BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED SITE-SPECIFIC	)	R03-11
WATER POLLUTION	)	
REGULATIONS APPLICABLE TO	)	
THE CITY OF EFFINGHAM,	)	
BLUE BEACON	)	
INTERNATIONAL, INC., and	)	
TRUCKOMAT CORPORATION	)	

ENTRY OF APPEARANCE OF DAVID M. WALTER

NOW COMES David M. Walter, of the law firm of HODGE DWYER ZEMAN, and hereby enters his appearance on behalf of Petitioners, CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT CORPORATION.

Respectfully submitted,

CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
and TRUCKOMAT CORPORATION,
Petitioners,

By: David M. Walter
David M. Walter

Dated: October 16, 2002

N. LaDonna Driver
David M. Walter
HODGE DWYER ZEMAN
3150 Roland Avenue
Post Office Box 5776
Springfield, Illinois 62705-5776
(217) 523-4900

BLUE:001/Fil/EOA-DMW

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STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED SITE-SPECIFIC WATER POLLUTION REGULATIONS APPLICABLE TO THE CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT CORPORATION	)	R03-11

MOTION TO WAIVE REQUIREMENT TO SUBMIT 200 SIGNATURES

NOW COMES the CITY OF EFFINGHAM ("City"), BLUE BEACON INTERNATIONAL, INC. ("BBI"), and TRUCKOMAT CORPORATION ("Truckomat") (collectively "Petitioners"), by and through their attorneys, HODGE DWYER ZEMAN and request the Illinois Pollution Control Board ("Board") to waive the requirement, under 35 Ill. Admin. Code § 102.202(f), to submit 200 signatures with their Petition for Site-Specific Regulation stating as follows:

1. BBI and Truckomat both operate truck washes in Effingham, Illinois, which discharge wastewater into the City's Publicly Owned Treatment Works ("POTW"). The wastewater from the truck washes contains fluoride resulting from the use of brighteners in washing the trucks. BBI and Truckomat operate three of the four industries that are the primary sources of fluoride in the City's wastewater. The fourth fluoride source, Fedders, Inc., plans to discontinue operation of the source of fluoride at its plant. In addition, the City adds fluoride to its water supply for dental health purposes.

2. The City is located at the intersection of two major interstates and is a prime location for over-the-road truck traffic, which has resulted in the construction and operation of three successful truck wash facilities. Currently, there are no effective

alternative replacements for the brighteners used by BBI and Truckomat. The negative economic impact that would occur, if the truck washes in the City were forced to discontinue use of these brighteners, would be severe. Moreover, the loss in car wash revenue due to the elimination of the brighteners would be compounded by the lost revenue for other associated businesses as well as loss of employment.

3. Attached to this Motion is a Petition for Site-Specific Regulation seeking relief from the general fluoride water quality standard and effluent standard of 1.4 mg/L and requesting a site-specific fluoride effluent standard of 4.5 mg/L.

4. The Board has waived signature requirements for site-specific rulemaking petitions in the past, including recently In the Matter of: Petition of Central Illinois Light Company for a Site Specific Air Rule: 35 Ill. Adm. Code 214.141, R02-21 (May 2, 2002).

5. Granting this Motion is in the public interest in light of the importance of the truck washes to the economy of the City.

WHEREFORE, Petitioners, CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC. and TRUCKOMAT CORPORATION respectfully request the

Illinois Pollution Control Board to waive the requirement to submit 200 signatures in support of its Petition for Site-Specific Regulation.

Respectfully submitted:

CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
and TRUCKOMAT CORPORATION,
Petitioners,

By: ______________________
One of their Attorneys

Dated: October 16, 2002

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Blue:001/Fil/Motion to Waive Requirement

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED SITE-SPECIFIC	)	R03-11
WATER POLLUTION	)	
REGULATIONS APPLICABLE TO	)	
THE CITY OF EFFINGHAM,	)	
BLUE BEACON	)	
INTERNATIONAL, INC., and	)	
TRUCKOMAT CORPORATION	)	

**CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
AND TRUCKOMAT CORPORATION'S
PETITION FOR SITE-SPECIFIC REGULATION**

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Springfield, Illinois 62705-5776
(217) 523-4900

Dated: October 16, 2002

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED SITE-SPECIFIC	)	R03 - 11
WATER POLLUTION	)	
REGULATION APPLICABLE TO	)	
THE CITY OF EFFINGHAM,	)	
BLUE BEACON	)	
INTERNATIONAL, INC., AND	)	
TRUCKOMAT CORPORATION	)	

**CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
AND TRUCKOMAT CORPORATION'S
PETITION FOR SITE-SPECIFIC REGULATION**

NOW COME the City of Effingham ("City"), Blue Beacon International, Inc. ("BBI"), and Truckomat Corporation ("Truckomat") (collectively "Petitioners"), by and through their attorneys, HODGE DWYER ZEMAN, and pursuant to 415 ILCS 5/27(a), 35 Ill. Admin. Code §§ 102.202 and 102.210, hereby petition the Illinois Pollution Control Board ("Board") for a site-specific effluent regulation, stating as follows:

I. PROPOSED SITE-SPECIFIC RULE

Petitioners are seeking a site-specific effluent limit for fluoride for discharges from the City's Publicly Owned Treatment Works ("POTW"), including wastewater from BBI and Truckomat's Effingham facilities. The Board's effluent regulations require, at Section 304.105, that effluent from the City not cause an applicable water quality standard to be exceeded. 35 Ill. Admin. Code § 304.105. The general numeric water quality standard for fluoride, which is set forth in Section 302.208(g), is 1.4 mg/L. 35 Ill. Admin. Code § 302.208(g).

This petition will demonstrate that treatment to a general fluoride water quality standard of 1.4 mg/L is neither technically feasible nor economically reasonable for the unnamed tributary of Salt Creek from the point of the City's discharge to a point approximately 44 miles downstream. It will also demonstrate that the elimination of fluoride-based chemicals from BBI and Truckomat's facilities would have a severe negative economic impact on the industries, as well as the City. Finally, the petition will demonstrate that the fluoride effluent standard requested will not harm the aquatic life in the waters downstream of the City's discharge or have a negative impact on the current use of surface waters as a public water supply.

As proposed, the site-specific effluent standard requested by Petitioners would provide as follows:

> Section 304.2xx City of Effingham Treatment Plant Discharge
>
> This section applies to the discharge from the POTW located at 903 E. Eichie Avenue in Effingham, Illinois, owned by the City of Effingham, to an unnamed tributary of Salt Creek, said point being located in Effingham County, T8N, R6E, Sec. 28, Lat: 39°06'24", Long: 88°31'55". Such discharge shall not be subject to Section 304.105 as it applies to the water quality standard for fluoride at 35 Ill. Admin. Code § 302.208(g). Such discharge must meet a fluoride effluent standard of 4.5 mg/L, subject to the averaging rule of Section 304.104.

As explained more fully herein, these fluoride levels, to the receiving waters of the State, will be protective of aquatic life, human health, and the environment as a whole. Moreover, adoption of the proposed site-specific effluent standard will allow socially and economically valuable services located in Effingham, Illinois, to continue.

II. STATEMENT OF REASONS

A. Existing Physical Conditions

As a result of its location at the intersection of two major interstates, the City derives much of its income from services provided to persons traveling along the nation's highways. BBI and Truckomat both operate truck washes in the City, and discharge wastewater produced from their operations to the City's POTW. The wastewater from the truck washes contains fluoride, which is sourced from the brightener used in washing the trucks. The City adds fluoride to its water supply for dental health purposes. Wastewater discharge from Fedders, Inc. ("Fedders") is an additional source of fluoride to the City's POTW.

The City's wastewater treatment plant ("WWTP") was originally constructed in 1912. The plant was upgraded around 1935 and again in 1957. In 1980, a new plant was constructed at its current location. The WWTP was upgraded again in 2001. The WWTP employs approximately five full-time personnel and serves approximately 4,600 residential and 250 industrial/commercial customers. Flow to the WWTP is split between residential and industrial/commercial users at 52 percent and 48 percent, respectively, based on water use.

The City's WWTP has a design average flow of 3.75 million gallons per day and a maximum hydraulic flow of 9.375 million gallons per day. The WWTP utilizes an oxidation ditch treatment system with tertiary rapid sand filtration. This treatment system is designed to address biological oxygen demand, and to remove suspended solids and carbonaceous biological oxygen demand. Like most POTWs, however, it is not designed to remove soluble inorganic anions such as fluoride.

The City's WWTP discharges its wastewater to an unnamed tributary of Salt Creek, pursuant to a National Pollutant Discharge Elimination System ("NPDES") permit issued by the Illinois Environmental Protection Agency ("IEPA" or "Agency"). A modified NPDES permit (No. IL0028622) ("Permit") was issued to the City on March 30, 2000. The original issue and effective dates for this permit were October 6, 1998, and November 1, 1998, respectively. The permit expiration date is October 31, 2003.

The 2000 Permit established a daily maximum fluoride discharge limit for the City's POTW of 8.6 mg/L "from the effective date of the modified permit [i.e., November 1, 1998] until the attainment of operational level of the new sewage treatment plant." Once the City's new sewage treatment plant became operational, the permit specified that the daily maximum fluoride discharge limit would become 1.4 mg/L. This 1.4 mg/L daily maximum fluoride discharge limit in the Permit is based on the water quality standards set forth in § 302.208(g) of the Board's regulations. 35 Ill. Admin. Code § 302.208(g). This limit was apparently established based on a 7-day, 10-year ("7Q10") low flow value of zero for the unnamed tributary of Salt Creek. In other words, for the case of no flow in the receiving water (i.e., 7Q10 of zero), the discharge itself would be required to meet the water quality standard for fluoride. In June 2001, the City's new sewage treatment plant became operational, and the 1.4 mg/L daily maximum fluoride discharge limit went into effect.

B. Affected Sources and Facilities and Character of the Area Involved

Following the issuance of the NPDES permit, with the fluoride discharge limit of 1.4 mg/L, the City attempted to determine the sources of the fluoride in its wastewater and to develop local limits for fluoride for those sources. Industry sampling was conducted in both 2000 and 2001. This sampling effort identified four Effingham industries as the primary sources of fluoride in the City's POTW. These four industries consist of two BBI truck washes, a Truckomat truck wash, and another industry named Fedders.

The background concentration of fluoride in the City's wastewater is 1.0 mg/L, since fluoride is added to the City water supply for dental health purposes. As a result, only a small amount of fluoride for industrial loading can be allowed, and the industrial discharge limit must be extremely stringent, in order for the City to comply with the general water quality standard of 1.4 mg/L. Indeed, in order to meet its new NPDES discharge limit of 1.4 mg/L, the City developed a preliminary local discharge limit of 2.54 mg/L for each of the four industrial sources of fluoride in the City. This discharge limit has not yet been approved by the IEPA; however, it is anticipated that the final local limit would be very close to this value.

1. Affected Industries

As stated earlier, four industries have been identified as the primary sources of fluoride in the City's wastewater discharge. Each source is discussed in greater detail below.

a. BBI Truck Wash

BBI operates truck washes at two separate locations in the City. One of the facilities opened as a double bay wash in 1981, the other opened as a single bay in 1993 and added a second bay in 1997. Both of these facilities operate 24 hours per day, seven days per week. At its facilities, BBI washes the exteriors of over-the-road trucks, using chemicals (soap and brightener) applied with high-pressure wands. The brightener used to wash the trucks contains hydrofluoric acid ("HF"), which is the source of the fluoride in the wastewater from BBI's Effingham facilities. Each truck wash generates approximately 24,000 gallons per day of wastewater with a fluoride concentration in the range of 40 to 130 mg/L.

A sampling program was conducted by the City of Effingham in June through August of 2001. Fifteen samples were collected during this sampling event. The average and maximum fluoride concentrations were 44 mg/L and 120 mg/L, respectively, at one BBI truck wash and 87 mg/L and 130 mg/L, respectively, at the other BBI truck wash.

Wastewater pretreatment at the BBI truck wash facilities is accomplished by providing retention in a three-stage settling pit located inside each truck wash bay. The settling pit is designed to remove heavy solids by gravity settling. In addition, free-floating oil and grease is captured within the pit. Soluble parameters such as fluoride are not removed in the settling pit and are, therefore, discharged to the City's municipal sewer system.

water from the Little Wabash River through a water supply intake, which is located approximately 37 miles downstream from Effingham on the Little Wabash River. There are no other public or private entities known to Petitioners, which use the subject stream segment for a water supply.

C. Nature of the Receiving Body of Water

As previously explained, the City's POTW discharges to an unnamed tributary of Salt Creek. The 7Q10 for this unnamed tributary is zero. This means that, from a statistical perspective, there can be periods where the stream flow in Salt Creek is comprised entirely of the discharge flow from the City. Furthermore, this means that the POTW discharge does not undergo any mixing with the receiving water. Therefore, the Agency set the General Use Water Quality Standard of 1.4 mg/L for fluoride as the NPDES permit limit for the City's discharge. Historical effluent fluoride data, as well as general facility information for the City's POTW, are summarized in Attachment A. As these data show, there have been only two occasions in the last three years where the City's effluent has achieved the 1.4 mg/L standard for fluoride. Indeed, the effluent fluoride concentration in the City's wastewater discharge ranged from 1.4 mg/L to 4.8 mg/L from January 1999 through December 2001. The average discharge fluoride concentration during that time period was 2.73 mg/L for 45 sampling events. Nevertheless, the fluoride levels in the City's discharge are not having an adverse impact on the fluoride levels downstream, as explained further below.

b. Truckomat Truck Wash

Truckomat has been in operation in Effingham since the 1970s and HF-based brightener has been used since 1996. Truckomat operations resemble BBI's, with the exception that Truckomat operates only one double-bay facility in the City. The chemicals used, wastewater flows, and fluoride concentrations at Truckomat's facility are otherwise similar to BBI's. Fourteen wastewater effluent samples from Truckomat were collected by the City of Effingham from June through August 2001 for fluoride analysis. The average and maximum fluoride concentrations for this sampling event at Truckomat were 39 mg/L and 100 mg/L, respectively.

c. Fedders, Inc.

Fedders manufactures air conditioning equipment. Fluoride is sourced from a process, which prepares metal parts for painting. Fedders discharges in the range of 38,000 gallons per day of wastewater. The City completed a sampling program at the Fedders facility during the period from June through August 2001. Fourteen effluent wastewater samples were collected from Fedders for fluoride analysis. The average and maximum fluoride concentrations at Fedders were 9 mg/L and 20 mg/L, respectively. Fedders plans to discontinue the process, which is the source of fluoride at the plant, in 2002.

2. Users of Affected Water Segments

Waters from the POTW are discharged to an unnamed tributary of Salt Creek. The potentially affected waters include the unnamed tributary, Salt Creek itself, and the Little Wabash River, into which Salt Creek flows. The City of Flora, Illinois, receives its

1. Historical Flow and Fluoride Data for Receiving Streams

The first location downstream of the City's discharge where fluoride data are available is at sampling Station C-19, which is located on the Little Wabash River at Louisville, Illinois. This sampling station is located approximately 34 miles downstream from the City's discharge. Fluoride concentration data and stream flow data at this sampling station are found in Table B-1. These data were generated from the STORET database. The average and maximum fluoride concentrations over the sampling period in Table B-1 (July 1970 through September 1992) were 0.30 mg/L and 0.90 mg/L, respectively.

The City of Flora's water supply intake is located approximately three miles downstream from the City of Louisville on the Little Wabash River. Fluoride data are available from the City of Flora's water supply intake. These data from the City of Flora are summarized in Table B-2.[1] The data presented in Table B-2 indicate that the average and maximum fluoride concentrations at the Flora intake were 0.26 mg/L and 0.77 mg/L, respectively, for the period from June 1994 through September 2001.

A map has also been included with Attachment B, which shows the 7Q10 stream flows for the Little Wabash Region. These data were recently updated (March 2002) by the Illinois State Water Survey.

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[1] The fluoride concentration data in Table B-2 were calculated using the "Monthly Operation and Chemical Feeding Reports" for the City of Flora. The following daily operational data were provided in those reports: finished water fluoride concentration; mass of sodium fluoride added to the water; and volume of finished water produced.

2. Dischargers to Affected Water Segments

Several municipalities and businesses discharge wastewater to Salt Creek and the Little Wabash River stream segments that are the subject of this petition. The Village of Edgewood and Village of Louisville both discharge to the Little Wabash River. The Town of Mason discharges to Second Creek, a tributary of the Little Wabash River. The Village of Teutopolis discharges to Salt Creek at a location upstream of the Effingham outfall. Harper Oil Company discharges to an unnamed tributary of Salt Creek. The Village of Watson discharges to Little Salt Creek. The following table shows, in million gallons per day ("MGD"), the design average flow ("DAF") and design maximum flow ("DMF") for each of the above-listed discharges.

