The Environmental Working Group, Drinking Water Quality, and ECUA.

Carl J. Mohrherr, PhD.
Research Associate

and

Richard A. Snyder, PhD.
Professor and Director

Wetlands Research Lab and the Watershed Center
Center for Environmental Diagnostics and Bioremediation (CEDB)
University of West Florida
11000 University Parkway
Pensacola, FL 32514

http://uwf.edu/cedb
TEL: (850) 474-2060
rsnyder@uwf.edu

Summary
A recent report released on the Internet and publicized in the media by the Environmental Working Group (EWG) has ranked the water supplied by the Emerald Coast Utilities Authority (ECUA) in Pensacola as being the worst of all rated systems on a scale of 1 to 100 for toxicity in a national comparison of water systems supplying populations of 250,000 or more. The mass media coverage has caused citizen concern for clean and safe potable water essential for public health. This report reviews the current status of ECUA water supply relative to the charges filed in the EWG report.

The EWG report does not present a valid scientific assessment of water toxicity, nor are its comparisons of utility systems statistically valid. It was an effective political campaign to raise public awareness for the issue of unregulated chemicals in drinking water, but was done at the expense of public confidence in regulation by US EPA, FL DEP and the ability of local utility systems to provide safe potable water. The EWG report ignores the risk assessment procedures used to establish safe regulatory standards and their comparative rankings have little to no scientific validity. The report also ignores the complexity of the ECUA water system with 30 supply wells, and the amount of sampling conducted by ECUA in making its comparisons.

According to accepted drinking water quality regulations, the water provided by ECUA offers minimal risk and is safe for human consumption according to Federal and State of Florida standards, as recognized in the EWG report. The object of public utilities is to obtain the lowest risk for potable water relative to cost of service to customers and available technology.

Despite the fear instigated by the EWG report to generate political pressure for US EPA to act on unregulated compounds, US EPA and Florida DEP are already working towards such regulation, and indeed, ECUA monitors for some of these compounds at the direction of US EPA. There has been a trend of increasing stringency in monitoring and regulation of chemicals in drinking water in the US over the last 40 years, and that trend is continuing. Rather than a reactionary process responding to fear such as that promoted by the EWG report, state and federal agencies approach such regulations with care to ensure that toxicity risk is based on scientific evidence and that the regulations do not put undue hardship on utility systems making it impractical for them to provide safe drinking water at a reasonable cost to consumers.

Overview of ECUA Wells and Water Monitoring

ECUA is a public utility that furnishes the majority of the drinking water as well as other services such sanitary sewer and garbage removal in Escambia County, FL. As a public utility, the costs of these services are borne by the customers through rate charges. ECUA provides monitoring and treatment for the drinking water it supplies to meet regulatory standards set by the US EPA and State of FL DEP. In 2008, laboratory reports showed that ECUA supplied water originated from 30 permitted wells (Table 1) that obtain water from the main producing zone of the sand and gravel aquifer. The sand and gravel aquifer is vulnerable to surface pollution since there is no complete confining layer between the surface and producing zone of the aquifer.

Table 1. Permitted 2008 ECUA wells in Escambia County, FL.

Permit Number	Well	Address	GAC
1	#6 Well	105 East Desoto Street	Yes
5	West Well Plant	"I" & Cervantes	Yes
6	Hagler Well Plant	Municipal Airport South	No
7	West Pensacola	Lillian & Mobile Hwy.	Yes
8	W & Avery	"W" & Avery	No
9	F & Scott	"F"& Scott	Yes
10	Lillian	Lillian West of Fairfield	Yes
11	Bronson	Bronson OLF	Yes
18	McAllister	9th Ave. & McAlister	Yes
19	Airport North	Municipal Airport North	No
20	Olive	Olive Road & Lawton	No
21	Davis	Davis Hwy	No
22	Sweeney	Old Palafox & 10 Mile Road	No
24	Broad Street	Broad & Alexia	No
25	Dunaway	Dunaway & 8 Mile Creek Road	No
27	University	North of Johnson Ave	No
28	OLF 4A	9 Mile Road	No
29	Carriage Hills	Esperanto	No
30	Avondale/ Muldoon	Muldoon & Cerny	No
37	Villa Drive	Fairfield & Villa Drive	Yes
38	Royce	Royce & Skyline	Yes
39	Ellyson	Johnson & Caminitti Lane	No
40	Cantonment	Beck Lake Road	No
41	Tennant	Broyhill & Charbar	No
42	McCrory	Chemstrand N. of 10 Mile Road	No
43	Spanish Trail	Municipal Airport East	No
45	Humphries	Douglas Ave.	Yes
47	Nine Mile Rd.	West Nine Mile Rd	No
48	Kingsfield	Kingsfield Road & Tate Road	No
49	Watson	Wedford & Harve Way	Yes

