Is Barton Springs Polluted?

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Why this article?

The January 19, 2003, banner headline for the Austin-American Statesman declared "Toxic chemicals taint Barton waters". The accompanying article and several articles published by the Statesman since then present many opinions and conclude the following:

- Water and sediments in Barton Springs pool and surrounding areas are contaminated with polycyclic aromatic hydrocarbons (PAH) several other toxic chemicals to levels that present threats to humans

- The most likely source for the hydrocarbon contaminants is a dump containing waste from coal gasification plants proximate to Barton Hills Park Place apartments

Although recently retired, I was employed as a hydrologist with the US Geological Survey in Austin. In cooperation of the City of Austin, I developed and supervised scientific investigations about Barton Springs and authored about 25 reports concerning the hydrology and water quality of the springs and aquifer. As a scientist I have been concerned about the confusion and misunderstanding expressed by many people about the Statesman articles.

Were the Statesman allegations investigated?

Six toxicologists and other experts from state and federal agencies and M.D. Anderson Cancer Center reviewed all pertinent data and reported that the water and sediment at Barton Springs and surrounding area absolutely do not pose a health threat from the chemicals identified by the Statesman articles. Also, an investigation of the apartment site area revealed that the source for the contaminants probably is coal tar based sealant from the apartment parking lot, as explained later in this article.

What is PAH?

Statesman articles identified levels of total PAH and benzo(a)pyrene (B(a)P) that have been found in sediments in and near Barton Springs. PAH represent a group member of organic compounds formed during incomplete combustion of organic matter, including wood and fossil fuels such as gasoline, coal, and fuel oil. Benzo(a)pyrene is one of many forms of PAH.

What are the toxic chemicals identified by the Statesman articles and their levels at Barton Springs?

Table 1 lists the chemicals identified as threatening in Statesman articles. The table also presents summaries for samples analyzed in sediment and water in Barton Springs pool.

Earlier Statesman articles make several references to contamination in Barton Spring pool without distinguishing the contaminant as being contained in water or sediment.However, (table 1) shows that substantial differences exist between criteria levels (minimum threat levels) in sediment and water. The minimum threat levels for contaminants in sediments generally are many thousands of times larger than those in water.

Table 1. Summary of contaminants in sediment and water at Barton Springs							
Water-Quality Contaminants	Number of samples	Number of samples with detected values	Number of samples with non-detected values	Maximum Detected Value (ppb)	Criteria level (ppb) (minimum threat level)	Number of samples exceeding criteria level	Average values for (mean value in ppb)
Sediment					*sediment PCL*		
ARSENIC	37	33	4	23,000	110,000	0	7427.793
BENZO(A)PYRENE	37	18	19	6482	1600	3	735.033
DDE	29	1	28	8.13	87,000	0	14.117
DDT	28	0	28	n/a	87,000	0	14.034
DIELDRIN	29	1	28	17.4	890	0	13.844
LEAD	38	37	1	35,966	500,000	0	13056.360
Total PAH	37	24	13	66,614	n/a	n/a	8309.171
Water					*water MCL or RBEL*		
ARSENIC	128	18	110	46	10	1	1.730
BENZO(A)PYRENE	13	0	13	n/a	0.2	0	n/a
DDE	44	0	44	n/a	0.0073	0	n/a
DDT	23	0	23	n/a	0.0073	0	n/a
DIELDRIN	44	0	44	n/a	0.00171	0	n/a
LEAD	146	31	115	28.4	15	3	2.327
Total PAH	14	0	14	n/a	n/a	n/a	n/a
Notes:							
ppb - parts per billion (micrograms per liter or micrograms per kilogram)							
n/a - not applicable							
Values for lead and arsenic concentrations represent total and dissolved values							
Total PAH is calculated by City of Austin Methodology							

The criteria for water in table 1 represent MCL and RBEL and criteria for sediment represent PCL as defined in footnotes at the end of this article. An acceptable criteria level for PAH in sediment does not exist but, as shown in table 1, PAH have not been detected in water and as explained below, the levels in sediment are not unusual. Table 1 also shows that only a few of many hundreds of water-quality analyses have exceeded the defined criteria and attests that the average levels for all shown contaminants are much less than criteria levels. It is not unusual for a small percent of samples to have levels that exceed water-quality criteria. Spills of contaminants in streams or in watersheds often cause anomalous high levels, which usually occur for short durations only.

How was the source of PAH determined?

Runoff from the apartment area enters a tributary to Barton Creek, which feeds Barton Creek immediately upstream from Barton Springs. An old USGS map shows that the site was a rock quarry, however the material used to fill the quarry is unknown. In an attempt to document values for PAH and determine its source, the COA collected data that include soil borings from under the apartments and adjacent property, parking lot sediment, and seal coating scraped from many parking lots, including the parking lot at the Barton Hills Park Place apartments. Investigation of parking lot sealants and analyses of the data provide the following conclusions:

- Many parking lots throughout Austin are coated with coal tar based sealants
- Parking lot sealants containing coal tar have PAH levels 20 to 40 times higher than used motor oil, the most contaminated urban source identified by Takada and others (1991).
- Such sealants show visible wear and over time and are applied typically every 2 or 3 years.