Discharger	DAF (MGD)	DMF (MGD)
Village of Edgewood	0.0615	0.123
Harper Oil Company	NA	NA
Village of Louisville	0.15	0.375
Town of Mason	0.052	0.131
Village of Teutopolis*	0.372	1.5
Village of Watson	0.035	0.070

* - discharges upstream of the Effingham outfall.

With the exception of the Harper Oil Company discharge, all of the dischargers to Salt Creek and the Little Wabash River stream segments, that are the subject of this petition, are municipalities. While there are no fluoride data available for these dischargers, based on a review of the regulated parameters, it can be concluded that the dischargers are primarily treating and discharging conventional pollutants (i.e., Biological Oxygen Demand ("BOD") and Total Suspended Solids ("TSS")). Accordingly, there do not appear to be any sources of fluoride in the subject streams, other than the City, BBI, Truckomat and, presently, Fedders.

3. Fluoride Impacts from City Discharge

The 7Q10 flow data show that the City's POTW discharge contributes a significant amount of the flow to Salt Creek during low flow periods. However, downstream fluoride data generated at sampling station C-19 documented that the fluoride contributed by the City's POTW discharge has little impact on the downstream fluoride concentrations. For example, as discussed earlier, the average and maximum fluoride concentrations in the Little Wabash River at Louisville (monitoring Station C-19) were 0.3 mg/L and 0.9 mg/L, respectively.

During the years 1999 and 2001, the effluent discharged from the City's POTW exhibited a fluoride concentration ranging between 1.5 mg/L to 4.8 mg/L. Nevertheless, 0.51 mg/L was the highest concentration of fluoride detected downstream on the Little Wabash River in the City of Flora's raw water supply intake during those same years.[2] Thus, the historic levels of fluoride discharged in the effluent from the City's POTW have clearly not affected downstream use of the water by the City of Flora.

As explained more fully herein, the IEPA requested that the Petitioners more fully evaluate the impact of evaporation on the expected fluoride levels in the affected stream

[2] Louisville did not use the Little Wabash River as a water supply between 1999 and 2001. The Louisville water supply data from prior years also did not allow calculation of the fluoride concentration.

segments during low flow periods. On behalf of the Petitioners, and at the request of the IEPA, Shepard Engineering, Incorporated conducted water balance and fluoride balance calculations on the stream segments in question. These calculations, which are set forth in Attachment F, demonstrate that using the standards proposed herein, the City of Flora's water supply will not exceed 2.0 mg/L fluoride, even under 7Q10 low flow conditions and taking evaporation into consideration.

D. Available Treatment or Control Options

1. Background

The Board's opinion setting forth the fluoride water quality standard of 1.4 mg/L was published on March 7, 1972, and provided the following rationale for the standard:

> Fluoride. Fluoride can delay the hatching of fish eggs and has been reported by McKee and Wolf to kill trout at concentrations ranging from 2.3 to 7.2 mg/L. They recommend a standard of 1.5 mg/L. The figure of 1.4, here repeated from the May 12 draft, is in line with that recommendation and should also assure a potable supply.

In the Matter of Water Quality Standards Revisions, Nos. 70-8, 71-14, 71-20, 1972 WL 8156 at *5 (Ill. PCB March 7, 1972).

In its earlier, January 6, 1972, opinion, the Board provides additional information regarding the treatment of fluoride, stating as follows:

> Our initial proposal for a fluoride effluent standard was 1.0 mg/L. This was somewhat tighter than the water quality standards we later proposed (1.4) for both aquatic life and public water supply, and it posed problems for municipal treatment plants whose influent has been deliberately dosed with as much as 1.0 mg/L of fluoride for dental purposes. Patterson reported that 1.0 mg/L was achievable only through relatively exotic and costly methods, such as ion exchange, and that 10.0 mg/L was a more appropriate standard to be achieved by ordinary precipitation. Weston and

> Dodge both said, however, that 1.0 mg/L was readily achievable, Weston specifying the use of alum at costs less than those for achieving most of the metals concentrations here proposed. The most specific information in the record came from Olin, which reports that its fertilizer works at Joliet consistently reduces fluoride concentrations by standard treatment from an influent of 15 mg/L to an effluent of 2.5, but that other ions present reduction as low as 1.0.

In the Matter of Water Quality Standards Revisions, Nos. 70-8, 71-14, 71-20, 1972 WL 8149 at *12 (Ill. PCB January 6, 1972).

2. Fluoride Removal Technologies

Fluoride is a component of brighteners used in truck wash operations. Specifically, the active ingredient in truck wash brighteners is HF. The HF chemically removes the aluminum oxide coating, which forms on the exposed aluminum surface of over-the-road trucks. In addition, HF removes film from a truck's paint by the simple process of spraying on and washing off. This allows trucks to be cleaned without the use of a brush, which virtually eliminates the possibility of scratching a vehicle and decreases the waiting time for drivers. Despite significant efforts by the truck wash industry, no alternative, which produces the wash quality of the HF-based brightener, has been discovered.

The fluoride anion is present in the truck wash wastewater effluent by virtue of its presence in the chemical that is used to brighten aluminum – logically referenced as "brightener." The brightener chemical constitutes a significant portion of the truck wash operational cost. Therefore, the truck wash facilities are driven by operational costs to use no more brightener than necessary to achieve the desired finished product. All truck wash operators are given extensive training with respect to chemical application procedures and rates. Also, management personnel track chemical use on a weekly basis. Specifically, chemical use is compared to total revenue (which is directly related to truck volume). Therefore, if excessive use of brightener were occurring, it would be quickly identified and corrected.

Obviously, elimination of the HF-based brightener would allow the truck wash wastewater to meet a 2.54 mg/L discharge limit. However, as stated earlier, there are no effective alternative replacements for HF. Moreover, economic incentives already prevent excess use of the brightener chemical.

A literature review summary and the results from bench test treatability studies are included as Attachment C. As discussed more fully in Attachment C, fluoride removal from industrial wastewater has typically focused on precipitation as calcium fluoride using calcium-based chemicals (i.e., calcium hydroxide or calcium chloride) or removal by sorption onto aluminum chemicals. The latter treatment methods have included sorption onto aluminum-based chemicals that are added to the wastewater solution (typically alum) or sorption onto a fixed bed such as alumina.

Since fluoride in wastewater is a soluble ion, other potential removal processes include ion exchange or reverse osmosis ("RO"). However, ion exchange and RO require that the wastewater be pretreated to a level where essentially all oil, grease and suspended solids are removed prior to the process. It has been reported that the chemical processes most widely used for fluoride removal are alum coagulation and lime treatment, with an insoluble fluoride complex that may be removed from the water as sludge. (See Treatment and Disposal of Regeneration Wastewater From Activated Alumina Columns

For Fluoride Removal From Groundwater At Rocky Mountain Arsenal, Army Engineer Waterways Experiment Station, Vicksburg, MS, Environmental Lab, January, 1980.)

The literature also indicates, however, that achievable fluoride removal levels are highly dependent on the type of wastewater stream being treated. Id. Therefore, BBI and its consultants, Shepard Engineering, Incorporated, completed bench tests using untreated truck wash wastewater samples. The results of these tests are found in Attachment C and are discussed below, along with the costs for this technology.

E. Technical Feasibility and Economic Reasonableness of Reducing Fluoride

During the bench tests, 27 jar tests were completed using varying dosages and combinations of calcium hydroxide, calcium chloride, and alum. These jar tests revealed that the lowest practicable fluoride removal level for the truck wash facilities was in the range of 10 mg/L. Thus, the lowest practicable fluoride removal level for the truck washes is significantly greater than the discharge limit of 2.54 mg/L proposed by the City. Accordingly, it is not technically feasible for BBI or Truckomat to achieve the fluoride limit proposed by the City.

Though the bench tests did not achieve fluoride reduction that would be required to comply with the discharge limits at issue, cost estimates were developed for wastewater treatment systems for the three truck wash operations in the City; the results of the cost analysis are as follows. Treatment system components would include an equalization tank, a rapid-mix tank, a slow-mix tank, a flash mixer, a flocculation (slow) mixer, an inclined plate clarifier and sludge thickener, a filter press, a wastewater transfer pump, chemical feed pumps, and chemical storage systems. The estimated total capital cost for this equipment (i.e., for separate systems at each of the three locations) is $1.5 million, based on a design wastewater flow rate of 30,000 gallons per day at each location. Moreover, it is estimated that the chemicals, operating labor, sludge disposal, maintenance and depreciation associated with such a wastewater treatment system would cost $600,000 annually. If an attempt were made to recoup this annual operating cost by increasing prices, the price of a wash would increase approximately 13 percent, i.e., an additional $5.00 every time a truck is washed. Such drastic increases would cripple the truck wash operations in the City, particularly since there are a number of truck wash competitors within driving range of the trucks utilizing these services. Thus, even if it was technically feasible using the available technology to achieve the fluoride standard currently imposed, which it is not, the costs of such technology would be prohibitively expensive.

In turn, it will not be possible for the City to comply with the water quality standard for fluoride. Pretreatment by the City is also not technically practicable, due to the same limitations as were found with treatment at the truck washes. Despite the addition of wastewater from other sources, at the City's WWTP, the lowest practicable fluoride removal level that could be achieved by the City still greatly exceeds the current fluoride effluent level.

Prior to its formal submittal, Petitioners provided a draft of this Petition to the IEPA, and participated in a telephone conference with the IEPA regarding that draft. The IEPA requested additional information regarding the possibility of combining the fluoride with calcium to form calcium fluoride. As set forth in Attachment D, Review of Fluoride

Toxicity Data, the literature indicates that fluoride combines easily with calcium in high-hardness water to form the relatively insoluble compound calcium fluoride. Nevertheless, the initial fluoride concentrations discussed in Attachment D were in the range of 181 mg/L as F^- (400 mg/L as sodium fluoride). Based on literature solubility values for calcium fluoride, as well as empirical data (e.g., BBI laboratory bench tests), it is certainly expected that some calcium fluoride would precipitate with an initial fluoride concentration of 180 mg/L. However, the literature referenced in Attachment D did not indicate a final fluoride concentration. Most certainly there would be a residual fluoride concentration in solution – probably in the range of 20 to 30 mg/L. Therefore, the information set forth in Attachment D does not conflict with the conclusion set forth in this petition; that removal of fluoride to levels below 10 to 20 mg/L is neither technically nor economically feasible.

At the IEPA's request, the Petitioners also reviewed the potential for discharging only partially treated wastewater to the City's POTW, thereby reducing the capital cost of a fluoride-removal treatment system. Specifically, the IEPA requested that the Petitioners evaluate the possibility of discharging wastewater directly to the City's WWTP following the addition of the calcium-based precipitation chemicals only, eliminating the need for an inclined plate clarifier, sludge thickener, and filter press and thereby reducing the system capital cost. Nevertheless, upon review, it was determined that it would not be possible to only partially treat the wastewater at the respective truck washes. This determination was based on the fact that all of the fluoride discharged to the City's WWTP as insoluble calcium fluoride would re-dissolve once it was mixed with all of the other wastewater in the WWTP. Thus, as explained in Attachment E hereto, solids removal and de-watering would be required as part of the pretreatment system at each location.

Presently, BBI is conducting extensive research in the area of wastewater recycle and re-use. Unfortunately, recycle systems do not reduce the total mass loading of soluble parameters such as fluoride. That is, if the truck washes were able to recycle 50 percent of their wastewater effluent, the fluoride concentration in the discharge would double and the total mass loading in the effluent would remain the same.

To summarize, there is no technically feasible or economically reasonable system available to reduce fluoride to the desired concentrations. Indeed, as discussed earlier, the systems would only reduce the effluent fluoride concentration to the 10 mg/L range, a level significantly higher than the level desired.

F. <u>Other Similar Persons' or Sites' Ability to Comply With the General Rule</u>

The City's inability to meet the current water quality standard for fluoride is a result of several factors. As discussed below, the City is a prime location for over-the-road truck traffic, which has resulted in the construction and operation of three successful truck wash facilities. These truck washes all utilize the industry standard for brighteners, which contain a significant concentration of hydrofluoric acid. Fluoride is an extremely soluble ion, and, as a result, its removal is extremely costly at the source. Also, due to its solubility, fluoride is not removed at the City wastewater treatment plant.

At many locations across the country, fluoride that is sourced from truck wash operations is simply mixed with the wastewater generated by other industrial, commercial, and residential users, as well as, the flow in the receiving stream. However, Effingham is a relatively small community (population 12,022), which discharges to an extremely low flow stream – specifically, Little Salt Creek, which has a 7Q10 value of zero. Therefore, no mixing is available with respect to the City's POTW discharge and the receiving stream. Conversely, most municipalities in Illinois and across the country do not have significant sources of fluoride from their industrial dischargers, and/or have significant volumes of wastewater from non-fluoride sources, and/or discharge to a receiving stream with significant flows.

Chemical costs (i.e., for brightener) are a significant portion of the operating cost for a truck wash. Consequently, both BBI and Truckomat carefully monitor and control the amount of brightener used in the truck washing process. In other words, the minimum amount of brightener is used at all times, which results in the minimum amount of fluoride being released to the City sewer.

Other Illinois dischargers have found it technically infeasible and economically unreasonable to comply with the general water quality standard for fluoride. In cases where technical infeasibility and economical unreasonableness of compliance was demonstrated by such dischargers, the Board has adopted site-specific rules or adjusted standards raising the fluoride standard. For example, the Modine Manufacturing Company and General Motors Corporation have been granted site-specific water quality standards for fluoride of 5.6 mg/L and 10 mg/L, respectively. See, In the Matter of Modine Manufacturing Company Facility, Ringwood, Illinois, R87-36, 1990 WL 323076 (Ill. PCB, March 22, 1990); In the Matter of General Motors Corporation, R93-13, 1995

WL 26039 (Ill. PCB, January 11, 1995). These cases have discussed the same dilemma faced by Petitioners in evaluating treatment for fluoride:

> Treatment of the wastewater using absorption on bone char, ion exchange with activated alumina or precipitation with high magnesium lime was also considered to reduce the fluoride level. [Citation to transcript.] However, none of these technologies could guarantee consistent compliance and the cost of each technology is extremely high....

In the Matter of General Motors Corporation, R93-13, 1995 WL 26039 at *3 (Ill. PCB, January 11, 1995). See, also, In the Matter of Granite City Steel Division of National Steel, AS90-4, 1993 WL 130486 at *2 (Ill. PCB, April 8, 1993) (discussing the high costs to treat fluoride in wastewater using activated alumina absorption, as well as low flow conditions in the receiving stream).

G. Economic Impact of the Proposed Rule

As previously discussed, the City's POTW discharges to an unnamed tributary of Salt Creek, which has a 7Q10 low water flow of zero. The general water quality standard for fluoride in Salt Creek is 1.4 mg/L, and since the City's POTW discharge receives no dilution from mixing, the Agency established an NPDES permit limit for fluoride from the City's discharge of 1.4 mg/L, as well.

Thus, the City developed a preliminary industrial wastewater discharge limit of 2.54 mg/L, in order to begin the process of meeting the 1.4 mg/L NPDES permit limit for fluoride. Nevertheless, as explained above, and documented in the bench study summary of results (Attachment C), it is not technically feasible and/or economically reasonable for the industries that are the sources of the fluoride to meet the 2.54 mg/L limit proposed by the City by employing standard wastewater treatment technologies. The source industries can continue the current amount of fluoride discharge if the City's fluoride discharge limit is raised to 4.5 mg/L. If the City's fluoride discharge limit is not raised to 4.5 mg/L, the truck washes will be forced to either shut down operations or discontinue use of the brightener.

The negative economic impact that would occur, if the truck washes in the City were forced to abandon the HF brightener and use an inferior product, would be severe. Specifically, BBI projects that the loss of HF brightener would result in annual revenue loss of $300,000 per double bay location. This correlates to a total economic loss of $900,000 in the City, based on the decrease of truck wash revenue alone. These economic losses would be compounded by the lost revenue for other associated businesses (e.g., restaurants, truck stops, motels, etc.), as well as loss of employment. It is also projected that the loss of HF brightener would result in the loss of seven to eight employees per truck wash location – a total of 21 to 24 lost jobs in the City.