In some areas pollutants have entered the aquifer and the water obtained from 8 wells is treated by Granular Activated Carbon (GAC) filters to remove chemicals (Table 1). There is not a complete mixing of water from individual wells within the entire system, and not all wells have the same contaminants. ECUA customers receive water from the nearest two to five wells to their residences. Some wells have been shut down due to contamination by both regulated and

unregulated compounds to ensure safety of the water supply. For example, recently a well near Pensacola Junior College was closed due to leaking of gasoline from underground storage tanks and a new well is under construction. Since there is not a single source for the water distribution system, each well is considered a separate treatment plant and water quality monitoring is conducted for each well increasing the number of tests conducted relative to other utilities. Calcium Hydroxide (lime) is added for pH adjustment; phosphoric Acid (H_3PO_4) is added for corrosion control in the distribution system and chlorine gas is added for water disinfection. GAC filters are installed on eleven active wells, eight for organic contamination removal and an additional three for iron removal. Water is also fluoridated prior to entering the distribution system.

Per Federal and State of Florida regulations water samples from all wells are tested for a series of analytes and parameters. Table 2 lists the types of analyses, treatments, and actions that the ECUA follows to assure the safety and quality of their water. The analyses include Primary Standards for organic compounds, metals, and radioactivity (Table 2). There are also nonbinding Secondary Standards that relate more to the aesthetic properties of the water: appearance, smell, and taste of the water. Other treatments for the potable water include mandated disinfection to remove pathogenic microbes, polyphosphate to control pipe corrosion, adjustments to pH to control pipe corrosion and compliance with guidelines, fluoridation for dental health, and charcoal filtration to remove organic chemical contaminants. A significant part of the samples taken and analyzed by ECUA are to monitor performance of the GAC filters and verify the removal of pollutants. Failure can occur when the filters are saturated and would result in release of toxic materials to the processed drinking water that is distributed to ECUA customers.

Table 2. Required Analyses and Water Treatments

PRIMARY STANDARDS	**STANDARDS ENFORCED**
Inorganic: Metals, Anions, Others	Yes
Lead And Copper (Tap Water)	Yes
Volatile Organics	Yes
Synthetic Organics: Pesticides & Others	Yes
Radionuclides	Yes
Disinfectants/Disinfection Products	Yes
Unregulated Contaminants	No
SECONDARY STANDARDS	**GUIDELINES**
pH (Acidity)	pH Range 6.5-8.5
Secondary Metals (Iron & Others)	Not Strictly Enforced
Sulfate	Not Strictly Enforced
Color	Not Strictly Enforced
Oder	Not Strictly Enforced
TREATMENT	**ACTIONS**
Lime	Control pH
Phosphoric Acid	Prevent Corrosion
Chlorine Gas	Remove pathogens
Granular Activated Carbon (GAC) Filters (12 Wells)	Remove Impurities
Hydrofluosilicic Acid	Water Fluoridation

Analysis and monitoring of water quality

There is considerable time and energy spent in monitoring and treating produced water to meet drinking water standards. According to ECUA, their onsite volatile organics laboratory has nine employees, with approximately four of them dedicated completely to drinking water analysis. The laboratory budget for 2010 is $797,464 of which about $354,428/yr is devoted to analysis of their drinking water wells and distribution system. The total monitoring costs may be higher as additional samples are sent out to other certified labs for radium and inorganics testing. Other costs are those associated with removal of pollutants. It costs $70,000 to change out one of the 12 GAC filters. Each change lasts from 3-18 months. Overall, significant time and dollar resources are committed to the production and monitoring of ECUA supplied water.

