		9000	ug/L	Sci.Total Environ.(Suppl.):799-808 (Author Communication Used) (Publ in Part As 3910)
238	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		310000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
239	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		470000	ug/L	Wasser-Abwasser-Forsch. 10(5):161-166(ENG TRANSL)(OECDG Data File)(GER)(ENG ABS)
240	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48 h		47000	ug/L	Chemosphere 28(5):989-997
241	Toluene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48 h		108660	ug/L	Rep.No.4380, NUS Corp., Houston Environ.Center, Houston, TX:99 p/ Appendix A, J.D.Home, M.A.Swirsky, T.A.Hollister, B.R.Oblad, and J.H.Kennedy (Eds.), Acute Toxicity Studies of Five Priority Pollutants, NUS Corp.Rep.No.4388, Houston, TX :47 p.
242	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48 h		25000	ug/L	Bull.Environ.Contam.Toxicol. 23(4-5):517-523
243	Toluene	Invertebrates	<i>Danio rerio</i>	Zebra danio	LC50	MOR		48 h		27000	ug/L	In: O.Hutzinger, I.H.Van Lelyveld and B.C.Zoeteman (Eds.), Aquatic Pollutants: Transformation and Biological Effects, Pergamon Press, NY :501-506
244	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		310000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
245	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		85300	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
246	Toluene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		97700	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
247	Toluene	Invertebrates	Chironomidae	Midge family	LC50	MOR		96 h		860000	ug/L	Environ.Ecol. 7(1):44-49
248	Toluene	Invertebrates	<i>Cyclops virens</i>	Cyclopoid copepod	LC50	MOR		96 h		215000	ug/L	Environ.Ecol. 7(1):44-49
249	Toluene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96 h		447000	ug/L	Environ.Ecol. 1(1):117-119
250	Toluene	Invertebrates	<i>Gammarus minus</i>	Scud	LC50	MOR		96 h		58000	ug/L	Rep.No.4380, NUS Corp., Houston Environ.Center, Houston, TX:99 p/ Appendix A, J.D.Home, M.A.Swirsky, T.A.Hollister, B.R.Oblad, and J.H.Kennedy (Eds.), Acute Toxicity Studies of Five Priority Pollutants, NUS Corp.Rep.No.4398, Houston, TX :47 p.
251	Toluene	Invertebrates	<i>Physa heterostroph</i>	Pond snail, pneumonate snail	LC50	MOR		96 h		55600	ug/L	Rep.No.4380, NUS Corp., Houston Environ.Center, Houston, TX:99 p/ Appendix A, J.D.Home, M.A.Swirsky, T.A.Hollister, B.R.Oblad, and J.H.Kennedy (Eds.), Acute Toxicity Studies of Five Priority Pollutants, NUS Corp.Rep.No.4398, Houston, TX :47 p.
252	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		24 h		NR	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
253	Benzene	Invertebrates	<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR		24 h		18400	ug/L	Sci.Total Environ.(Suppl.):799-808 (Author Communication Used) (Publ in Part As 3910)
254	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		250000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
255	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		1130000	ug/L	Wasser-Abwasser-Forsch. 10(5):161-166(ENG TRANSL)(OECDG Data File)(GER)(ENG ABS)
256	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		24 h		NR	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
257	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48 h		200000	ug/L	Aquat.Toxicol. 4(2):113-128
258	Benzene	Invertebrates	<i>Aedes aegypti</i>	Yellow fever mosquito	LC50	MOR		48 h		200000	ug/L	Natl.Tech.Inf.Serv., Springfield, VA:25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
259	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48 h		97800	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
260	Benzene	Invertebrates	<i>Artemia sp.</i>	Brine shrimp	LC50	MOR		48 h		139000	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
261	Benzene	Invertebrates	<i>Asellus aquaticus</i>	Aquatic sowbug	LC50	MOR		48 h		120000	ug/L	Aquat.Toxicol. 4:73-82
262	Benzene	Invertebrates	<i>Chironomus thummi</i>	Midge	LC50	MOR		48 h		100000	ug/L	Aquat.Toxicol. 4:73-82
263	Benzene	Invertebrates	<i>Cloeon dipterum</i>	Mayfly	LC50	MOR		48 h		34000	ug/L	Aquat.Toxicol. 4:73-82
264	Benzene	Invertebrates	<i>Corixa punctata</i>	Water boatman	LC50	MOR		48 h		48000	ug/L	Aquat.Toxicol. 4:73-82
265	Benzene	Invertebrates	<i>Culex pipiens</i>	Northern house mosquito	LC50	MOR		48 h		71000	ug/L	Aquat.Toxicol. 4(2):113-128
266	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48 h		356000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
267	Benzene	Invertebrates	<i>Daphnia cucullata</i>	Water flea	LC50	MOR		48 h		390000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
268	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		200000	ug/L	Bull.Environ.Contam.Toxicol. 24(5):684-691 (OECDG Data File)
269	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		400000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
270	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		620000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
271	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		412000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
272	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		356000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
273	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		682000	ug/L	Arch.Environ.Contam.Toxicol. 13(1):105-111
274	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		412000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
275	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		356000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
276	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		96200	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
277	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		99200	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
278	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		76900	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
279	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		59600	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
280	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		156600	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
281	Benzene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		48 h		135700	ug/L	Environment Canada, EE-111, Dartmouth, Nova Scotia :64
282	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48 h		345000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
283	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		48 h		285000	ug/L	Hydrobiologia 59(2):135-140 (Used Reference 2018)
284	Benzene	Invertebrates	<i>Dugesia lugubris</i>	Planarian, Vortex worm	LC50	MOR		48 h		74000	ug/L	Aquat.Toxicol. 4:73-82
285	Benzene	Invertebrates	<i>Eprobolla octoculata</i>	Leech	LC50	MOR		48 h		>320000	ug/L	Aquat.Toxicol. 4:73-82

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Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
286	Benzene	Invertebrates	<i>Gammarus pulex</i>	Scud	LC50	MOR		48 h		42000	ug/L	Aquat.Toxicol. 4:73-82