The City is a transportation hub located at the intersection of Interstate 57, connecting Chicago to New Orleans, and Interstate 70, stretching from the nation's capital to Los Angeles. The City has access to three interstate exchanges, as well as U.S. Highway 40, U.S. Highway 45, IL Highway 32, IL Highway 33, and IL Highway 37. The City has 18 motels and/or hotels to offer those traveling the nation's highways, and more than 60 restaurants.

According to the 1997 Special Census, the City has a population of 12,022 and 180,873 persons reside within a 35-mile radius of the City. Industries in the City include Fedders; Quebecor World; Quebecor/Petty Printing; Sherwin-Williams Company; McLeod

U.S.A. Publishing; Mid America Direct; Effingham Equity; Peerless of America; TSI Graphics, Inc.; Kingery Printing Company; Southeastern Container, Inc.; Effingham-Clay Service Company; John Boos and Company; Eagle Soft, A Patterson Company; Nukabe, Inc., U.S.A.; Effingham Daily News; Mid-Illinois Concrete, Inc.; J&J Ventures; Midco International; and Pepsi Cola Bottling Company. Given the industrial and transportation presence in the Effingham area, truck washes are an important industry in, and source of income for, the City.

Indeed, the Average Daily Traffic Report for 2001 indicates that 47 percent of the approximately 33,100 vehicles travelling on Interstate 57 and Interstate 70 are semi-trucks. The drivers of these 15,557 trucks make a substantial contribution to the Effingham community each day. It is estimated that, on a daily basis, an average of 1,000 truck drivers purchase fuel in the City. The drivers of these trucks spend an average of $71.00 per person in the City, i.e., $71,000 contributed to the local economy on a daily basis. Statistical research has shown that truck drivers generally stop for a truck wash, fuel, and food at the same time. An average of 26 percent of the 1,000 truck drivers stopping daily for fuel in the City will also obtain a truck wash, at an average cost of $37.50. This does not even take into consideration the dollars spent by these truck drivers at local restaurants or hotels. If these truck drivers travel through or around the City to obtain a truck wash elsewhere, these restaurants and hotels will be impacted, as well as the truck washes and filling stations.

H. Detailed Assessment of the Environmental Impact of the Proposed Change

The site-specific fluoride effluent standard will be protective of the waters of the State located downstream. Waters from the POTW are discharged to an unnamed tributary of Salt Creek. The potentially affected waters flow from this discharge point to the confluence of the unnamed tributary with Salt Creek, from there downstream to the juncture of Salt Creek with the Little Wabash River, and from there downstream to a point approximately 9.8 river miles downstream from the City of Louisville, Illinois, on the Little Wabash River at the confluence of Buck Creek and the Little Wabash River.

Petitioners studied and calculated fluoride levels at these locations. If the proposed site-specific effluent standard is adopted, fluoride levels as a result of the discharge from the POTW to the above-listed potentially affected waters would be as follows. From the point of discharge of the City's POTW to the confluence of Salt Creek with the Little Wabash River, the fluoride levels would be less than or equal to 5.0 mg/L. From the confluence of Salt Creek with the Little Wabash River to a point on the Little Wabash River located 2.8 miles downstream of Louisville, Illinois, the fluoride levels would be less than or equal to 3.2 mg/L. From a point on the Little Wabash River located 2.8 miles downstream of Louisville, Illinois to the confluence of Buck Creek and the Little Wabash River, a point on the Little Wabash River located approximately 9.8 miles downstream of Louisville, Illinois, the fluoride levels would be less than or equal to 2.0 mg/L. Furthermore, Petitioners are working with the IEPA on permit conditions that will require monitoring of flow conditions downstream, including the impacts, if any, of the discharge on downstream water supplies.

At Petitioners' request, Commonwealth Biomonitoring, Inc. ("CBI"), Indianapolis, Indiana, conducted a detailed scientific assessment of the effects of fluoride on the water downstream from the City's WWTP. A detailed report of that assessment is included as Attachment D. To determine a site-specific effluent limit for fluoride that would be protective of aquatic life downstream from Effingham, Illinois, fluoride toxicity data, as well as water quality and bioassessment data from the receiving stream, were collected and analyzed.

1. Fluoride Toxicity Data

First, the available data concerning the toxicity of fluoride to aquatic life were examined. The lowest fluoride concentration at which a short-term (acute) toxic effect of exposure to a freshwater animal species was observed is 17 mg/L for the caddisfly *Ceratopsyche bronta*. Attachment D at 5. Based on the available information, the lowest concentration of fluoride determined in laboratory tests to have a long-term (chronic) effect on freshwater animals present in Illinois was 3 mg/L. Attachment D at 2. Nevertheless, this determination of chronic effect of fluoride exposure was made in a test conducted on rainbow trout in very soft water. Attachment D at 2.

2. The Effect of Hardness on Fluoride Toxicity

The fact that the above-referenced test of the lowest concentration of fluoride with a long-term effect occurred in very soft water is significant, because the scientific literature demonstrates that there is a relationship between the hardness values for water and the concentration at which fluoride is toxic to aquatic life. Attachment D at 5. Indeed, additional tests have demonstrated that concentrations of fluoride significantly higher than 3 mg/L are not toxic to aquatic life in the characteristically much harder water of Central Illinois. Attachment D at 2.

Multiple species have been used in aquatic toxicity tests involving varying hardness values of test water. Attachment D at 6. For each species tested, the test results demonstrate that, as water hardness values increase, fluoride toxicity levels decrease. Attachment D at 6. In other words, the harder the water, the higher the concentration of fluoride that can be maintained without causing any harm to aquatic life.

Here, too, because of the hardness of the water for which site-specific relief is sought, higher concentrations of fluoride are acceptable and will not be detrimental to aquatic life. Indeed, the water in the Little Wabash River downstream from Effingham, Illinois, is very hard, with hardness values of more than 300 mg/L during low flow conditions. Attachment D at 10. Using a method developed by the United States Environmental Protection Agency ("USEPA"), the effects of hardness on fluoride toxicity were evaluated. Those data demonstrate that fluoride in the water downstream from Effingham would not be detrimental to aquatic life at concentrations at or below 10 mg/L. Attachment D at 2.

Further support for this finding exists in field studies published in the scientific literature. Indeed, each study published in the scientific literature, including one conducted in Illinois, demonstrates that sensitive aquatic species can exist in waters where fluoride concentrations exceed 5-10 mg/L. Attachment D at 2. Moreover, bioassessments show no harm to aquatic life from fluoride downstream from the City.

3. Bioassessments of the Site Show No Harm to Aquatic Life from Fluoride

Recent studies conducted at Effingham, Illinois, illustrate that fluoride from the City's WWTP discharge is not, in fact, causing any environmental harm. Attachment D at 2. The first study, a 1999 bioassessment by the IEPA, showed that net-spinning caddisflies are the dominant group of animals in the receiving stream one mile below the City's WWTP. Attachment D at 2. Net-spinning caddisflies are known to be very sensitive to fluoride, yet they flourish in the receiving stream downstream from the City's WWTP. Their presence is further evidence that the concentration of fluoride from the City's WWTP discharge is not causing any environmental harm to aquatic life in the receiving water. Similarly, toxicity tests conducted by an independent laboratory in 1998 showed that effluent from the City's WWTP had no adverse effects on *Ceriodaphnia dubia* and fathead minnows in the receiving stream. Attachment D at 2. Thus, the available bioassessments demonstrate that fluoride from the City's WWTP discharge is not causing any environmental harm.

At the IEPA's request, an additional bioassessment was completed on June 20, 2002, by CBI in order to obtain additional information with respect to the environmental impact on the subject receiving stream. The benthic samples obtained during the June 20, 2002, assessment were compared to the sample results from 1999. The study methods and results of this assessment and comparison are summarized in Attachment F. Based upon this additional assessment, and its comparison with the 1999 data, CBI concluded that there is no evidence that the fluoride in the City WWTP effluent is harming the aquatic community immediately downstream from the discharge. Attachment F at 3. Indeed, more taxa are present in 2002 than were observed in 1999, and net-spinning caddisflies are relatively abundant in an area immediately downstream from the City's WWTP discharge. Attachment F at 3.

Bioassessments from the IEPA and CBI demonstrate that fluoride from the City's WWTP discharge is not causing any harm to aquatic life. In addition, studies published in the scientific literature demonstrate that sensitive aquatic species can exist in waters with higher fluoride concentrations than those proposed by Petitioners for the site-specific water quality and effluent standards. Finally, because of the hardness of the water for which site-specific relief is sought, such higher concentrations of fluoride are acceptable and will not be detrimental to the environment. The site-specific relief can therefore be granted without any harm to either aquatic life or the environment.

III. SYNOPSIS OF TESTIMONY

Petitioners will call several individuals to testify in support of the facts set forth in this Petition and requested relief, including the following:

A. Mr. Max Shepard

Mr. Max Shepard, P.E., of Shepard Engineering, Incorporated, will testify regarding, among other things, the derivation of the proposed site-specific effluent standard; the condition of the receiving streams; the historical flow and fluoride data for the receiving streams; the entities presently discharging to the affected water segments, as well as the entities using water downstream; fluoride impacts from the City's discharge; the available treatment or control options; fluoride removal technologies; and the technical feasibility of reducing fluoride levels from the truck washes.

B. Mr. Greg Bright

Mr. Greg Bright, of CBI, will also testify regarding the conditions of the receiving tributary to Salt Creek, Salt Creek, and the Little Wabash River. In addition, Mr. Bright will testify regarding the effects of fluoride on the water downstream from the City's WWTP. Mr. Bright's testimony will include a description of the available data concerning the toxicity of fluoride to aquatic life; the effect of water hardness on fluoride toxicity; and bioassessments of the receiving stream. Mr. Bright will testify that the site-specific effluent standard for fluoride proposed by Petitioners can be granted without any harm to either aquatic life or the environment.

C. Mr. Mike Rose

Mr. Mike Rose, Environmental Research and Development Director for BBI, will testify regarding BBI's operation, including the use of fluoride by BBI's and Truckomat's truck wash facilities; the ability of other persons to comply with the general water quality standard for fluoride; the beneficial economic impact of BBI's and Truckomat's operations to the City and surrounding area; the economic impact of the proposed rule; and the economic reasonableness of reducing fluoride levels from the truck washes.

D. Mr. Steve Miller

Mr. Steve Miller, P.E., Engineer for the City, will testify regarding the City in general, and more specifically, the City's WWTP; the NPDES permit issued to the City and the limits therein; the sources of fluoride at the City's WWTP; the efforts taken by the City to comply with the general water quality fluoride standard; and the economic impact of the proposed rule.

IV. MOTION FOR WAIVER OF SIGNATURE REQUIREMENT

In a separate Motion filed simultaneous with this Petition, Petitioners respectfully request that the Board waive the requirement, set forth at 35 Ill. Admin. Code § 102.202(f), that a petition for rulemaking be signed by at least 200 persons.

V. STATEMENT OF RECENCY

The rules proposed in this Petition do not amend any existing Board rules but, instead, requests that the Board amend its effluent standards set forth in Part 304, by establishing the new site-specific rule proposed. The new site-specific regulation proposed to be added to Part 304 would amend the most recent version of Part 304 published on the Board's Web site, which was last amended in R98-14 at 22 Ill. Reg. 687, effective December 31, 1998.

VI. ATTACHMENTS

The following attachments are included by Petitioners in support of the site-specific effluent standard proposed, and are hereby made a part of this Petition:

A. City of Effingham Sewage Treatment Plant Data Summary ("Attachment A");

B. Receiving Stream Flow And Fluoride Concentration Data ("Attachment B");

C. Bench-Scale Treatability Study Report ("Attachment C");

D. Review of Fluoride Toxicity Data and Development of Fluoride Aquatic Toxicity Criteria for the Effingham, Illinois Waste Water Treatment Plant ("Attachment D");

E. Letter from Shepard Engineering, Inc. to IEPA, dated July 3, 2002 ("Attachment E"); and

F. Rapid Bioassessment of a Tributary of Salt Creek, Effingham Illinois ("Attachment F").

VII. CONSISTENCY WITH FEDERAL LAW

The Board has previously recognized that it has the authority and broad discretion, consistent with federal law, to adopt water quality and effluent standards that do not adversely affect the designated uses of a water body.

> Generally, states must adopt water quality standards which protect the designated use of interstate and intrastate waters. 33 U.S.C. § 1313(c) (1998). The Board has adopted the water quality standards at 35 Ill. Adm. Code § 302.203 in compliance with federal law. States may also revise water quality standards. 40 C.F.R. § 131.4 (1998).
>
> * * *
>
> The Board has stated previously that federal directives give it "broad discretion in determining the appropriate standard of control to apply to discharges from water treatment plants". In re Site Specific Exception to Effluent Standards for the Illinois American Water Company, East St. Louis Treatment Plant (February 2, 1989), R85-11, slip op. at 10.

In the Matter of Petition of Illinois American Water Company's Alton Public Water Supply Replacement Facility, AS 99-66, 2000 WL 141967 at *25 (Ill. PCB September 7, 2000.

Thus, the Board has the authority, pursuant to the broad discretion provided it pursuant to federal directives, to determine that the site-specific effluent standard requested by Petitioners is the appropriate standard of control to be applied, and will be protective of the portions of the water bodies identified above.

VIII. CONCLUSION

Petitioners respectfully request that the Board grant the site-specific relief requested herein. As demonstrated above, treatment to a general fluoride water quality standard and effluent standard of 1.4 mg/L is neither technically feasible nor economically reasonable for this site. Moreover, the elimination of fluoride-based chemicals from BBI's and Truckomat's facilities would have a severe negative economic impact on theses industries, as well as the City, and potentially the State. Finally, a site-specific effluent standard of 4.5 mg/L fluoride will not harm the aquatic life in the receiving stream to which the City discharges.

Further, the relief requested by Petitioners is consistent with the Board's recent decision in Rhodia, Inc., et al., which determined that relief from Part 304 of the Board's regulations was more appropriate than relief from Part 302. See, In the Matter of Rhodia, Inc., et al., AS 01-9, slip op. at 10 (Ill. PCB, January 10, 2002). The relief requested in this Petition would not do away with the Part 302 water quality standard for fluoride in the receiving stream, but would rather obviate the need for the City's effluent to comply with the specific fluoride limitations of that water quality standard. In the alternative, however, if it is determined that a specific water quality standard must be designated, Petitioners request that the Board utilize a standard of 5.0 mg/L fluoride, which as this Petition demonstrates, is the highest fluoride level that may potentially occur in the receiving stream if an effluent limit for the City's discharge of 4.5 mg/L is utilized.

WHEREFORE, for the above and foregoing reasons, the Petitioners, CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT

CORPORATION, respectfully request that the Illinois Pollution Control Board promulgate the site-specific effluent standard for fluoride requested, and/or grant such other relief as is appropriate and just.