The data used by EWG to write their report were obtained from the monitoring data that ECUA routinely submits to the FL DEP in accordance with the FL DEP and US EPA procedures and regulations. The validity of the data used in the EWG report is not in question; it is the way the data were used by EWG that is questionable. The data is obtained in laboratories certified for the analyses of drinking water. These analyses have followed basic State of Florida and US EPA Quality Assurance/Quality Control (QA/QC) protocols. Certification must be obtained by laboratories that perform drinking water analyses. For certification the laboratory must go through a certification process according to the mandates of the FL DEP, Florida Department of Health, and US EPA. Standardized analytical methodologies are followed such as the US EPA Standard Analytical Methods and Protocols. Labs are certified by the National Environmental

Laboratory Accreditation Council (NELAC) following strict and standardized procedures to ensure adequate analytical performance.

ECUA monitoring and treatment of water covers 30 wells, each of which must be considered as a separate source to be regularly monitored and treated. The Arlington, TX system that scored as the best water in the EWG report only has two supply sources (Table 4). Thus, not all systems are comparable in the extent of testing that occurs, both in the number of point sources and in the number of analytes tested for. A comparison of the number of tests from the EWG report show that the ten "best ranked" systems did 3,865 tests on average and the ten worst water systems performed 20,339 tests. The more tests and the more wells a system has the more likely the results will show a greater number of detected analytes that were the basis of the ranking. Detection of analytes alone, as used in the EWG report, does not necessarily equate to increased risk. However, a major question remaining is what is the risk to the consumer of ECUA water.

Preliminary Analysis of 2008 ECUA Water Quality Data

The analytical results show that during 2008 ECUA water did not present a health risk relative to US EPA risk-based legal standards. In Table 3 is the annual 2008 analytical results listed by the highest average from individual producing wells. The detected compounds are compared to the lowest applicable standard. In some cases the State of Florida standards are lower than those set by US EPA. US EPA risk-based regulatory limits are generally set at a threshold of one serious illness out of a 1,000,000 for life time consumers at a rate of 2 liters per day.

Overall, the most frequently detected compound was nitrate present in the water as anions (negatively charged particles). This analyte was found in all 30 wells, but is present at an average of less than 15% of the legal standard and below any discernable health risk. However, increasing nitrate concentrations are a concern for the future use of the aquifer Major sources are commonly applied lawn fertilizer and septic tank drain fields, one reason supporting the septic to sewer conversions being aggressively pursued by ECUA. Cyanide, also a negative ion, was found in 12 twelve wells averaging only 2.2% of the legal limit. Mercury was also quite common, being detected at an average of 3.5% of the legal limit in 13 samples. At the concentrations found for these three analytes: Nitrate, Cyanide, and Mercury, they do not at present represent health concerns relative to FL DEP or US EPA regulations. Lead was detected in four wells at low levels. Lead in solder joints of older water pipe and in household plumbing however, can be of concern, and is one reason why ECUA adjusts pH and adds polyphosphate for corrosion control. There were single detections of the metals barium and cadmium at trace levels. Two metals cited as being detected below regulatory thresholds in the 2008 water report, Nickel and Chromium, were not listed by well of origin.

Radium radioactivity was routinely detected in all sampled wells, but at concentrations that did not exceed guidelines. Two other forms of radioactivity were also frequently detected at levels that did not exceed guidelines. The likely origin of the detected radioactivity is naturally occurring minerals and the natural acidity of the sand and gravel aquifer that dissolves these radionuclides. Phosphate fertilizers can also be another potential source of radium, as with the former Agrico fertilizer Superfund site, but there is no evidence that this type of contamination is affecting the current drinking water supply.