Analyses of the data for the area around Barton Hills Park Place apartments reveal the following:

- Scrapings from the Barton Hills Park Place apartment parking lot contained PAH values up to about 10 times higher than levels found in sediments adjacent to the parking lot.
- Analyses of the soil borings show that PAH levels decrease with greater depths
- PAH and B(a)P levels sharply decrease with increased distance from the apartments.

Prior to the Statesman articles about Barton Springs, the City of Austin suspected that coal-tar-based sealants represent a source of urban contamination. Based on the above analyses, the COA identified an unknown source of urban contamination, which has led to efforts to have the EPA identify and regulate this source.

At the request of the COA, the USGS reviewed the data and agreed with the COA that the parking lot probably is at least the major source for the high levels of PAH in the area (Van Meter and Mahler, written communication, February 14, 2003). The USGS concluded that if a waste site was the source, PAH levels in soil borings would increase with depth rather than decrease.

Also, PAH and B(a)P levels decreased substantially from the sealant scrapings in the parking lot, to sediment from the parking lot surface, to the tributary, to Barton Creek, to Barton Springs pool (after a flood in Barton Creek upstream from the springs flowed through Barton springs pool). The PAH level in the pool was about 4 times less than the level in Barton Creek which was about 200 times less than the level in sealant scrapings. Therefore, the parking lot probably is at least a major source for elevated levels of PAH in sediment in Barton Creek and Barton Springs.

Do PAH and other Toxic Chemicals Exist in Sediments Elsewhere?

Toxics in stream sediment

The USGS has sampled streambed sediments at sites throughout the United States. A report aggregating results for this nation-wide database found that at least one type of PAH was detected in most of the 536 stream sampling sites across the United States (Lopes and Furlong, 2001). PAH levels for many of the stream sediment sampling sites exceed PAH levels found in sediments in Barton Springs (table 1).The report further concluded that increased PAH levels are related to urbanization.

Chemical analyses of trace elements in streambed sediment were aggregated and investigated by Rice (1999). She reported that the average (median) concentration of lead in sediment for 541 sampled stream sites is 27,000 parts per billion (ppb)-a value more than double the average lead level in Barton Springs sediment (table 1). Rice also found that increased levels of trace elements are related to urbanization.

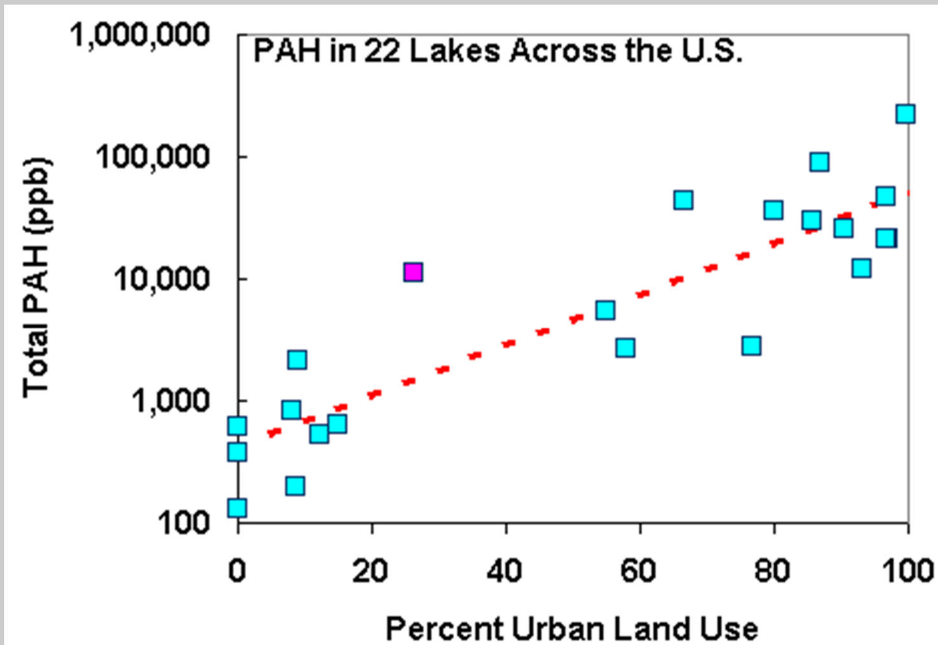
Toxics in reservoir sediment

The USGS also has been collecting and analyzing core samples of sediment in reservoirs throughout Texas and the United States (explained on the Web at http://tx.usgs.gov/coring/sites.asp). Sediments in core samples are dated (older sediments are at greater depths) and analyzed for chemical quality. Such data are valuable, because sediment-quality trends can be made since the year the reservoir was built.