Respectfully submitted:

CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
and TRUCKOMAT CORPORATION,
Petitioners,

By: [signature]
One of their Attorneys

Dated: October 16, 2002

N. LaDonna Driver
David M. Walter
HODGE DWYER ZEMAN
3150 Roland Avenue
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(217) 523-4900

BLUE:001/Fil/Petition – Site Specific Reg

ATTACHMENT A

CITY OF EFFINGHAM

SEWAGE TREATMENT PLANT DATA SUMMARY

Facility Name: City of Effingham Wastewater Treatment Plant

Location: Effingham, Illinois

NPDES Permit No.: 0028622

Community Population: 12,022

Treatment Type: Oxidation ditch with tertiary rapid sand filtration

Design Average Flow: 3.25 MGD

Maximum Hydraulic Flow: 9.375 MGD

Historical Fluoride Data Summary for Effingham POTW Effluent:

Sample Date	Fluoride Conc. (mg/L)	Sample Date	Fluoride Conc. (mg/L)
1/27/99	2.9	4/11/01	2.4
7/13/99	3.6	5/7/01	3.1
1/25/00	4.2	5/14/01	2.8
5/1/00	3.8	6/4/01	1.8
5/8/00	1.4	6/11/01	2.5
6/8/00	4.3	7/9/01	2.5
6/14/00	2.3	7/16/01	3.2
7/5/00	1.7	8/6/01	2.7
7/17/00	3.2	8/15/01	3.0
7/19/00	2.5	9/10/01	2.5
8/2/00	1.9	9/17/01	2.9
8/9/00	1.2	10/1/01	3.7
9/6/00	2.4	10/10/01	2.7
9/13/00	1.5	11/12/01	3.0
10/2/00	3.0	11/20/01	2.8
10/9/00	1.6	12/3/01	1.9
11/1/00	3.1	12/10/01	2.5
11/6/00	3.6		
12/4/00	2.2		
12/13/00	1.7		
1/3/01	1.8		
1/10/01	4.8		
1/16/01	2.0		
2/5/01	3.4		
2/13/01	2.4		
3/5/01	3.7		
3/13/01	3.7		
4/4/01	3.1		

ATTACHMENT B

RECEIVING STREAM FLOW AND FLUORIDE CONCENTRATION DATA

TABLE B-1: FLUORIDE AND FLOW DATA - MONITORING STATION C-19, LOUISVILLE, IL

Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)	Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)	Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)
23-Jul-70	56.00	0.20	08-Oct-74	67.00	0.10	12-Mar-78	921.00	NM
11-Aug-70	20.00	0.30	05-Nov-74	115.00	0.30	13-Mar-78	2340.00	NM
09-Sep-70	13.00	0.40	03-Dec-74	242.00	0.30	14-Mar-78	5580.00	NM
02-Oct-70	32.00	NM	06-Jan-75	597.00	0.10	16-Mar-78	6880.00	NM
10-Nov-70	24.00	0.40	04-Feb-75	2450.00	0.20	17-Mar-78	9760.00	NM
02-Dec-70	32.00	0.40	06-Mar-75	254.00	NM	17-Mar-78	10200.00	NM
04-Jan-71	111.00	0.40	07-Apr-75	283.00	0.10	19-Mar-78	8330.00	NM
26-Jan-71	22.00	0.50	06-May-75	NM	0.30	22-Mar-78	9370.00	NM
02-Mar-71	450.00	0.20	03-Jun-75	540.00	0.20	23-Mar-78	7190.00	NM
30-Mar-71	106.00	0.20	09-Jul-75	108.00	0.20	30-Mar-78	1460.00	NM
06-May-71	38.00	0.30	05-Aug-75	107.00	0.20	31-Mar-78	627.00	NM
02-Jun-71	68.00	0.40	05-Sep-75	75.00	0.30	08-May-78	2950.00	NM
14-Jul-71	835.00	0.90	03-Oct-75	17.00	0.30	14-Jul-78	36.20	NM
11-Aug-71	21.00	0.50	04-Nov-75	46.00	0.20	31-Jul-78	1200.00	NM
09-Sep-71	8.30	0.40	01-Dec-75	1110.00	0.20	16-Aug-78	124.00	NM
06-Oct-71	28.00	0.40	08-Jan-76	180.00	0.20	05-Sep-78	18.00	NM
12-Nov-71	5.40	0.30	30-Jan-76	269.00	NM	25-Sep-78	15.00	NM
07-Dec-71	14.00	0.30	05-Feb-76	100.00	0.20	02-Oct-78	5.80	NM
11-Jan-72	165.00	0.20	08-Mar-76	4120.00	0.20	01-Nov-78	3.50	NM
14-Feb-72	42.00	0.30	02-Apr-76	259.00	0.20	27-Nov-78	102.00	NM
20-Mar-72	97.00	0.30	11-May-76	43.00	0.20	04-Dec-78	443.00	NM
18-Apr-72	4099.99	0.30	01-Jun-76	617.00	0.20	19-Dec-78	69.00	NM
17-May-72	102.00	0.30	07-Jul-76	8.40	0.30	16-Jan-79	90.00	NM
02-Jun-72	41.00	0.40	03-Aug-76	76.50	0.20	01-Feb-79	127.00	NM
07-Jul-72	9.90	0.50	01-Sep-76	9.60	0.20	28-Feb-79	4470.00	NM
09-Aug-72	63.00	0.40	07-Oct-76	157.00	NM	12-Mar-79	512.00	NM
12-Sep-72	7.30	0.40	03-Nov-76	44.00	NM	27-Mar-79	4670.00	NM
05-Oct-72	7.80	0.30	08-Dec-76	6.51	NM	09-Apr-79	2450.00	NM
10-Nov-72	205.00	0.30	05-Jan-77	3.03	NM	18-Apr-79	517.00	NM
05-Dec-72	114.00	0.20	25-Jan-77	4.76	NM	18-Apr-79	515.00	NM
09-Jan-73	314.00	0.30	09-Mar-77	133.00	NM	03-May-79	469.00	NM
09-Feb-73	313.00	0.20	14-Mar-77	2720.00	NM	04-Jun-79	46.00	NM
07-Mar-73	2880.00	0.30	28-Mar-77	5309.99	NM	04-Jun-79	45.00	NM
04-Apr-73	1680.00	0.50	30-Mar-77	9180.00	NM	12-Jun-79	138.00	NM
09-May-73	1850.00	0.30	14-Apr-77	113.00	NM	03-Jul-79	21.00	NM
06-Jun-73	2280.00	0.30	09-May-77	377.00	NM	18-Jul-79	24.00	NM
11-Jul-73	174.00	0.20	07-Jun-77	11.80	NM	18-Jul-79	24.00	NM
07-Aug-73	46.00	0.40	13-Jul-77	22.00	NM	04-Sep-79	65.00	NM
11-Sep-73	131.00	0.30	15-Aug-77	8.47	NM	13-Sep-79	14.00	NM
15-Oct-73	55.00	0.30	14-Sep-77	168.00	NM	03-Oct-79	7.50	NM
20-Nov-73	25.60	0.30	18-Oct-77	30.00	NM	10-Oct-79	5.50	NM
06-Dec-73	1120.00	0.90	15-Nov-77	22.10	NM	10-Oct-79	5.50	NM
08-Jan-74	250.00	0.10	17-Nov-77	1240.00	NM	08-Nov-79	6.40	NM
06-Feb-74	274.00	0.20	18-Nov-77	633.00	NM	13-Nov-79	19.00	NM
06-Mar-74	2540.00	0.30	01-Dec-77	1600.00	NM	17-Dec-79	7.00	NM
03-Apr-74	1750.00	0.40	02-Dec-77	2370.00	NM	07-Jan-80	35.00	NM
07-May-74	155.00	0.40	17-Dec-77	6690.00	NM	04-Feb-80	21.00	NM
03-Jun-74	6680.00	0.30	18-Dec-77	5280.00	NM	19-Feb-80	184.00	NM
24-Jul-74	22.10	0.20	20-Jan-78	77.00	NM	10-Mar-80	78.00	NM
04-Sep-74	540.00	0.30	22-Feb-78	47.20	NM	11-Mar-80	746.00	NM

TABLE B-1: FLUORIDE AND FLOW DATA - MONITORING STATION C-19, LOUISVILLE, IL (continued)

Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)	Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)	Sample Date	Stream Flow (CFS)	Flouride Conc. (mg/L)
07-Apr-80	521.00	NM	25-Aug-82	13.00	NM	14-Apr-88	173.00	NM
07-Apr-80	521.00	NM	26-Aug-82	13.00	NM	12-May-88	55.00	NM
21-Apr-80	213.00	NM	01-Oct-82	20.00	NM	16-Jun-88	9.00	NM
14-May-80	142.00	NM	13-Oct-82	383.00	NM	16-Aug-88	6.00	NM
14-May-80	176.00	NM	20-Dec-82	252.00	NM	08-Sep-88	3.00	NM
14-May-80	142.00	NM	26-Jan-83	307.00	NM	13-Oct-88	0.20	NM
21-May-80	134.00	NM	06-Apr-83	3020.00	NM	15-Feb-89	271.00	NM
04-Jun-80	581.00	NM	25-May-83	311.00	NM	28-Mar-89	372.00	NM
18-Jun-80	60.00	NM	20-Jun-83	1370.00	NM	31-May-89	348.00	NM
18-Jun-80	75.00	NM	25-Jul-83	21.00	NM	29-Jun-89	110.00	NM
01-Jul-80	278.00	NM	11-Oct-83	5.00	NM	08-Aug-89	68.00	0.44
14-Jul-80	49.00	NM	14-Nov-83	139.00	NM	06-Sep-89	26.00	NM
15-Jul-80	41.30	NM	03-Jan-84	80.00	NM	25-Oct-89	20.00	0.31
15-Jul-80	41.30	NM	06-Mar-84	3230.00	NM	14-Dec-89	10.00	NM
24-Jul-80	91.50	NM	04-Apr-84	2760.00	NM	18-Jan-90	35.00	NM
04-Aug-80	307.00	NM	29-May-84	500.00	NM	22-Feb-90	500.00	0.18
07-Aug-80	33.00	NM	11-Jun-84	64.00	NM	05-Apr-90	500.00	NM
11-Sep-80	22.40	NM	25-Jul-84	7.90	NM	31-May-90	230.00	NM
11-Sep-80	22.00	NM	12-Sep-84	127.00	NM	26-Jun-90	210.00	NM
23-Sep-80	103.00	NM	07-Nov-84	217.00	NM	16-Aug-90	70.00	NM
16-Oct-80	8.40	NM	17-Dec-84	1160.00	NM	08-Nov-90	120.00	NM
18-Nov-80	10.00	0.30	16-Jan-85	150.00	NM	18-Dec-90	1270.00	NM
20-Nov-80	10.00	NM	25-Feb-85	13600.00	NM	31-Jan-91	90.00	NM
23-Dec-80	16.00	NM	17-Apr-85	716.00	NM	26-Feb-91	250.00	NM
13-Jan-81	10.00	NM	28-May-85	11.00	NM	11-Apr-91	270.00	NM
03-Feb-81	17.00	NM	24-Jun-85	210.00	NM	21-May-91	86.00	NM
05-Mar-81	105.00	NM	22-Jul-85	42.00	NM	20-Jun-91	49.00	NM
06-Mar-81	931.00	NM	25-Sep-85	10.00	NM	13-Aug-91	22.00	NM
07-Apr-81	72.00	NM	29-Oct-85	9.50	NM	17-Sep-91	8.40	NM
23-Apr-81	93.00	NM	20-Nov-85	15000.00	NM	05-Nov-91	145.00	NM
11-May-81	1450.00	NM	09-Jan-86	54.00	NM	10-Dec-91	150.00	NM
12-May-81	1650.00	NM	10-Feb-86	530.00	NM	23-Jan-92	260.00	NM
19-May-81	2850.00	0.2	10-Apr-86	204.00	NM	20-Feb-92	950.00	NM
02-Jul-81	682.00	NM	28-May-86	53.00	NM	26-Mar-92	400.00	NM
20-Jul-81	1940.00	NM	25-Jun-86	16.00	NM	12-May-92	140.00	NM
01-Oct-81	129.00	NM	23-Jul-86	5.60	NM	04-Jun-92	89.00	NM
28-Oct-81	159.00	NM	26-Aug-86	10.50	NM	11-Aug-92	65.00	NM
18-Nov-81	59.00	NM	28-Oct-86	558.00	NM	22-Sep-92	740.00	NM
01-Dec-81	386.00	NM	08-Dec-86	257.00	NM			
14-Dec-81	56.00	NM	22-Jan-87	710.00	NM			
18-Jan-82	107.00	NM	18-Feb-87	200.00	NM			
25-Jan-82	2970.00	NM	16-Apr-87	2540.00	NM			
22-Feb-82	13100.00	NM	27-May-87	20.00	NM			
09-Mar-82	379.00	NM	18-Jun-87	12.00	NM			
05-Apr-82	478.00	NM	18-Aug-87	6.90	NM			
07-Apr-82	564.00	NM	30-Sep-87	21.00	NM			
05-May-82	87.00	NM	10-Nov-87	4.20	NM			
09-Jun-82	957.00	NM	15-Dec-87	1170.00	NM			
29-Jun-82	139.00	NM	04-Feb-88	8840.00	NM			
12-Jul-82	1870.00	NM	10-Mar-88	591.00	NM			

TABLE B-2: CITY OF FLORA RAW WATER SUPPLY FLUORIDE CONCENTRATION DATA SUMMARY

Month	Year	Fluoride Conc. (mg/L)	Month	Year	Fluoride Conc. (mg/L)	Month	Year	Fluoride Conc. (mg/L)
June	1994	0.16	January	1997	0.26	May	1999	0.18
July	1994	0.22	February	1997	0.67	June	1999	0.16
August	1994	0.27	March	1997	0.19	July	1999	0.17
September	1994	0.42	April	1997	0.3	August	1999	0.22
October	1994	0.61	May	1997	0.54	September	1999	0.35
November	1994	0.47	June	1997	0.25	October	1999	0.51
December	1994	0.37	July	1997	0.21	November	1999	0.47
January	1995	0.3	August	1997	0.2	December	1999	0.37
February	1995	0.28	September	1997	0.36	January	2000	0.41
March	1995	0.59	October	1997	0.51	February	2000	0.45
April	1995	0.31	November	1997	0.56	March	2000	0.13
May	1995	0.21	December	1997	0.77	April	2000	0.07
June	1995	0.2	January	1998	0.37	May	2000	0.05
July	1995	0.12	February	1998	0.44	June	2000	0.07
August	1995	0.18	March	1998	0.22	July	2000	0.06
September	1995	0.27	April	1998	0.22	August	2000	0.04
October	1995	0.38	May	1998	0.2	September	2000	0
November	1995	0.6	June	1998	0.18	October	2000	0
December	1995	0.48	July	1998	0.17	November	2000	0
January	1996	0.35	August	1998	0.23	December	2000	0
February	1996	0.09	September	1998	0.41	January	2001	0.08
March	1996	0.3	October	1998	0.28	February	2001	0.04
July	1996	0.24	November	1998	0.23	June	2001	0
August	1996	0.3	December	1998	0.38	July	2001	0
September	1996	0.27	January	1999	0.23	August	2001	0
October	1996	0.43	February	1999	0.06	September	2001	0
November	1996	0.47	March	1999	0.08			
December	1996	0.24	April	1999	0.18			

Note:

Raw water fluoride concentration calculated from following equation:

$F_I = F_{FAVG} - (0.054 * M_{SF}/Q)$

Where:

F_I = calculated fluoride concentration for intake water in mg/L.

F_{FAVG} = average monthly fluoride concentration of finished water in mg/L.

M_{SF} = mass of sodium fluoride added for the month in lb.

Q = volume of finished water produced for the month in million gallons.

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED SITE-SPECIFIC	)	R03-11
WATER POLLUTION	)	
REGULATIONS APPLICABLE TO	)	
THE CITY OF EFFINGHAM,	)	
BLUE BEACON	)	
INTERNATIONAL, INC., and	)	
TRUCKOMAT CORPORATION	)	

ENTRY OF APPEARANCE OF N. LADONNA DRIVER

NOW COMES N. LaDonna Driver, of the law firm of HODGE DWYER ZEMAN, and hereby enters her appearance on behalf of Petitioners, CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT CORPORATION.

Respectfully submitted,

CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
and TRUCKOMAT CORPORATION,
Petitioners,

By: ______________________
N. LaDonna Driver

Dated: October 16, 2002

N. LaDonna Driver
David M. Walter
HODGE DWYER ZEMAN
3150 Roland Avenue
Post Office Box 5776
Springfield, Illinois 62705-5776
(217) 523-4900

BLUE:001/Fil/EOA-NLD

CERTIFICATE OF SERVICE

I, David M. Walter, the undersigned, hereby certify that I have served the attached ENTRY OF APPEARANCE OF N. LADONNA DRIVER; ENTRY OF APPEARANCE OF DAVID M. WALTER; CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC. and TRUCKOMAT CORPORATION'S PETITION FOR SITE-SPECIFIC REGULATION; and MOTION TO WAIVE REQUIREMENT TO SUBMIT 200 SIGNATURES upon:

Ms. Dorothy M. Gunn
Clerk of the Board
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601

Deborah J. Williams, Esq.
Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

James E. Ryan, Esq.
Attorney General
500 South Second Street
Springfield, Illinois 62706

Robert T. Lawley, Esq.
Chief, Legal Division
Illinois Department of Natural Resources
524 South Second Street
Springfield, Illinois 62701

by depositing said documents in the United States Mail in Springfield, Illinois on October 16, 2002.

David M. Walter

BLUE:001/NOF-COS/Petition for Site-Specific Regulation

REQUIREMENT TO SUBMIT 200 SIGNATURES, attached herewith, copies of which are herewith served upon you.