Table 3. Review of ECUA Annual 2008 Contaminant Report By Well

Analyte	Average per Well (range)!	MSLS*	Wells where detected**
Barium	0.1 PPM	2 PPM	1-F
Bromodichloromethane	0.1 PPB	None	10-F
Dibromochloromethane	0.1 PPB	None	10-F
Trichlorofluoromethane	0.1 PPB	None	38-F
Cadmium	0.5 PPB	5 PPB	27
1,1-Dichloroethane	0.5 PPB	None	47
Chloroform	0.5 PPB	None	8
Trichloroethylene	2.26 PPB	3 PPB	38-F
1,1-Dichloroethylene	1.27 PPM (0.81-1.73)	7 PPB	38-F, 48
Methyl-tert-butyl ether	1.88 PPM (0.57-2.57)	None	45-F, 28, 1-F
Tetrachloroethylene	1.33 PPM (0.64-**3.19**)	3 PPB	19, 28, 6
Lead	0.78 PPB (0.59-1.1)	15 PPB	9-F, 19, 21, 40
Cyanide	4.4 PPB (2.0-9.0)	200 PPB	6, 7, 9-F, 11-F, 19, 20, 21, 24, 25, 27, 28, 39
Mercury	0.07 PPB (0.005-0.14)	2 PPB	1-F, 7-F , 9-F, 10-F, 19, 21, 22, 24, 25, 27, 28, 29, 39,
Nitrate	1.42 PPM (2.0-4.4)	10 PPM	All Wells
Analyte	Reported Data	MSLS	Wells where detected
TTHM (ppb)	2.95	80 PPB	NA
HAA5 (ppb)	0.6	70 PPB	NA
Chlorine (ppm)	0.56	4 PPM	NA
Species of Radioactivity	Average per Well	MSLS	Wells where detected
Uranium	0.23 pCi/L	15.0 pCi/L	30, 40, 7-F, 8, 6, 47, 48, 22, 20, 39, 45-F,
Gross Alpha	1.68 pCi/L	15.0 pCi/L	All wells minus 49
Radium 226 + 228	1.61 pCi/L	5.0 pCi/L	All wells minus 49

! Range of detections.

*Most Stringent Legal Health Risk Standards-Lists the most stringent standards from US EPA and FL DEP water standards

**Numbers correspond to the well permit numbers in Table 1; F indicates GAC filter.

Organic compounds without legal standards and unregulated by the US EPA .have caused concern because of possible toxicity towards humans. The US EPA continues to review new chemicals to add to its standards list, and ECUA, at the direction of US EPA, is providing analysis of some of these unregulated compounds. Detection of anthropogenic organic compounds occurred infrequently in ECUA water when compared to the inorganic compounds. At the Lillian well, which has a filter in place, there were trace amounts of Bromodichloromethane and Dibromochloromethane. These are common disinfection byproducts caused by the addition of chlorine gas and are not originating from the aquifer. Refrigerants such as Trichlorofluoromethanes were detected in trace amounts for the Royce well with a filter in place. There were other organic products detected such as the dry cleaning solvents Trichloroethylene and Tetrachloroethylene that have entered the aquifer.

Tetrachloroethylene from the Hagler well exceeded the Florida, but not the US EPA Standard. This does not likely result in risk above the Florida standard to the consumer since the water from this well is mixed with that of other nearby wells. Pollution of the aquifer by gasoline is a major threat to the aquifer and Methyl-tert-butyl ether that originates from gasoline has entered the aquifer and was detected at three wells. It currently does not have a legal standard, but as part of a program for unregulated chemicals is being analyzed for. The ECUA has recently closed at least one well due to the presence of gasoline contamination that would include this chemical.

The EWG Report

The EWG report is not attributable to any specific authors and no mention is made of any expertise on the part of the authors or the organization. This is an important observation since the deficits of this report are primarily due to a lack of appropriate scientific and toxicological use of the data.

According to the EWG there were no violations for ECUA tap water of Federal requirements relative to public health for the contaminants that are regulated for public health risk. This is in agreement with the annual 2008 report issued by ECUA. However, ECUA supplied water still received low marks due to the EWG's biased system of evaluation of the detected analytes. EWG did not evaluate on the basis of toxicity based risk, nor did they compare equivalent types of systems (multiple supply wells vs single source monitoring) or data sets with equivalent sampling effort. In Table 4 are tabulated the EWG results taken from the individual reports for the "best" water from Arlington, TX compared to that of "worst" water from ECUA. For the legally binding US EPA "Health Standard Exceedences" both water systems are in compliance, but in the third column it is seen that for all utilities the National Average had 0.5 exceedances. This means that in terms of real health risk, there were other utilities that were worse than ECUA.