Data for sediment core samples for 10 of the reservoirs were analyzed and reported by Van Metre and others (2000) who reported that PAH were found in each of the reservoirs. PAH levels in sediment for 9 of the 10 reservoirs exceed average levels found in sediments in Barton Springs pool (table 1). The report also found that concentrations of PAH have increased in each reservoir during the past 20-40 years. Increased PAH values are found at reservoirs with increasing urbanization, as shown in figure 1.

Figure 1. Relation between total PAH values and urban land use

Note: The purple box represents Town Lake in Austin TX



Is there a water-quality threat at Barton Springs?

In 2000, the City of Austin analyzed current and historic water-quality data to determine if water-quality trends (improvement or degradation) have occurred in Barton Springs water (Turner, 2000). The database represents the period 1975-1999 or 1980-1999 and includes all reliable data.

The data were aggregated into 3 separate databases based on flow conditions for the samples-base flow without recharge (to the Edwards aquifer); base flow with recharge; and storm flow. Statistical tests performed for each water-quality contaminant and for each flow condition found that water-quality improvement has not occurred but degradation has occurred for five water-quality contaminants (table 2). As the table shows, the percent changes in the contaminants range from 3 percent for specific conductance to 127 percent for total organic carbon. Degradation also has occurred for nitrate nitrogen, based on comparison of current data with data collected prior to 1975.

Table 2. Degradation in water quality at Barton Springs						
		Normalized period median values				
Water Quality Contaminant	**Flow condition**	**1975-1979 or 1980-1984**	**1995-1999**	**Change from early to late period**	**Percent change**
Specific conductance (microsiemens per centimeter)	Baseflow without recharge	655	677	22	3%
	Baseflow with recharge	590*	646	56	9%
	Storm flow	624	642	18	3%
Dissolved oxygen (parts per million)	Baseflow without recharge	6.8	5.7	1.1	16%
Total organic carbon (parts per million)	Storm flow	1.5	3.4	1.9	127%
Sulfate (parts per million)	Baseflow with recharge	28.3*	38.8	10.5	37%
Turbidity (nephelometric turbidity units)	Storm flow	5.3	7	1.7	32%

Note:

* data for 1981 and 1982 removed from analyses because of affects due to sewer line break

Also pesticides have been detected in recent water samples from Barton Springs (http://txwww.cr.usgs.gov/reports/dist/dist-2000-02/). The source for the water-quality degradation and pesticides is urbanization.

What is the Conclusion?

The January 19th Statesman article states that PAH and other chemicals threaten Barton Springs and surrounding area and are probably from a waste dump. However, the PAH levels don't pose a threat and aren't from a waste dump. The source for the Statesman-identified contaminants and other contaminants is urbanization, which also is the source for existing and future threats to Barton Springs. The article further states "compounds found in sediments at Barton Springs warrant temporarily closing Austin's environmental treasure, the spring-fed pool whose iconic value has driven more than a decade of anti-development campaigning and reshaping city politics". I believe it is ironic that the City is criticized for perceived contamination at Barton Springs and also is criticized for trying to limit the development that is causing actual contamination.

The Texas Department of Health and the Agency for Toxic Substances and Disease Registry have prepared a health consultation for Barton Springs and have found that *... swimming in Barton Springs Pool on a daily basis poses no apparent public health hazard*.

The stream basins that provide flow to Barton Springs cover an area of about 360 square miles southwest of Austin. Only a small percent of the area currently represents urban land use, thus additional water-quality degradation probably will occur as the area is further developed. Although some degradation has occurred, the water quality of Barton Springs is still well within swimming criteria. However, it is likely that uncontrolled urbanization in the watersheds feeding the springs will eventually cause Barton Springs to be degraded to the extent that it must be closed to swimming.

Footnotes and References

PCL (protective concentration limits) are established by the Texas Commission on Environmental Quality as part of the Risk Reduction Program for humans and ecological receptors.More information is available athttp://www.tnrcc.state.tx.us/permitting/trrp.htm

MCL (maximum contaminant levels) are established by the EPA as national drinking water standards.More information is available at http://www.epa.gov/safewater/mcl.html

RBEL (risk-based exposure limits) are established by the Texas Commission on Environmental Quality for humans an aquatic biota. More information can be found at http://www.tnrcc.state.tx.us/permitting/trrp.htm andhttp://www.tnrcc.state.tx.us/permitting/remed/techsupp/trrp24.pdf

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Vita for Raymond Slade, Jr.

Raymond Slade, Jr. recently retired from the U.S. Geological Survey with 33 years of experience as a hydrologist, serving the last 6 years as the Surface-Water Specialist for Texas. During his career with the USGS, he authored about 75 reports on Texas water resources, with subjects including floods and droughts, hydrology of rural and urban watersheds, and water quality of surface and ground water. In cooperation with the City of Austin, he developed and supervised a long-term investigation of Barton Springs and associated Edwards aquifer and authored about 25 reports on the hydrology and water-quality of the springs and aquifer.

He has served as guest lecturer and on thesis and dissertation committees for several Texas universities and served as a water-resources expert on technical and advisory committees for many Federal and State agencies, city departments, river authorities, and water districts. He presently serves as an Adjunct Professor at Austin Community College.