Respectfully submitted,

CITY OF EFFINGHAM,
BLUE BEACON INTERNATIONAL, INC.,
and TRUCKOMAT CORPORATION,
Petitioners,

By: David M. Walter
One of their Attorneys

Dated: October 16, 2002

N. LaDonna Driver
David M. Walter
HODGE DWYER ZEMAN
3150 Roland Avenue
Post Office Box 5776
Springfield, Illinois 62705-5776
(217) 523-4900

RECEIVED
CLERK'S OFFICE

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD OCT 2 2 2002

STATE OF ILLINOIS
Pollution Control Board

IN THE MATTER OF: PROPOSED SITE-SPECIFIC WATER POLLUTION REGULATIONS APPLICABLE TO THE CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT CORPORATION	)))))))))	R03-11

NOTICE OF FILING

TO: Ms. Dorothy M. Gunn
Clerk of the Board
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(VIA FIRST CLASS MAIL)

(SEE PERSONS ON ATTACHED LIST)

PLEASE TAKE NOTICE that I have today filed with the Office of the Illinois Pollution Control Board an original and nine copies each of the **ENTRY OF APPEARANCE OF N. LADONNA DRIVER; ENTRY OF APPEARANCE OF DAVID M. WALTER; CITY OF EFFINGHAM, BLUE BEACON INTERNATIONAL, INC., and TRUCKOMAT CORPORATION'S PETITION FOR SITE-SPECIFIC REGULATION; and MOTION TO WAIVE**

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Stored in cabinet #36

ATTACHMENT C

BENCH-SCALE

TREATABILITY STUDY REPORT

BENCH-SCALE TREATABILITY STUDY REPORT

FLUORIDE REMOVAL FROM TRUCK WASH WASTEWATER

prepared by

Shepard Engineering, Inc.
Salina, Kansas

January, 2002

INTRODUCTION

Bench-scale treatability tests were conducted in late 2001 in order to investigate the following issues relating to fluoride removal in truck wash wastewater:

- Fluoride concentrations, which could be achieved by chemical treatment.
- Chemicals and quantities, which would be required for fluoride removal.
- Quantities of sludge that are generated with fluoride removal.
- Capital and operating costs for wastewater fluoride treatment systems.

These studies were conducted in part to generate information for use in addressing the industrial wastewater discharge limit of 2.47 mg/L fluoride, which has been proposed by the City of Effingham. The largest percentage of fluoride generated in the City of Effingham is sourced from truck washes (2 truck washes operated by Blue Beacon International and 1 truck wash operated by Truck-O-Mat). Therefore, fluoride-bearing truck wash wastewater was used in these studies.

The bench-tests were developed based on a review of the literature for fluoride removal from industrial wastewater. A synopsis of this literature review is presented in a subsequent section.

This report summarizes the procedures that were followed and results that were generated from these bench studies.

LITERATURE REVIEW

Fluoride removal from industrial wastewater has typically focused on precipitation as calcium fluoride using calcium-based chemicals (i.e., calcium hydroxide or calcium chloride) or removal by sorption onto aluminum chemicals. The latter treatment methods have included sorption onto aluminum-based chemicals that are added to the wastewater solution (typically alum) or sorption onto a fixed bed such as alumina.

Since fluoride in wastewater is a soluble ion, other removal processes include ion exchange or reverse osmosis (RO). However, those processes require that the wastewater must be pretreated to a level where essentially all oil & grease and suspended solids are removed before feeding to the ion exchange or RO process.

A fluoride removal study was conducted by the Environmental Laboratory of the U.S. Army Engineer Waterways Experiment Station for Rocky Mountain Arsenal in 1979[1]. That study addressed the removal of fluoride from regeneration wastewater generated from activated alumina columns used to treat fluoride-bearing wastewater. The study report stated that the most widely used chemicals used for fluoride removal are alum coagulation and lime treatment. These chemicals are used to produce an insoluble fluoride complex that may be removed from the water as a sludge.

The subject report also concluded the following:

1. Process selection for fluoride removal is highly dependent upon the chemical characteristics of the waste stream.
2. Lime addition was reported to be the most widely used method for removal of high fluoride concentrations.
3. Some correlation has been found between fluoride removal and magnesium hardness removal. However, if magnesium hardness is not present in the water to be treated, it must be added in order to accomplish the fluoride removal, which makes the process economically unfeasible.
4. Alum coagulation was first investigated for fluoride removal in the mid-1930s. Exact chemical requirements are difficult to estimate since various studies reported data, which varied greatly with respect to raw-water pH, mixing, and commercial products utilized.
5. Alum is much more costly than lime.
6. Coagulation-precipitation processes require process trains generally including chemical addition, rapid mix, slow mix for flocculation, precipitate settling, and dewatering.
7. Ion exchange processes are not generally used on wastewaters with high concentrations of fluoride.
8. Reverse osmosis processes are generally expensive and used mainly in situations where contaminants cannot be removed by less expensive techniques.

Bench studies were conducted and produced the following results.

1. Lime addition only at a dose of 4000 mg/L reduced the fluoride concentration from 66 mg/L to 20 mg/L.
2. Lime addition followed by alum/polymer reduced the fluoride concentration from 66 mg/L to 9 mg/L.
3. Calcium chloride addition at a dose of 2500 mg/L reduced the fluoride concentration from 101 mg/L to 51 mg/L.
4. Lime and calcium chloride addition reduced the fluoride concentration from 101 mg/L to 44 mg/L.

A literature search report was prepared by the Department of the Army, Rocky Mountain Arsenal[2]. That report determined the following:

1. A full-scale removal and ultimate disposal system for treatment of concentrated fluoride wastewaters has not been reported in the available literature.
2. Precipitation of fluoride as calcium fluoride or fluorapatite and dewatering of calcium fluoride sludge is in commercial practice.
3. The cost of fluoride precipitation is specific to each wastewater.
4. A number of full-scale industrial wastewater systems are reported to be removing concentrated fluoride ions by means of precipitation with lime, calcium chloride, tricalcium phosphate or combinations of the three.
5. Chemical requirements to precipitate fluoride relate not only to the fluoride concentration in the wastewater but also to a myriad of other chemical reactions specific to each waste composition.
6. Under optimum conditions for precipitation, all full-scale systems report residual fluoride concentrations in the supernatant of 20 mg/L ± 5 mg/L.

In addition to published studies, numerous wastewater treatment texts address fluoride removal. One such text[3] states the following with respect to fluoride removal:

1. Calcium precipitation is a well-established and widely utilized technology.
2. The most common calcium reagent is lime.
3. Industrial wastewater treatment systems using lime typically reduce fluoride concentrations to the range of 10 to 40 mg/L.

Finally, fluoride removal at the Wyman-Gordon Company located in Worcester, Massachusetts is detailed in a paper that was presented at the 1996 Purdue Industrial Waste Conference[4]. This paper discussed treatability studies, which investigated the efficacy of calcium, aluminum, and the combination of calcium and aluminum to remove fluoride. This study found that the lowest achievable fluoride concentrations using calcium-based chemicals were in the range of 10 to 20 mg/L. Fluoride concentrations in the range of 5 to 7 mg/L were achieved using combinations of lime and alum. However, for those cases, large chemical dosages were required and large quantities of sludge were generated.

LITERATURE REVIEW BIBLIOGRAPHY

1. Treatment and Disposal of Regeneration Wastewater From Activated Alumina Columns Used For Fluoride Removal From Groundwater At Rocky Mountain Arsenal, Army Engineer Waterways Experiment Station, Vicksburg, MS, Environmental Lab, January, 1980.

2. Removal of Fluoride From Concentrated Fluoride Wastewater: A Literature Search, Rubel and Hager, Inc., Tucson, AZ, June, 1979.

3. Toxicity Reduction: Evaluation and Control, Ford, Davis, L., Technomic Publishing Co., Inc., Lancaster, PA, 1992.

4. Proceedings of the 51st Industrial Waste Conference, May 6, 7, 8, 1996, Purdue University, Ann Arbor Press, Chelsea, MI, 1997.

TREATABILITY STUDY PROCEDURES

The subject treatability studies were developed and supervised by Shepard Engineering, Inc., Salina, Kansas. The bench tests were conducted by Chris Roelke, Industrial Wastewater Treatment Plant operator for the Blue Beacon Truck Wash in Carlisle, Pennsylvania. Untreated wastewater samples used in the bench tests were collected from the wastewater generated by the Blue Beacon of Carlisle truck wash. This wastewater is essentially the same as that generated in Effingham (for both Blue Beacon and Truck-O-Mat), therefore; the results described herein are applicable for the Effingham wastewater.

Two sets of trials were conducted – one in October, 2001 and one in December, 2001. For both cases, untreated wastewater samples were collected from a 20,000 gallon wastewater equalization tank for use in conducting the treatability studies. The 20,000 gallon volume represents a minimum of 16 hours storage. Therefore, the treatability study samples are a good representation of wastewater that is generated on a daily basis.

The primary difference between the two sets of bench test procedures that were conducted is the untreated fluoride concentrations. That information will be so stated in the summary of results.

Specific bench test procedures are enumerated below.

1. 1000 ml of untreated wastewater were used in each trial.
2. The initial pH was measured and recorded.
3. The 1000 ml aliquot was well-mixed and the following treatment steps taken:

Trial 1-A: Lime added to pH 9.0, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-B: Lime added to pH 10.0, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-C: Lime added to pH 11.0, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-D: Lime added to pH 12.0, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-E: Added 825 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-F: Added 1650 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-G: Added 2475 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-H: Added 3300 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-I: Added 4125 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-J: Added 300 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-K: Added 900 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-L: Added 1800 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-M: Added 3600 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-N: Added 825 mg/L calcium chloride and 300 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-O: Added 825 mg/L calcium chloride and 900 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-P: Added 825 mg/L calcium chloride and 1800 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 1-Q: Added 825 mg/L calcium chloride and 3600 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-A: Added lime to pH = 12.0, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-B: Added lime to pH = 12.0 and 150 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-C: Added lime to pH = 12.0 and 450 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-D: Added lime to pH = 12.0 and 900 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-E: Added lime to pH = 12.0 and 1,800 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-F: Added 4125 mg/L calcium chloride, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-G: Added 4125 mg/L calcium chloride and 150 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-H: Added 4125 mg/L calcium chloride and 450 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-I: Added 4125 mg/L calcium chloride and 900 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

Trial 2-J: Added 4125 mg/L calcium chloride and 1800 mg/L alum, mixed rapidly for 20 minutes, then slowly for 10 minutes, allowed solids to settle overnight, collected supernatant sample for fluoride analysis.

RESULTS

Bench study treatability results are summarized in Table 1. Fluoride concentration data were measured by Continental Analytical Services Laboratory, Salina, Kansas using EPA Method 300.0/9056. Copies of the CAS Laboratory Reports and QA/QC data are included as Appendix A.

DISCUSSION OF RESULTS

The data summarized in Table 1 indicate that none of the treatability test trials was able to achieve the fluoride discharge limit of 2.47 mg/L, which has been proposed by the City of Effingham. The lowest fluoride concentration was achieved with trial #s 1-M and 2-H.; these trials produced supernatant fluoride concentrations of 8 mg/L and 13 mg/L, respectively. Trial 1-M used an alum dosage of 3600 mg/L, while trial 2-H used a calcium chloride dosage of 4125 mg/L in combination with an alum dosage of 450 mg/L.

The other trials, which used varying dosages and combinations of calcium-based treatment chemicals (i.e., lime and calcium chloride) and alum, produced fluoride removals that ranged from 1 to 90 percent.

CONCLUSIONS

1. A review of the literature indicates that the most common and cost-effective methods for (high concentration) fluoride removal from wastewater typically include the use of calcium and/or aluminum based treatment chemicals.

2. Bench test treatability studies using Blue Beacon truck wash wastewater indicated that fluoride removal from an untreated concentration of 180 mg/L to a level in the range of 10 mg/L could be achieved using alum or a combination of calcium chloride and alum.

APPENDIX A – LABORATORY REPORTS

TABLE 1: BENCH TEST TREATABILITY STUDY SUMMARY OF RESULTS

Trial No.	Description	Untreated Fluoride Conc. (mg/L)	Treated Fluoride Conc. (mg/L)	% Fluoride Removal
1-A	lime to pH = 9.0	180	131	27.2
1-B	lime to pH = 10.0	180	141	21.7
1-C	lime to pH = 11.0	180	112	37.8
1-D	lime to pH = 12.0	180	46	74.4
1-E	825 mg/L calcium chloride	180	95	47.2
1-F	1650 mg/L calcium chloride	180	75	58.3
1-G	2475 mg/L calcium chloride	180	65	63.9
1-H	3300 mg/L calcium chloride	180	55	69.4
1-I	4125 mg/L calcium chloride	180	32	82.2
1-J	300 mg/L alum	180	179	0.6
1-K	900 mg/L alum	180	180	0.0
1-L	1800 mg/L alum	180	160	11.1
1-M	3600 mg/L alum	180	8	95.6
1-N	825 mg/L calcium chloride and 300 mg/L alum	180	72	60.0
1-O	825 mg/L calcium chloride and 900 mg/L alum	180	102	43.3
1-P	825 mg/L calcium chloride and 1800 mg/L alum	180	116	35.6
1-Q	825 mg/L calcium chloride and 3600 mg/L alum	180	85	52.8
2-A	lime to pH = 12.0	174	90	48.3
2-B	lime to pH = 12.0 and 150 mg/L alum	174	79	54.6
2-C	lime to pH = 12.0 and 450 mg/L alum	174	44	74.7
2-D	lime to pH = 12.0 and 900 mg/L alum	174	54	69.0
2-E	lime to pH = 12.0 and 1800 mg/L alum	174	32	81.6
2-F	4125 mg/L calcium chloride	174	20	88.5
2-G	4125 mg/L calcium chloride and 150 mg/L alum	174	67	61.5
2-H	4125 mg/L calcium chloride and 450 mg/L alum	174	13	92.5
2-I	4125 mg/L calcium chloride and 900 mg/L alum	174	40	77.0
2-J	4125 mg/L calcium chloride and 1800 mg/L alum	174	18	89.7

Notes:

1. # 1 trials conducted using untreated wastewater sample collected from Blue Beacon of Carlisle truck wash equalization tank on October 19, 2001.
2. # 2 trials conducted using untreated wastewater sample collected from Blue Beacon of Carlisle truck wash equalization tank on December 27, 2001.
3. Analyses conducted by CAS Laboratories, Salina, Kansas.

Received 1-24-02

Continental Analytical Services, Inc.

10/25/2001

Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Received: 10/20/2001
Continental File No.: 5891
Continental Order No.: 74128
Your P.O./Project No.: #42 - CA

Dear Mr. Rose:

This laboratory report consisting of 7 pages contains the analytical results for the following samples:

CAS LAB ID #	SAMPLE DESCRIPTION	SAMPLE TYPE	DATE SAMPLED
01101918	#42 - CA Al-1	Liquid	10/19/2001
01101919	#42 - CA Al-2	Liquid	10/19/2001
01101920	#42 - CA Al-3	Liquid	10/19/2001
01101921	#42 - CA Al-4	Liquid	10/19/2001
01101922	#42 - CA CaAl-1	Liquid	10/19/2001
01101923	#42 - CA CaAl-2	Liquid	10/19/2001
01101924	#42 - CA CaAl-3	Liquid	10/19/2001
01101925	#42 - CA CaAl-4	Liquid	10/19/2001
01101926	#42 - CA Lime 1	Liquid	10/19/2001
01101927	#42 - CA Lime 2	Liquid	10/19/2001
01101928	#42 - CA Lime 3	Liquid	10/19/2001
01101929	#42 - CA Lime 4	Liquid	10/19/2001
01101930	#42 - CA CaCl-1	Liquid	10/19/2001
01101931	#42 - CA CaCl-2	Liquid	10/19/2001
01101932	#42 - CA CaCl-3	Liquid	10/19/2001
01101933	#42 - CA CaCl-4	Liquid	10/19/2001
01101934	#42 - CA CaCl-5	Liquid	10/19/2001

Thank you for choosing Continental for this project. If you have any questions, please contact me at (800)535-3076.

CONTINENTAL ANALYTICAL SERVICES, INC.