Table 4. Arlington, TX water system (ranked as number one) is compared to ECUA Pensacola, ranked as number 100.

Topic	Arlington, TX	ECUA	National Average
Exceed Health Guidelines	7	21	4
Health Standards Exceedances	0	0	0.5
Pollutants Found	15	45	8
Tests Conducted	1,882	74,897	420

The EWG Water Report presents for each water service utility a summary for the analytes classified relative as to how detrimental they are to human health but without regard to toxicity or risk-based toxicity assessment. Table 4 shows data extracted from two of these summaries. EWG has introduced a "Exceed Health Guideline" that is misleading, of their own creation, and has no regulatory or risk basis for use. It is based upon the MCLG (Maximum Contaminant Level Goal) that is not intended to be used for ranking water quality in the manner that EWG is using it. The reader is being led to believe that this is similar to a legally binding standard such as

the MCL which is listed under "Health Standards Exceedances" shown in Table 4. The MCLG, under the guise of "Exceed Health Guidelines" cited in the individual reports, were never intended as a water quality/toxicity health guideline and in most cases are currently unattainable, as they are, as it states, goals. By definition, most detections, no matter how minimal, will exceed MCLGs since the majority of the goals are zero in concentration.

It is not possible to detect the absence or zero concentration of a pollutant or any other chemical. The raw data from the analytical reports list the minimum detection limit (MDL) possible with current technology for analytes. These are all non-zero values. The MDL, depending on the analyses, can be: ppm (Parts Per Million), ppb (Parts Per Billion), ppt (Parts Per Trillion), and ppq (Parts Per Quadrillion). The more toxic compounds can be toxic down to the ppq range. The lower the MDL, the more sophisticated the analytical requirements, and the more expensive the analysis. Some commercial analyses for dioxins (MDL at ppq) can exceed $500 per sample although most analyses are less expensive and have higher MDLs. These costs which are reflected by the monthly charges presented to ECUA customers, do mount up when one considers that 74,897 analyses were conducted by ECUA from 2004-2008. The majority of the detected analytes of concern had MDLs of 0.1 to 3.53 ppb (bromobenzene and methyl-tert-butyl-ether respectively).

Due to the sensitivity of analytical analyses it is generally impossible to run analyses on tap water without the detection of some analyte that has a MCLG that is exceeded.

Regulatory Criteria

Regulated contaminants that are listed under US EPA National Primary Drinking Water Standards do have specified concentrations called the MCL (Maximum Contaminant Level) or other legal maximum concentrations enforced by US EPA and FL DEP regulations that can not be exceeded. No contaminants in ECUA water exceed the regulatory criteria. The MCLGs are goals not reasonably attainable under current technology and acceptable expense.

Ideally even the minutest presence of a carcinogen, teratogen (birth defects), or hazardous chemical is undesirable. Obviously detected analytes exceed the MCLG where it is defined as a zero concentration. It is simply not meaningful to list an analyte that did not exceed the MCL as a "Contaminants Exceeding Health Guidelines". The correct procedure for sub MCL detections is to assign a risk of illness or death based on its proven toxicity. MCLs have a specified risk and it is possible with some research of the specific chemical to calculate an estimate of toxicity for sub MCL level concentrations. This requires some effort yet is a more responsible way to report and compare data instead of simply assuming all detections present equal toxicity risk as was done in the EWG report, although performing this analysis with that kind of scientific approach would not result in the public impact that the EWG desired.

EWG Ranking System

EWG ranked larger water utilities (serving population over 250,000) based on three criteria:

1-Total number of chemicals detected from 2004-2008
2-Percentage of chemicals found of those tested for
3-The highest average level for an individual analyte
    a-Legal limits for regulated chemicals
    b-National average concentrations for non regulated chemicals

EWG then:

- Scaled the values calculated for each parameter from 0 to 100 across all utilities assessed.
- Assigned weights to these scaled values to account for each parameter's relative importance in the ranking system. The highest relative average pollutant level was assigned a weight of 0.5; the total number of contaminants found was assigned a weight of 0.3; and the percentage of chemicals found of those tested for was assigned a weight of 0.2.
- Calculated final ranks by summing the individual weighted ranks for the three parameters listed above and then ranking the sums.