287	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48 h		34000	ug/L	Aquat.Toxicol. 4(2):113-128
288	Benzene	Invertebrates	<i>Hydra oligactis</i>	Hydra	LC50	MOR		48 h		34000	ug/L	Aquat.Toxicol. 4:73-82
289	Benzene	Invertebrates	<i>Ischnura elegans</i>	Damselfly	LC50	MOR		48 h		10000	ug/L	Aquat.Toxicol. 4:73-82
290	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48 h		230000	ug/L	Aquat.Toxicol. 4(2):113-128
291	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48 h		230000	ug/L	Aquat.Toxicol. 4:73-82
292	Benzene	Invertebrates	<i>Lymnaea stagnalis</i>	Great pond snail	LC50	MOR		48 h		230000	ug/L	Natl.Tech.Inf.Serv., Springfield, VA-25 p.(DUT) (ENG ABS) (U.S.NTIS PB83-200386)
293	Benzene	Invertebrates	<i>Nemoura cinerea</i>	Stonefly	LC50	MOR		48 h		130000	ug/L	Aquat.Toxicol. 4:73-82
294	Benzene	Invertebrates	Tubificidae	Oligochaete family	LC50	MOR		48 h		>320000	ug/L	Aquat.Toxicol. 4:73-82
295	Benzene	Invertebrates	<i>Daphnia pulex</i>	Water flea	LC50	MOR		96 h		15000	ug/L	Environ.Pollut.Ser.A Ecol Biol. 31(3):191-202
296	Benzene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96 h		710000	ug/L	Environ.Ecol. 1(1):117-119
297	Benzene	Invertebrates	<i>Gammarus pseudolimnaeus</i>	Scud	LC50	MOR		96 h		12100	ug/L	Center for Lake Superior Environ.Stud., Univ of Wisconsin-Superior, Superior, WI -24
298	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		253000	ug/L	Ecotoxicol.Environ.Saf. 21(3):308-317 (OECDG Data File)
299	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		252700	ug/L	Bull.Environ.Contam.Toxicol. 49(2):266-271
300	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		24 h		253000	ug/L	Final Report, U.S.Army Medical Research and Development Command, Ft.Detrick, Frederick, MD -29 p.(U.S.NTIS AD-A268002)
301	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		24 h		1080000	ug/L	Indian J.Environ.Health 17(2):140-146
302	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		150000	ug/L	Wasser-Abwasser-Forsch. 10(5):161-166(ENG TRANS)(OECDG Data File)(GER)(ENG ABS)
303	Xylene	Invertebrates	<i>Daphnia magna</i>	Water flea	LC50	MOR		24 h		NR		J.Water Pollut.Control Fed. 37(9):1308-1316
304	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48 h		253000	ug/L	Environ.Toxicol.Chem. 11(9):1249-1257
305	Xylene	Invertebrates	<i>Brachionus calyciflorus</i>	Rotifer	LC50	MOR		48 h		253000	ug/L	Final Report, U.S.Army Medical Research and Development Command, Ft.Detrick, Frederick, MD -29 p.(U.S.NTIS AD-A268002)
306	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		48 h		950000	ug/L	Indian J.Environ.Health 17(2):140-146
307	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra dario	LC50	MOR		48 h		20000	ug/L	Bull.Environ.Contam.Toxicol. 23(4-5):517-523
308	Xylene	Invertebrates	<i>Danio rerio</i>	Zebra dario	LC50	MOR		48 h		20000	ug/L	In: O.Hutzinger, I.H.Van Lelyveld and B.C.Zoeteman (Eds.), Aquatic Pollutants: Transformation and Biological Effects, Pergamon Press, NY -501-506
309	Xylene	Invertebrates	<i>Cyprinus carpio</i>		LC50	MOR		96 h		780000	ug/L	Indian J.Environ.Health 17(2):140-146
310	Xylene	Invertebrates	<i>Diaptomus forbesi</i>	Calanoid copepod	LC50	MOR		96 h		99500	ug/L	Environ.Ecol. 1(1):117-119
311	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		1 h		30500	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
312	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		1 h		46000	ug/L	EPA-600/3-76-097, U.S.EPA, Duluth, MN -12
313	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		2 h		19900	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
314	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		4 h		15900	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
315	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		8 h		13600	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
316	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		16 h		11000	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
317	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		75000	ug/L	In: Proc.Control of Hazardous Material Spills, Rockville, MD -104-108
318	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		30550	ug/L	Water Res. 10(2):165-169
319	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		24 h		36810	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
320	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		25600	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
321	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		16800	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
322	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		10400	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
323	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		24000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
324	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		36000	ug/L	In: Fish and Wildl.Serv.Circ.226, Effects of Pesticides on Fish and Wildlife - 1964 Research Findings of the Fish and Wildlife Service, Washington, D.C. :51-63 (Publ In Part As 6797)
325	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		14000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
326	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		12500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
327	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		16500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
328	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		14000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
329	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		12000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
330	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		12000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
331	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		16300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
332	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		17400	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
333	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		15000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
334	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		15600	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
335	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		13500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
336	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		24 h		15600	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
337	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		8300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
338	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		3300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
339	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		13500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
340	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		24 h		17300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC -505 p. (USGS Data File)
341	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		28770	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)