Gregory J. Groene
Project Manager

1804 Glendale Road • Salina, Kansas 67401-6675
785-827-1273 • 800-535-3076 • FAX 785-823-7830

QUALITY ETHICS SERVICE
ACIL Seal of Excellence

Continental
Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 10/25/2001
Date Sample Recd: 10/20/2001
Continental File No: 5891
Continental Order No: 74128
Client P.O.: #42 - CA

Lab Number: 01101918
Sample Description: #42 - CA Al-1

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	179.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101918

Lab Number: 01101919
Sample Description: #42 - CA Al-2

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	180.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101919

Lab Number: 01101920
Sample Description: #42 - CA Al-3

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	160.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

-Continued-

QUALITY ETHICS SERVICE
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Client: Blue Beacon International, Inc.
Lab Number: 01101920

Analysis	Concentration	Units	Date Analyzed	Book/Page

Conclusion of Lab Number: 01101920

Lab Number: 01101921
Sample Description: #42 - CA Al-4
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	87.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101921

Lab Number: 01101922
Sample Description: #42 - CA CaAl-1
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	72.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101922

Lab Number: 01101923
Sample Description: #42 - CA CaAl-2
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	102.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-2	GT	300.0/9056

-Continued-

Client: Blue Beacon International, Inc.
Lab Number: 01101923

Conclusion of Lab Number: 01101923

Lab Number: 01101924
Sample Description: #42 - CA CaAl-3
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	116.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-2	GT	300.0/9056

Conclusion of Lab Number: 01101924

Lab Number: 01101925
Sample Description: #42 - CA CaAl-4
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	85.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-2	GT	300.0/9056

Conclusion of Lab Number: 01101925

Lab Number: 01101926
Sample Description: #42 - CA Lime 1
Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	131.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-2	GT	300.0/9056

-Continued-

Client: Blue Beacon International, Inc.
Lab Number: 01101926

Conclusion of Lab Number: 01101926

Lab Number: 01101927
Sample Description: #42 - CA Lime 2

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	141.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101927

Lab Number: 01101928
Sample Description: #42 - CA Lime 3

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	112.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101928

Lab Number: 01101929
Sample Description: #42 - CA Lime 4

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	46.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

-Continued-

Client: Blue Beacon International, Inc.
Lab Number: 01101929

Conclusion of Lab Number: 01101929

Lab Number: 01101930
Sample Description: #42 - CA CaCl-1

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	95.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101930

Lab Number: 01101931
Sample Description: #42 - CA CaCl-2

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	75.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101931

Lab Number: 01101932
Sample Description: #42 - CA CaCl-3

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	65.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

-Continued-

Client: Blue Beacon International, Inc.
Lab Number: 01101932

Conclusion of Lab Number: 01101932

Lab Number: 01101933
Sample Description: #42 - CA CaCl-4

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	55.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101933

Lab Number: 01101934
Sample Description: #42 - CA CaCl-5

Date Sampled: 10/19/2001
Time Sampled: 0900

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	32.	mg/L	10/23/2001	5055/19

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	011023-1	GT	300.0/9056

Conclusion of Lab Number: 01101934

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Clifford J. Baker
Technical Manager

Continental Analytical Services, Inc.

COVER SHEET

LAB NO. 02010121-0126

=================
| ORDER #: 75739 | FILE NO: 6755
=================

PROJ. MNGR. MDM
APPROVED BY mdm DATE: 1/4/02

Not approved by ____ Date: / /
Not approved by ____ Date: / /
Not approved by ____ Date: / /
Not approved by ____ Date: / /

CLIENT NAME: Western Resources
CLIENT CONTACT: Tom Brown
ADDRESS: P.O. Box 889
CITY AND STATE: Topeka, KS 66601
DATE RECEIVED: 01/04/2002
SAMPLE LOCATION: C-32
REPORT DUE DATE: / /
CLIENT SPECIAL INSTRUCTIONS:

ASSEMBLED BY plh DATE 1-4-02
LOG-IN BY ml DATE 1-4-02

Send original report with Inv. if Tom Brown Project. Send copy of report with invoice if not Tom Brown Project. Always type Project Name (Ex: Hutchinson EC). JEC Bottom Ash - Send kit when recd.

REASON FOR NON APPROVAL

WRONG SAMPLE DESCRIPTION ____________

WRONG TEST ASSIGNMENTS ____________

WRONG DUE DATE ____________

WRONG PRICES ____________

OTHER:

SEND: _____ NOTHING ✓ WORKSHEETS ✓ BILLING ✓ COOLER REC'T FORM

FINAL REPORT:		QC REPORTS:	
______	FAX (F / I)	X	NO QC
______	FED EX STD/PRIORITY	______	ALL STD. QC
______	MAIL W/QC	______	ICV/CCV
______	~~MAIL W/OUT QC~~	______	LCS/LCSD SUR
______	HOLD FOR PM/DELIVERY	______	MS/MSD SUR
______	DISKETTE	______	______
1/11/02	~~E-MAIL~~	______	______
______	~~MAIL W/INVOICE~~ to acctg	______	______
______	FIELD DATA	______	______
______	RAW DATA	______	______
______	______	______	______

FAX / MAIL / FED-EX COPY ~~OF FINAL~~ REPORT TO: Tom Cleland
INCLUDE COPY OF QC REPORT: ______ YES ______ NO LEC

1/11/02

Continental Analytical Services, Inc.

1-24-02

01/23/2002

Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Re: Continental File Number: 5891
Continental Order Number: 74128
Continental Project Manager: Gregory J. Groene
Your P.O./Project No.: #42 - CA

Dear Mr. Rose:

Enclosed are the Quality Control Reports for the referenced order number. A general description of the information contained in each report is presented below.

METHOD BLANK DATA
A method blank is a matrix similar to that of the sample which has been prepared and analyzed by the same method as the sample. The method blank is used to assure that the preparation and analysis method has not introduced contamination. The Method Blank Data Report provides the analytical results for each method blank prepared and analyzed from the same quality control batch as that of the client's samples.

LABORATORY CONTROL SAMPLE/LABORATORY CONTROL SAMPLE DUPLICATE DATA
A laboratory control sample is a matrix similar to that of the sample which has been spiked with known concentrations of analytes and prepared and analyzed by the same method as the sample. The Laboratory Control Sample (LCS) percent recovery is a measure of the accuracy of the preparation and analysis method. The Laboratory Control Sample Duplicate (LCSD) is a duplicate preparation and analysis of the LCS. The LCS and LCSD are used to calculate the relative percent difference, which is a measure of the precision of the preparation and analysis method. The LCS/LCSD Report provides the analytical results for all laboratory control samples prepared and analyzed from the same quality control batch as that of the client's samples.

SURROGATE DATA
A surrogate is a compound that is similar to the compounds of interest, but is not normally found in environmental samples. Surrogates are added to the sample prior to preparation and analysis. The surrogate percent recovery is a measure of the effectiveness of the preparation and analysis method on the individual sample. The Surrogate Data Report provides the surrogate recoveries for each sample that required organic analysis.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE DATA
A matrix spike is an aliquot of a sample spiked with compounds of interest and prepared and analyzed by the same method as the sample. The Matrix Spike (MS) percent recovery is a measure of the effectiveness of the preparation and analysis method on the specific sample matrix. The Matrix Spike Duplicate (MSD) is a duplicate preparation and analysis of the MS. The MS and MSD are used to calculate the relative percent difference, which is a measure of the precision of the preparation and analysis method. The MS/MSD Report provides the analytical results for all matrix spike and matrix spike duplicate analyses performed either on samples from the client's order or on samples from the same quality control batch as that of the client's sample.

POST DIGESTION SPIKE DATA
A post digestion spike (PDS) is performed only on samples requiring analysis for metals. A portion of the sample, after preparation by digestion with acid, is spiked with known concentrations of the metals of interest and analyzed. Acceptable recovery of the spike indicates that a matrix interference does not exist in the sample for the metal analyzed.

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785-827-1273 • 800-535-3076 • FAX 785-823-7830

01/23/2002

ACCURACY AND PRECISION LIMITS
The accuracy and precision limits are method or laboratory determined limits indicating acceptable accuracy or precision for a given matrix. The accuracy limits are expressed with units of percent recovery. The precision limits are expressed with units of relative percent difference (RPD). Accuracy and/or precision limits are provided on the LCS/LCSD Report, MS/MSD Report and the Surrogate Data Report.

QUALITY CONTROL BATCH
Each batch of twenty or fewer samples of the same matrix, prepared and analyzed by the same method, is assigned a Quality Control Batch number. The Quality Control Batch number for each sample is provided on the Laboratory Report. With each batch, a method blank, two laboratory control samples and a matrix spike/matrix spike duplicate are prepared and analyzed. The analytical results for the method blank, laboratory control and matrix spike/matrix spike duplicate samples are provided on the Method Blank Data Report, LCS/LCSD Report and MS/MSD Report, respectively.

DATE PREPARED
The date prepared is the date the sample was extracted or digested in preparation for analysis. If the extraction or digestion is performed as part of the analysis, "N/A" is reported for the date prepared. The date prepared for each sample is provided on the Laboratory Report.

DATE ANALYZED
The date analyzed is the date the analysis was performed on the sample. The date analyzed for each sample is provided on the Laboratory Report.

If you have any questions regarding this data, please contact me or your Continental Project Manager at (800)535-3076.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Enclosures
Quality Control Reports:
- Method Blank Data
- Laboratory Control Sample/Laboratory Control Sample Duplicate Data
- Matrix Spike/Matrix Spike Duplicate Data

Continental Analytical Services, Inc.

QUALITY CONTROL REPORT
METHOD BLANK DATA

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 10/20/2001
Continental File No: 5891
Continental Order No: 74128
Client P.O.: #42 - CA

QC Batch	Lab Number	Analysis	Concentration	Units	Book/Page
011023-1	011023BLK1	Fluoride	ND(0.1)	mg/L	5055/19
011023-2	011023BLK2	Fluoride	ND(0.1)	mg/L	5055/19

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Paulette K Guzman for
Jacqueline Cairo
Quality Assurance Officer

Quality Ethics Service
ACIL Seal of Excellence

Continental
Analytical Services, Inc.

QUALITY CONTROL REPORT
LABORATORY CONTROL SAMPLE / LABORATORY CONTROL SAMPLE DUPLICATE DATA

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 10/20/2001
Continental File No: 5891
Continental Order No: 74128
Client P.O.: #42 - CA

QC Batch	Lab Number	Analysis	Spike Level	Units	Accuracy Data (% Recovery) LCS	LCSD	Limits	Precision Data RPD	Limit
011023-1	011023LCS1	Fluoride	10	mg/L	104.	104.	93.7-109	0.0	4.4
011023-2	011023LCS2	Fluoride	10	mg/L	104.	104.	93.7-109	0.0	4.4

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Jacqueline Cairo
Quality Assurance Officer

QUALITY ETHICS SERVICE
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QUALITY CONTROL REPORT
MATRIX SPIKE / MATRIX SPIKE DUPLICATE DATA

Client: Blue Beacon International, Inc.
Attn:Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 10/20/2001
Continental File No: 5891
Continental Order No: 74128
Client P.O.: #42 - CA

Matrix Spike/Matrix Spike Duplicate Data from Sample Batch:

Analysis	QC Batch	Spike Level Units	Accuracy Data (% Recovery) MS	MSD	Limits	Precision Data RPD	Limit	Laboratory Number
Fluoride	011023-1	100 mg/L	96.6	96.2	81.8-121	0.4	2.9	01101893
Fluoride	011023-2	10 mg/L	98.9	97.8	81.8-121	1.1	2.9	01101820

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Jacqueline Cairo
Quality Assurance Officer

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Analytical Services, Inc.

1-24-02

01/11/2002

Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Received: 12/28/2001
Continental File No.: 5891
Continental Order No.: 75675
Your P.O./Project No.: #42 - CA

Dear Mr. Rose:

This laboratory report consisting of 12 pages contains the analytical results for the following samples:

CAS LAB ID #	SAMPLE DESCRIPTION	SAMPLE TYPE	DATE SAMPLED
01122124	CA - #42 Inf	Liquid	12/27/2001
01122125	CA - #42 Lime 1	Liquid	12/27/2001
01122126	CA - #42 Lime 2	Liquid	12/27/2001
01122127	CA - #42 Lime 3	Liquid	12/27/2001
01122128	CA - #42 Lime 4	Liquid	12/27/2001
01122129	CA - #42 Lime 5	Liquid	12/27/2001
01122130	CA - #42 CaCl 1	Liquid	12/27/2001
01122131	CA - #42 CaCl 2	Liquid	12/27/2001
01122132	CA - #42 CaCl 3	Liquid	12/27/2001
01122133	CA - #42 CaCl 4	Liquid	12/27/2001
01122134	CA - #42 CaCl 5	Liquid	12/27/2001

Thank you for choosing Continental for this project. If you have any questions, please contact me at (800)535-3076.

CONTINENTAL ANALYTICAL SERVICES, INC.

Gregory J. Groene
Project Manager

1804 Glendale Road • Salina, Kansas 67401-6675
785-827-1273 • 800-535-3076 • FAX 785-823-7830

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Continental Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122124
Sample Description: CA - #42 Inf

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	174.	mg/L	01/04/2002	5112/3

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020103-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Continental Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122125
Sample Description: CA - #42 Lime 1

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	90.	mg/L	01/08/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

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Clifford J. Baker
Technical Manager

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Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122126
Sample Description: CA - #42 Lime 2

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	79.	mg/L	01/08/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

for Clifford J. Baker
Technical Manager

1804 Glendale Road • Salina, Kansas 67401-6675
785-827-1273 • 800-535-3076 • FAX 785-823-7830

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122127
Sample Description: CA - #42 Lime 3

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	44.	mg/L	01/08/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

Continental
Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122128
Sample Description: CA - #42 Lime 4

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	54.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

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Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122129
Sample Description: CA - #42 Lime 5

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	32.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

for
Clifford J. Baker
Technical Manager

QUALITY ETHICS SERVICE
ACIL Seal of Excellence

Continental Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122130
Sample Description: CA - #42 CaCl 1

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	20.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

for Clifford J. Baker
Technical Manager

1804 Glendale Road • Salina, Kansas 67401-6675
785-827-1273 • 800-535-3076 • FAX 785-823-7830

Quality Ethics Service
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Continental Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122131
Sample Description: CA - #42 CaCl 2

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	67.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

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Analytical Services, Inc.

Client: Blue Beacon International, Inc.	Date Sample Rptd: 01/11/2002
Attn: Mike Rose	Date Sample Recd: 12/28/2001
P.O. Box 0856	Continental File No: 5891
Salina, KS 67402-0856	Continental Order No: 75675
	Client P.O.: #42 - CA

Lab Number: 01122132
Sample Description: CA - #42 CaCl 3

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	13.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

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for Clifford J. Baker
Technical Manager

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Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122133
Sample Description: CA - #42 CaCl 4

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	40.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

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Continental Analytical Services, Inc.

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Rptd: 01/11/2002
Date Sample Recd: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Lab Number: 01122134
Sample Description: CA - #42 CaCl 5

Date Sampled: 12/27/2001
Time Sampled: 1000

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	18.	mg/L	01/09/2002	5112/9

Analysis	Date Prepared	QC Batch	Analyst	Method(s)
Fluoride	N/A	020108-1	MDB	300.0/9056

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA Publication, SW-846, 3rd edition, September, 1986 and the latest promulgated update. ND(), where noted, indicates none detected with the reporting limit in parentheses. Samples will be retained for thirty days unless otherwise notified.

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1-24-02

01/23/2002

Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Re: Continental File Number: 5891
Continental Order Number: 75675
Continental Project Manager: Gregory J. Groene
Your P.O./Project No.: #42 - CA

Dear Mr. Rose:

Enclosed are the Quality Control Reports for the referenced order number. A general description of the information contained in each report is presented below.

METHOD BLANK DATA
A method blank is a matrix similar to that of the sample which has been prepared and analyzed by the same method as the sample. The method blank is used to assure that the preparation and analysis method has not introduced contamination. The Method Blank Data Report provides the analytical results for each method blank prepared and analyzed from the same quality control batch as that of the client's samples.

LABORATORY CONTROL SAMPLE/LABORATORY CONTROL SAMPLE DUPLICATE DATA
A laboratory control sample is a matrix similar to that of the sample which has been spiked with known concentrations of analytes and prepared and analyzed by the same method as the sample. The Laboratory Control Sample (LCS) percent recovery is a measure of the accuracy of the preparation and analysis method. The Laboratory Control Sample Duplicate (LCSD) is a duplicate preparation and analysis of the LCS. The LCS and LCSD are used to calculate the relative percent difference, which is a measure of the precision of the preparation and analysis method. The LCS/LCSD Report provides the analytical results for all laboratory control samples prepared and analyzed from the same quality control batch as that of the client's samples.

SURROGATE DATA
A surrogate is a compound that is similar to the compounds of interest, but is not normally found in environmental samples. Surrogates are added to the sample prior to preparation and analysis. The surrogate percent recovery is a measure of the effectiveness of the preparation and analysis method on the individual sample. The Surrogate Data Report provides the surrogate recoveries for each sample that required organic analysis.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE DATA
A matrix spike is an aliquot of a sample spiked with compounds of interest and prepared and analyzed by the same method as the sample. The Matrix Spike (MS) percent recovery is a measure of the effectiveness of the preparation and analysis method on the specific sample matrix. The Matrix Spike Duplicate (MSD) is a duplicate preparation and analysis of the MS. The MS and MSD are used to calculate the relative percent difference, which is a measure of the precision of the preparation and analysis method. The MS/MSD Report provides the analytical results for all matrix spike and matrix spike duplicate analyses performed either on samples from the client's order or on samples from the same quality control batch as that of the client's sample.