Review of EWG Ranking Criteria

1-Total number of chemicals detected 2004-2008: For a comparative study the critical point here is that not all utilities test for the same number of analytes or test as many sample sites or total number of samples as does the ECUA. The more thorough the chemical monitoring, the more likely that more different analytes will be detected. Since a significant portion of the ECUA samples are represented by monitoring of known problem wells to ensure the function of GAC filters, analytes found in those wells are overrepresented in the dataset. Table 4 compares EWG report results for two water systems: Arlington, TX (Pop. 290,000) that has only two tested sources that was evaluated by EWG as having the best water quality with that of ECUA Pensacola (POP. 307,076) that got the worst rating that has about 30 sources to test. The most obvious difference is noted in the number of tests conducted: 1,882 to 74,897. There were 15 different analytes found in Arlington versus 45 found in ECUA water. Neither the 15 detections by Arlington or the 45 detections by ECUA were shown by EGW to increase risk to water consumers on the basis of toxicology. Importantly it is not clear for ECUA as to which the 30 wells had detections over the 2004-2008 data period and for what periods of exposure time were analytes present in the tap water. Some detected analytes were detected once or a few times (*see Table 3 for listing of results by individual well for 2008*) in the five year period, but were given equal weight to those consistently found, which should be of greater concern.

2-Percentage of chemicals found of those tested for: A rating percentage was calculated on the number of unique analytes detected without regard to the number of samples tested, but rather the number of analytes tested for and without regard to the type of compound or its relative toxicity. This criterion as designed could penalize any utility that analyzes more samples than those that analyzed fewer samples.

3- The highest average level for an individual pollutant: The highest average was likely taken from the ECUA reported data since this is how water data is reported to the US EPA.

3a-*legal limits for regulated chemicals*:

3b-national average concentrations for non regulated chemicals:

The italicized explanation above as to how EWG calculated the "*highest average level*" is not very complete and the precise manner of the calculations used are not explained further in their report. In any case their average has little scientific merit. The highest relative average pollutant level was assigned a weight of 0.5. The criterion for the third evaluation that accounts for 50% of the ranking is misleading and is based on the highest average levels of detected pollutant analytes and ranked according. An assumption is made that all of these analytes if detected are equally toxic on the basis of averaged mass and not on their specific toxicities.

Emerging Pollutants

Our evaluation of ECUA water is that it is within the safety parameters established by the laws and regulations of the State of Florida and the Federal Government. This means that the known risk from its consumption is extremely low. We suggest that the ECUA continue to be prudent and proactive in its quest to deliver the safest water that is feasible within reasonable costs. The ECUA in their 2008 Annual Water Quality Report monitored for six unregulated organic contaminants as part of a program for Unregulated Contaminant Monitoring (UCM) program of the USEPA. These organic chemicals are:

1,1-Dichloroethane (ppb), Dibromochloromethane (ppb), Methyl tert-butyl-ether (MTBE) (ppb), Chloroform (ppb), Bromodichloromethane (ppb), and Trichlorofluoromethane (ppb). GAC filter systems being used are likely effective against these compounds. In many cases the addition of chlorine is responsible for the formation of disinfection products that accounts for the majority of the tested unregulated chemicals. These can be formed after the water has passed through the filter.

ECUA should investigate other pollutants within the classes of chemicals called "emerging pollutants" that are not now being tested for since there is no Federal or State of Florida mandate to do so ECUA should maintain its vigilance and be proactive in this regard so that ECUA can continue to provide the highest quality water in accordance with the best technology and science that is available.

ECUA should continue to investigate other pollutants within the classes of chemicals called "emerging pollutants" that are not now being tested for since there is no Federal or State of Florida mandate to do so. ECUA should maintain its vigilance in being proactive in this regard so that it can continue to provide the highest quality water in accordance with the best technology and science that is available.