Appendix A  
EPA ACQUIRE Database (3/10/04)  
(http://www.epa.gov/ecotox)

Test No.	Compound	Organism	Scientific Name	Common Name	Endpoint	Effect	Modifier	Test Duration	Duration Units	Conc Mean	Conc Units	Ref Source
342	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		28770	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
343	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		24 h		42000	ug/L	EPA-600/3-76-097, U.S.EPA, Duluth, MN :12
344	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		24 h		34730	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
345	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48 h		25100	ug/L	Water Res. 10(2):165-169
346	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		48 h		36810	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
347	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		25600	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
348	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		16500	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
349	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		24000	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
350	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		48 h		19000	ug/L	In: Fish and Wildl.Serv.Circ.226, Effects of Pesticides on Fish and Wildlife - 1964 Research Findings of the Fish and Wildlife Service, Washington, D.C. :51-63 (Publ in Part As 6797)
351	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		27710	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
352	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		28770	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
353	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		48 h		42000	ug/L	EPA-600/3-76-097, U.S.EPA, Duluth, MN :12
354	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		48 h		34730	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
355	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		72 h		20720	ug/L	Water Res. 10(2):165-169
356	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		72 h		25600	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
357	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		72 h		16500	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
358	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		72 h		42000	ug/L	EPA-600/3-76-097, U.S.EPA, Duluth, MN :12
359	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96 h		16940	ug/L	Water Res. 10(2):165-169
360	Xylene	Vertebrates	<i>Carassius auratus</i>	Goldfish	LC50	MOR		96 h		36810	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
361	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		24500	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
362	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		15700	ug/L	In: R.C.Bahner and D.J.Hansen (Eds.), Aquatic Toxicology and Hazard Assessment, 8th Symposium, ASTM STP 891, Philadelphia, PA :193-212
363	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		20870	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
364	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		19000	ug/L	In: Fish and Wildl.Serv.Circ.226, Effects of Pesticides on Fish and Wildlife - 1964 Research Findings of the Fish and Wildlife Service, Washington, D.C. :51-63 (Publ in Part As 6797)
365	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		13500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
366	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		8600	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
367	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		12000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
368	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		13300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
369	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		12000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
370	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		12000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
371	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		16100	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
372	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		17400	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
373	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		15000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
374	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		14400	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
375	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		13500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
376	Xylene	Vertebrates	<i>Lepomis macrochirus</i>	Bluegill	LC50	MOR		96 h		15000	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
377	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		8200	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
378	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		3300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
379	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		13500	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
380	Xylene	Vertebrates	<i>Oncorhynchus mykiss</i>	Rainbow trout,donaldson trout	LC50	MOR		96 h		17300	ug/L	Resour.Publ.No.160, U.S.Dep.Interior, Fish Wildl.Serv., Washington, DC :505 p. (USGS Data File)
381	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		1,34E+04	ug/L	Center for Lake Superior Environmental Stud., Univ. of Wisconsin-Superior, Superior, WI 1332 p.
382	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		26700	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
383	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		28770	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
384	Xylene	Vertebrates	<i>Pimephales promelas</i>	Fathead minnow	LC50	MOR		96 h		42000	ug/L	EPA-600/3-76-097, U.S.EPA, Duluth, MN :12
385	Xylene	Vertebrates	<i>Poecilia reticulata</i>	Guppy	LC50	MOR		96 h		34730	ug/L	J.Water Pollut.Control Fed. 38(9):1419-1429 (OECDG Data File)
386	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		135000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
387	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		76000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
388	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		54000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
389	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		78000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
390	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		92000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
391	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		68000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
392	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		56000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
393	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		87000	ug/L	Environ.Toxicol.Chem. 16(5):968-976
394	Xylene	Vertebrates	<i>Xenopus sp.</i>	Clawed toad	LC50	MOR	<=	96 h		80000	ug/L	Environ.Toxicol.Chem. 16(5):968-976