POST DIGESTION SPIKE DATA
A post digestion spike (PDS) is performed only on samples requiring analysis for metals. A portion of the sample, after preparation by digestion with acid, is spiked with known concentrations of the metals of interest and analyzed. Acceptable recovery of the spike indicates that a matrix interference does not exist in the sample for the metal analyzed.

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) 23/2002

A URACY AND PRECISION LIMITS
T accuracy and precision limits are method or laboratory determined limits indicating acceptable accuracy or precision for a given matrix. The accuracy limits are expressed with units of percent recovery. The precision limits are expressed with units of relative percent difference (RPD). Accuracy and/or precision l its are provided on the LCS/LCSD Report, MS/MSD Report and the Surrogate Data Report.

QUALITY CONTROL BATCH
Each batch of twenty or fewer samples of the same matrix, prepared and analyzed by the same method, is a signed a Quality Control Batch number. The Quality Control Batch number for each sample is provided on the L boratory Report. With each batch, a method blank, two laboratory control samples and a matrix spike/matrix spike duplicate are prepared and analyzed. The analytical results for the method blank, laboratory control and matrix spike/matrix spike duplicate samples are provided on the Method Blank Data Report, LCS/LCSD Report a d MS/MSD Report, respectively.

DATE PREPARED
The date prepared is the date the sample was extracted or digested in preparation for analysis. If the e traction or digestion is performed as part of the analysis, "N/A" is reported for the date prepared. The d te prepared for each sample is provided on the Laboratory Report.

DATE ANALYZED
T e date analyzed is the date the analysis was performed on the sample. The date analyzed for each sample is p ovided on the Laboratory Report.

If you have any questions regarding this data, please contact me or your Continental Project Manager at 00)535-3076.

CONTINENTAL ANALYTICAL SERVICES, INC.

Ufford J. Baker

ifford J. Baker
Technical Manager

closures
Quality Control Reports:
- Method Blank Data
- Laboratory Control Sample/Laboratory Control Sample Duplicate Data
- Matrix Spike/Matrix Spike Duplicate Data

Continental
Analytical Services, Inc.

QUALITY CONTROL REPORT
METHOD BLANK DATA

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

QC Batch	Lab Number	Analysis	Concentration	Units	Book/Page
020103-1	020103BLK1	Fluoride	ND(0.1)	mg/L	5112/3
020108-1	020108BLK1	Fluoride	ND(0.1)	mg/L	5112/9

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

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Clifford J. Baker
Technical Manager

Paulette K Guzman for
Jacqueline Cairo
Quality Assurance Officer

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QUALITY CONTROL REPORT
LABORATORY CONTROL SAMPLE / LABORATORY CONTROL SAMPLE DUPLICATE DATA

Client: Blue Beacon International, Inc.
Attn: Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

QC Batch	Lab Number	Analysis	Spike Level Units	Accuracy Data (% Recovery) LCS	LCSD	Limits	Precision Data RPD	Limit
020103-1	020103LCS1	Fluoride	10 mg/L	103.	103.	93.7-109	0.0	4.4
020108-1	020108LCS1	Fluoride	10 mg/L	94.3	96.9	93.7-109	2.7	4.4

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

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Technical Manager

Paulette K Guzman for
Jacqueline Cairo
Quality Assurance Officer

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QUALITY CONTROL REPORT
MATRIX SPIKE / MATRIX SPIKE DUPLICATE DATA

Client: Blue Beacon International, Inc.
Attn:Mike Rose
P.O. Box 0856
Salina, KS 67402-0856

Date Sample Reported: 01/23/2002
Date Sample Received: 12/28/2001
Continental File No: 5891
Continental Order No: 75675
Client P.O.: #42 - CA

Matrix Spike/Matrix Spike Duplicate Data from Sample Batch:

Analysis	QC Batch	Spike Level	Units	Accuracy Data (% Recovery) MS	MSD	Limits	Precision Data RPD	Limit	Laboratory Number
Fluoride	020103-1	1000	mg/L	103.	103.	81.8-121	0.0	2.9	01120678
Fluoride	020108-1	1000	mg/L	101.	101.	81.8-121	0.0	2.9	01122149

Quality control analyses were performed on samples at time of analysis in accordance with procedures Published in Title 40 of the Code of Federal Regulations, Parts 136 or 141, or in EPA publication, SW-846, 3rd edition, Nov. 1986 and the latest promulgated update.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker
Technical Manager

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Jacqueline Cairo
Quality Assurance Officer

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ATTACHMENT D

REVIEW OF FLUORIDE TOXICITY DATA AND DEVELOPMENT OF FLUORIDE AQUATIC TOXICITY CRITERIA FOR THE EFFINGHAM, ILLINOIS WASTE WATER TREATMENT PLANT

Review of Fluoride Toxicity Data
and Development of Fluoride Aquatic Toxicity Criteria
for the Effingham, Illinois Wastewater Treatment Plant

Prepared for:

Blue Beacon
Salina, Kansas

Prepared by:

COMMONWEALTH BIOMONITORING
8061 Windham Lake Drive
Indianapolis, Indiana 46214
(317)297-7713

Submitted: February 2002

EXECUTIVE SUMMARY

Blue Beacon requested Commonwealth Biomonitoring make a scientific evaluation of fluoride toxicity and potential effects of fluoride on the receiving stream at the Effingham, Illinois wastewater treatment plant.

We assembled all available information on the toxicity of fluoride to aquatic life. The lowest concentration determined in laboratory tests to have a long-term (chronic) effect on freshwater animals present in Illinois was 3 mg/l. This was a test on rainbow trout in very soft water.

Tests with five different animals showed that fluoride toxicity is significantly reduced in the much harder water characteristic of Central Illinois. The Little Wabash River downstream from Effingham is very hard (greater than 300 mg/l during low flow conditions). Therefore we used a method developed by U.S. EPA to account for hardness effects on toxicity. The available data indicate that there is little likelihood that fluoride would be detrimental to aquatic life downstream from Effingham until concentrations exceed 10 mg/l.

Field studies published in the scientific literature support this finding. Each study, including one conducted in Illinois, shows that sensitive aquatic species may exist where fluoride concentrations exceeds 5-10 mg/l.

Two recent studies done at Effingham also indicate that fluoride in the wastewater treatment plant discharge is not causing any environmental harm. A bioassessment by Illinois EPA in 1999 showed that net-spinning caddisflies, which are known to be very sensitive to fluoride, are the dominant group of animals in the receiving stream a mile below the wastewater treatment plant. Also, a whole effluent toxicity test in 1998 showed that the Efffingham effluent had no adverse effects on *Ceriodaphnia dubia* or fathead minnow survival.

Table 1. Macroinvertebrate data collected during the Effingham FRSS. September 08, 1999.

TAXON	TOLERANCE RATING	STATION A1	C1	C2	C4	C5	C6	D1
Plecoptera	1.5							
Oligoneuriidae	3.0							
Corydalidae	3.0							
Calopterygidae	3.5					1	2	
Trichoptera (Non-Hydropsychidae)	3.5							
Heptageniidae	3.5							
Sialidae	4.0							
Amphipoda	4.0							
Baetidae	4.0					4	8	
Potamanthidae	4.0							
Tipulidae	4.0							
Cyrenidae (*Corbicula fluminae)*	4.0							
Anisoptera	4.5				2	2		2
Ephemeridae	5.0							
Cambaridae	5.0							
Ceratopogonidae	5.0							
Elmidae or Dryopidae	5.0					1		
Sphaeriidae	5.0			4	2	8	1	4
Caenidae or Tricorythidae	5.5							
Coenagrionidae	5.5	6		24	31	29	22	7
→ Hydropsychidae	5.5	4				34	9	
Asellidae	6.0							
Chironomidae (Non-Chironomus)	6.0	2	24	15	13	15	2	9
Simuliidae	6.0				1			
Turbellaria	6.0	3				1		
Other Gastropoda	6.0							
Planorbidae	6.5							
Scirtidae (larvae only)	7.0							
Lymnaeidae	7.0							
Ancylidae (*Ferrissia sp.*)	7.0					1		
Tabanidae	7.0					1		
Culicidae	8.0							
Hirudinea	8.0						1	1
Physidae	9.0		19	45	8	3	2	1
Oligochaeta	10.0			2	1		1	
Red Chironomidae (blood midge)	11.0	4	58	34	22	5		7
TOTAL ABUNDANCE		19	101	124	80	105	48	31
TAXA RICHNESS		5	3	6	8	13	9	7
MBI		6.8	9.4	8.4	7.5	5.8	5.5	7.0

AGENCY BIOMONITORING TEST RESULTS SUMMARY

Reviewer's Name: **Mike Henebry** Date: **February 26, 1998**

Facility Name: **Effingham STP** NPDES No.: **IL0028622-001** Expiration Date: **08/31/98**
Receiving Water: **Unnamed Tributary Salt Creek** Reach No.: **05120114011/off**

Upstream 7Q10: 0 CFS Discharge Average (**August, October, November, 1996**) Low Flow: 2.8 CFS
Dilution Ratio: 0 Instream Waste Concentration: 100% Waste concentration in 25% of dilution water: 100%

Facility Type: **Municipal** DID Number: **CP-049-01**
Treatment Level:
Process Information: **RBCs, rapid sand filters**
Effluent Ammonia (total): 0.66 mg/L
Effluent Variability:
M.Z. Delineation Study: Effluent Chlorine (TRC): 0.08 mg/L (not dechlorinated)

TOXICITY DATA

Bioassay Date: **02/04/98** Laboratory: **The Advent Group, Inc.**

Dilution Water Source: **Moderately Hard Reconstituted Water** Receiving Water Toxicity: **Not tested**

Acute Bioassays: Screen *Ceriodaphnia*: N/A Definitive *Ceriodaphnia*: **No effect**
Screen Fathead Minnow: N/A Definitive Fathead Minnow: **No effect**

Chronic Bioassays: *Ceriodaphnia* NOEC: N/A Fathead Minnow NOEC: N/A Algae NOEC: N/A
* in 100% effluent

Other Bioassays:

Test Date	Laboratory	Dilution Water Source	Acute Bioassays	Chronic Bioassays
12/07/87	IEPA	Unnamed Tributary Salt Creek	No effect to *Ceriodaphnia* No effect to fathead minnow	*Ceriodaphnia* NOEC = 32% No effect to fathead minnow No effect to algae
06/22/88	USEPA	Unnamed Tributary Salt Creek	Not conducted	No effect to *Ceriodaphnia* No effect to fathead minnow No effect to algae
05/05/92	IEPA	Unnamed Tributary Salt Creek	*Ceriodaphnia* LC50 = 19.1% No effect to fathead minnow	Not conducted
06/18/97	SF Analytical for IEPA	Unnamed Tributary Salt Creek	*Ceriodaphnia* mortality = 15% * No effect to fathead minnow	Not conducted

* in 100% effluent

Date of Most Recent IEPA Biosurvey: August, 1986

Comments: The 1986 biosurvey noted a slight impact to the receiving stream. Previous bioassays have found some acute toxicity to *Ceriodaphnia*. No significant toxicity to *Ceriodaphnia* was observed in this most recent toxicity test.

Recommendations: No biomonitoring is recommended as a permit condition other than the routine acute definitive testing with *Ceriodaphnia* and fathead minnow one year before permit renewal.

Effinghm.wpd

Review of Fluoride Toxicity Data
and Development of Fluoride Aquatic Toxicity Criteria
for the Effingham, Illinois Wastewater Treatment Plant

OBJECTIVE

The objective of this study was to review fluoride toxicity data and to determine a water quality criterion which could be used to protect aquatic life downstream from the City of Effingham, Illinois Wastewater Treatment Plant.

METHODS

We assembled all available information on the toxicity of fluoride to aquatic animals. Much of this information was present in the USEPA database AQUIRE, which is maintained and updated by the EPA Environmental Research Laboratory at Duluth, Minnesota. The information was edited to include only the following:

- Data on North American and Illinois freshwater species
- Data from laboratory toxicity tests
  - 48 or 96-hr acute tests
  - partial life-cycle or early life stage chronic tests

Because much of the scientific literature on fluoride suggests that there is a relationship between fluoride toxicity and hardness, the hardness values of water used in the toxicity tests was reported whenever possible.

RESULTS OF DATABASE SEARCH

The literature search revealed acceptable information on the aquatic toxicity of fluoride for twelve Illinois freshwater animal species. The available database was adequate for calculating water quality criteria using USEPA's method published in 50 F.R. 30784, July 29, 1985. Acute to chronic ratios were available for three species.

SUMMARY OF ACUTE TOXICITY EFFECTS

A summary of the data is attached in the Appendix. The lowest acute effect observed for fluoride toxicity to a freshwater animal species was 17 mg/l to the caddisfly *Ceratopsyche bronta*. A fish species (bluegill) appeared to be the most tolerant animal tested. Acute toxicity was reduced by water hardness for five species tested at different hardness values.

SUMMARY OF HARDNESS-RELATED EFFECTS ON FLUORIDE TOXICITY

Three species have been used in aquatic toxicity tests in which hardness values of the test water were significantly different in two or more tests. The following summary shows these effects:

	LC50	hardness
Rainbow trout	51	17
	128	49
	140	182
	193	385
Daphnia magna	130	70
	154	72
	227	100
	190	115
	279	169
	270	180
	340	280
Threespine stickleback	340	78
	380	146
	460	300
Fathead minnow	125	70
	134	110
	179	170
	190	260
Ceriodaphnia dubia	133	75
	157	120
	178	180
	197	280

For each of these species, toxicity decreased with increasing hardness. The inverse relationship between hardness and fluoride toxicity may be due to changes in fluoride speciation occuring in high-hardness waters. Several authors have remarked on the chemistry of fluoride in the presence of relatively high calcium concentrations (high-hardness waters).

For example, Smith et al. (Reference 8) observed that "combinations of high fluoride and moderate to high hardness caused rapid precipitation of finely divided solid, which spectorgraphic analysis indicated to consist of calcium and magnesium salts". In their tests with water of an initial hardness of 256 mg/l, the hardness dropped to 12 mg/l within a few hours after the addition of 400 mg/l fluoride (as sodium fluoride). Vallin (reference 16) noted a formation of calcium fluoride precipitate in his fluoride tests with hardness values of 320 mg/l. Apparently, fluoride combines easily with calcium in high-hardness water to form the relatively insoluble compound calcium fluoride. Once out of solution, the fluoride precipitate is in a form which is not readily available as a toxicant.

The relationship between toxicity and hardness can be expressed mathematically using the technique employed by EPA in the Gold Book (Water Quality Criteria for Water 1986, EPA 440/5-86-001). All data are normalized and a least squares regression on the normalized data is performed. The technique produces a pooled slope of the regression, by which predicted toxicity at any given hardness value may be calculated for each species.

Slopes of the regression for acute toxicity range from 0.2100 for sticklebacks to 0.5858 for *Daphnia magna*. When the available data from all three species are used in the analysis, the pooled slope of the acute toxicity-hardness regression is 0.2344. EPA uses the following equation to predict acute toxicity effects at various hardness values for each species:

$$Y = \ln W - V(\ln X - \ln Z)$$

where Y = predicted LC50
W = geometric mean of the LC50 values available
V = pooled slope
X = geometric mean of all hardness values available
Z = selected hardness value

At a hardness of 300 mg/l (the approximate hardness of the Little Wabash River at Effingham, Illinois) resident freshwater species would have the LC50 values shown in Table 1.

Table 1. ACUTE AQUATIC TOXICITY INFORMATION FOR FLUORIDE

Illinois species
Adjusted to 300 mg/l hardness

Rank	Species	48 or 96 hr LC50 mg/l
1	Ceratopsyche bronta	27
2	Cheumatopsyche pettiti	69
3	Salmo gairdneri	154
4	Philodina acuticornus	164 *
5	Brachionus calyciflorus	182 *
6	Ceriodaphnia dubia	200
7	Cyprinus carpio	202
8	Simocephalus vetulus	202 *
9	Pimephales promelas	225
10	Daphnia magna	272
11	Gambusia affinis	434 *
12	Lepomis macrochirus	861 *

* = approximate value (hardness values in the original test unknown)

SUMMARY OF CHRONIC TOXICITY EFFECTS

Chronic toxicity information was available for three species. The lowest reported chronic value to a freshwater animal species was 2.7 mg/l to rainbow trout in very soft water. However, the chronic value in very hard water was greater than 100 mg/l.

Acute to Chronic Ratios for these three species ranged from 2 to 19 for tests done under similar conditions of water hardness. The geometric mean of these A/C ratios was 8.

The chronic slopes for three species tested in a variety of water hardness conditions show that chronic toxicity of fluoride is also inversely related to hardness. The pooled chronic slope (1.1299) is even greater than the acute slope, indicating that water hardness reduces chronic toxicity to an even greater degree than it does for acute toxicity. This would be expected because the calcium available to bind with fluoride would not be used up as quickly at lower fluoride concentrations.

The U.S.EPA formula for calculating a final chronic value (FCV) at a selected hardness value is:

$$FCV = e^{\text{chronic slope (ln hardness) + chronic intercept}}$$

The chronic intercept is determined by the formula:

$$\text{intercept} = \ln \text{FCV at hardness 50} - (\text{chronic slope} \times \ln 50)$$

The FCV at hardness 50 is 1.6 mg/l (FAV 13 / A:C Ratio 8). Therefore the chronic intercept is -3.9502 and the final chronic equation for hardness effects on fluoride toxicity is:

$$FCV = e^{1.1299 (\ln \text{hardness}) - 3.9502}$$

A CHRONIC CRITERION FOR FLUORIDE AT EFFINGHAM

At low flow conditions, when fluoride concentrations would be at their highest, water hardness in the Little Wabash River downstream from Effingham exceeds 300 mg/l. The calculated chronic fluoride criterion at this hardness value is 12 mg/l. An NPDES permit limit of 5.0 mg/l in Effingham effluent appears to be more than adequate to protect downstream aquatic life from the long-term toxic effects of fluoride.

That 5.0 mg/l would protect aquatic life is supported by field studies that show no harmful effects to sensitive species where fluoride concentrations are relatively high. For example, a thriving population of brown trout (closely related to brook trout) exist in the Firehole River of Montana, where fluoride concentrations are as high as 14 mg/l (reference 12). Another field study done in Colorado showed that the benthic community in a "softwater" Colorado stream showed no reduction in diversity where fluoride averaged 3.5 mg/l (reference 14). A field study done in Illinois showed that hydropsychid caddisflies were abundant in a stream where fluoride concentrations frequently exceeded 5 mg/l (see attachment). This field study is especially important, since hydropsychid caddisflies are the most sensitive animal in the fluoride toxicity database. Finally, a 1999 bioassessment of the Effingham Wastewater Treatment Plant receiving stream showed that the stream, although impacted by low dissolved oxygen, was dominated by hydropsychid caddisflies within a mile of the Effingham discharge. Therefore, fluoride in the city's effluent appeared to be having no adverse affect on this sensitive group of aquatic organisms.

AQUATIC TOXICITY INFORMATION FOR FLUORIDE
Acute Toxicity
Illinois species only

Species	48 or 96 hr LC50 mg/l	hardness mg/l	reference
Ceratopsyche bronta	17	40	20
Cheumatopsyche pettiti	43	40	20
Salmo gairdneri	51	17	2
	128	49	2
	140	182	2
	193	385	2
Cyprinus carpio	75-91	10	1
Daphnia magna	154	72	4
	227	100	5
	279	169	19
	130	70	15
	190	115	15
	270	180	15
	340	280	15
Philodina acuticornus	158		6
Lepomis macrochirus	861		22
	>239		7
Pimephales promelas	315	20-48	8
	180	92	8
	205	256	8
	125	70	15
	134	110	15
	179	170	15
	190	260	15
Gambusia affinis	418		9
Ceriodaphnia dubia	133	75	15
	157	120	15
	178	180	15
	197	280	15
Brachionus calyciflorus	182		23
Simocephalus vetulus	202		24

Chronic Toxicity Data

Rank	Species	Chronic Value mg/l	Hardness mg/l	Reference
1	Salmo gairdneri	2.7	10	1
		>100	320	16
2	Ceriodaphnia dubia	13	80	15
		20	190	15
		33	290	15
3	Daphnia magna	47	236	15
		32	170	15
		28	114	15

Acute to Chronic Ratios (at equivalent hardness values)

Species	Acute mg/l	Chronic mg/l	Hardness mg/l	A/C Ratio
Salmo gairdneri	51	2.7	10-17	19
	193	>100	320-385	<2
Ceriodaphnia dubia	178	20	180-190	9
	197	20	280-290	10
Daphnia magna	279	31	169	9
	190	33	115	6
	270	31	180	9
	340	40	280	9

The geometric mean of these A/C Ratios is 8.

Acute Toxicity - Other North American Species

Species	48 or 96 hr LC50 mg/l	hardness mg/l	reference
Threespine stickleback	460	300	8
Threespine stickleback	380	146	8
Threespine stickleback	340	78	8
Polycelis nigra	21		21
Hydropsyche Occidentalis	35	40	23

Additional data are available on the following species, which do not occur in North America:

Chimarra marginata
Hydropsyche bulbifera
Hydropsyche exocellata
Hydropsyche lobata
Hydropsyche pellucidulla

Other Data

Species	Effect	Concentration mg/1	Reference
Green algae Scenedesmus subspicatus	4-day EC50	900	10
Green algae Selenastrum capricornutum	4-day EC50	122	7
Leopard frog Rana pipiens	reduced mobility heart enlargement	>50	11
Brown trout	healthy specimens in Firehole River	14	12
Goldfish	mortality seen after 4 days	100	13
Benthos in Colorado softwater stream	no reduction in diversity	3.5	14
Ceriodaphnia dubia	48-hr LC50	120-340	15
Rainbow trout	100-hr LC50 in water with no "hardness"	6-22	17

A program to adjust a measured LC50 value at a measured hardness value to an adjusted LC50 value at another hardness value.
The adjustment is based on a pooled slope of the effect of hardness on toxicity.
In this program, the LC50 values are adjusted to a hardness of 50 mg/l.

Metal	Species	slope	measured hardness(i)	ln hardness(i)	actual LC50i	ln LC50i	adjusted LC50x	ln LC50x	adjusted hardness(x)	ln hardne
fluoride	Daphnia magna	0.2344	70	4.2485	130	4.8675	120.14	4.7887	50	3.912
		0.2344	72	4.2767	154	5.037	141.38	4.9515	50	3.912
		0.2344	100	4.6052	227	5.425	192.96	5.2625	50	3.912
		0.2344	115	4.7449	190	5.247	156.3	5.0518	50	3.912
		0.2344	169	5.1299	279	5.6312	209.71	5.3457	50	3.912
		0.2344	180	5.193	270	5.5984	199.97	5.2982	50	3.912
		0.2344	280	5.6348	340	5.8289	227.04	5.4251	50	3.912
	Rainbow trout	0.2344	17	2.8332	51	3.9318	65.674	4.1847	50	3.912
		0.2344	49	3.8918	128	4.852	128.61	4.8568	50	3.912
		0.2344	182	5.204	140	4.9416	103.42	4.6388	50	3.912
		0.2344	385	5.9532	193	5.2627	119.61	4.7842	50	3.912
	Stickleback	0.2344	78	4.3567	340	5.8289	306.34	5.7247	50	3.912
		0.2344	146	4.9836	380	5.9402	295.6	5.689	50	3.912
		0.2344	300	5.7038	460	6.1312	302.25	5.7112	50	3.912
	Fathead minnow	0.2344	70	4.2485	125	4.8283	115.52	4.7494	50	3.912
		0.2344	110	4.7005	134	4.8978	111.39	4.713	50	3.912
		0.2344	170	5.1358	179	5.1874	134.36	4.9005	50	3.912
		0.2344	260	5.5607	190	5.247	129.1	4.8606	50	3.912
	Ceratopsyche	0.2344	40	3.6889	17	2.8332	17.913	2.8855	50	3.912
	Cyprinus	0.2344	10	2.3026	91	4.5109	132.7	4.8881	50	3.912
	Cheumatopsyche	0.2344	40	3.6889	43	3.7612	45.309	3.8135	50	3.912
	Ceriodaphnia	0.2344	75	4.3175	133	4.8903	120.94	4.7953	50	3.912
		0.2344	110	4.7005	157	5.0562	130.51	4.8714	50	3.912
		0.2344	170	5.1358	178	5.1818	133.61	4.8949	50	3.912
		0.2344	197	5.2832	197	5.2832	142.85	4.9618	50	3.912
	Gambusia	0.2344	200	5.2983	418	6.0355	302.03	5.7105	50	3.912
	Philodina	0.2344	200	5.2983	158	5.0626	114.17	4.7376	50	3.912
	Lepomis	0.2344	200	5.2983	830	6.7214	599.73	6.3965	50	3.912
	Brachionus	0.2344	200	5.2983	182	5.204	131.51	4.8791	50	3.912
	Simocephalus	0.2344	200	5.2983	202	5.3083	145.96	4.9833	50	3.912

* hardness values in the tests with Gambusia, Philodina, Lepomis, Brachionus, and Simocephalus are unknown (assume 200)

Calculation of acute and chronic criteria for fluoride (Illinois site-specific)
Hardness = 50 mg/l

		GMCV mg/l	Rank (R)	lnGMAI	lnGMAI^2	P=R/n+1	SQRT P
1	Ceratopsyche	18	1	2.890372	8.354249	0.076923	0.27735
2	Cheumatopsyche	45	2	3.806662	14.49068	0.153846	0.392232
3	Salmo	100	3	4.60517	21.20759	0.230769	0.480384
4	Philodina	114	4	4.736198	22.43158	0.307692	0.5547
5	Pimephales	120					
6	Ceriodaphnia	130					
7	Brachionus	132					
8	Cyprinus	133					
9	Simocephalus	146					
10	Daphnia	170					
11	Gambusia	302					
12	Lepomis	600					

E (P) = 0.769231
E SQRT(P) = 1.704667
E (lnGMAV) = 16.0384
E lnGMAV(lnGMAV) : 66.4841

T=4

S= 7.134595 FAV = 13.02959
L= 0.969074
A= 2.567223

The mean acute to chronic ratio for 3 species 8

The estimated final chronic value at 50 mg/l
FAV/chronic value 13/8 = 1.6 mg/l

REFERENCES

1. Neuhold, J.M. & W.F. Sigler. 1960. Effects of sodium fluoride on carp and rainbow trout. Trans. Amer. Fish. Soc. 89: 358-370.

2. Pimentel, R. and R.V. Bulkeley. 1983. Influence of water hardness on fluoride toxicity to rainbow trout. Environ. Toxicol. Chem. 2: 381-386.

3. Dave, G. 1984. Effects of fluoride on growth, reproduction, and survival in Daphnia magna. Comp. Biochem. Physiol. 78C: 425-431.

4. LeBlanc, G. 1980. Acute toxicity of priority pollutants to water flea Daphnia magna. Bull. Env. Contam. Toxicol. 24: 684-691.

5. Anderson, B.G. 1946. The toxicity thresholds of various sodium salts determined by the use of Daphnia magna. Sewage Works Journal. 18:82-87.

6. Buikema, A.L., C.L. See, & J. Cairns. 1977. Rotifer sensitivity to combinations of inorganic water pollutants. Va. Water Resour. Res. Center Bull. No. 92. Blacksburg, VA.

7. LeBlanc, G. 1983. Species relationships in acute toxicity of chemicals to aquatic organisms. Env. Toxicol. Chem. 2: 47-60.

8. Smith, L.R. et al. 1985. Studies on the acute toxicity of fluoride ion to stickleback, fathead minnow, and rainbow trout. Chemosphere 14: 1383-1389.

9. Wallen, I.E., W.C. Greer, & R. Lasater. 1957. Toxicity to Gambusia affinis of certain pure chemicals in turbid waters. Sewage Ind. Wastes 29:695-711.

10. Kuhn, R. & Pattard, M. 1990. Results of the harmful effects of water pollutants to green algae (Scenedesmus subspicatus) in the cell multiplication inhibition test. Water Res. 24:31-38.

11. Kaplan, H.M., Yee, N., & Glaczenski, S.S. 1964. Toxicity of fluoride for frogs. Lab. Anim. Care 14: 185-189.

12. Sigler, W.F. and J.M. Neuhold, 1972. Fluoride intoxication in fish: a review. J. Wildlife Dis. 8: 252-254.

13. Ellis, M.M. 1937. Detection and measurement of stream pollution. Bull. Bur. Fish. No. 22. Dept. of Commerce, Washington, D.C.

14. Bender, M. 1979. Unpublished manuscript.

15. Fieser, A.H. 1986. Toxicity of fluorides to aquatic organisms: modelling for water hardness and temperature. Diss. Abstr. B Sci. Eng. 46:4439-4440.

16. Vallin, S. 1968. Giftverkan av fluor pa fisk (toxicity of fluoride to fish). Vatten. 24: 51-52.

17. Neuhold, J.M. and W.F. Sigler. 1962. Chlorides affect the toxicity of fluorides in rainbow trout. Science 135: 732-733.

18. Kuhn,R. et al. 1989. Results of the harmful effects of water pollutants to Daphnia magna in the 21 day reproduction test. Wat. Res. 23: 501-510.

19. Fieser, A.H. et al. 1986. Effect of fluorides on survival and reproduction of Daphnia magna. J. Wat. Poll. Contr. Fed. 58:83-86.

20. Camargo, J.A., J.V. Ward, & K.L. Martin, 1992. The relative sensitivity of competing hydropsychid species to fluoride toxicity in the Cache la Poudre River (Colorado). Arch. Environ. Cont. Toxicol. 22: 107-113.

21. Jones, J.R.E., 1941. A study of the relative toxicity of anions with Polycelis nigra as test animal. J. Exp. Biol. 18: 170-181.

22. U.S. EPA, 1995. Environmental effects database. Office of Pesticide Programs, Washington, D.C.

23. Calleja, M.C., G. Persoone, & P. Geladi, 1994. Comparative toxicity of invitro chemicals to aquatic non-vertebrates. Arch. Environ. Contam. Toxicol. 26: 69-78

24. Hickey, C.W. 1989. Sensitivity of four New Zealand cladoceran species to aquatic toxicants. N.Z. J. Mar. Freshwater Res. 23: 131-137.

Evaluation of Potential Fluoride Effects on the GM Powertrain Receiving Stream

Commonwealth Biomonitoring
Indianapolis, Indiana
December 1992

GM Powertrain operated a facility in Danville, Illinois. In the 1990s, wastewater from the facility often contained 5-10 mg/l fluoride. Its effluent hardness was consistently higher than 300 mg/l. The benthic community of the receiving stream, although having relatively low diversity due to effects from historic strip mining in the watershed, was dominated by what most aquatic biologists regard as pollution-intolerant hydropsychid caddisfly larvae. These animals were very abundant immediately downstream from the discharge to a stream dominated by GM effluent.

Table 1.
Macroinvertebrate Sampling Results
Unnamed GM Powertrain Receiving Stream
Site 1
December 4, 1992

Diptera	
Simuliidae	1
Chironomidae	
Psectrocladius psilopterus	1
Chironomus riparius group	1
Polypedilum illinoense	1
Trichoptera	
Hydropsyche betteni	88
Oligochaeta (Tubificidae)	8

CPOM (Coarse Particulate Organic Matter) Sample

Shredders	0
Non-shredders (Chironomidae, Hydropsychidae, Tubificidae)	8

BIOMETRICS

Total Number of Genera - 6
Total Number of EPT (Ephemeroptera, Plecoptera, Trichoptera) Genera - 1
Ratio of Scrapers/Filtering Collectors - 0.0
Ratio of EPT Abundance/Chironomids - 29.3
Ratio of Shredders/Total - 0.0
Percent Contribution of Dominant Taxon - 88%
Community Loss Index - 1.7
Hilsenhoff Biotic Index - 6.2

Table 2.

Macroinvertebrate Sampling Results

Tributary to Unnamed GM Powertrain Receiving Stream
Site 2 (Not Affected by Wastewater)
December 4, 1992

Bedrock Sample

Diptera	
Tipulidae	7
Chironomidae	
Parametriocnemus sp.	1
Psectrocladius psilopterus	4
Trichoptera	
Hydropsyche betteni	5
Cheumatopsyche sp.	3
Isopoda (*Lirceus* sp.)	1
Mollusca	
Sphaeridae	1
Physa sp.	1

* Only 23 organisms in sample, even after intensive effort

CPOM Sample

Shredders (Isopoda and Tipulidae)	19
Non-shredders (Chironomidae & Tubificidae)	3

BIOMETRICS

Total Number of Genera - 8
Total Number of EPT Genera - 2
Ratio of Scrapers/Filtering Collectors - 0.0
Ratio of EPT Abundance/Chironomids - 1.6
Ratio of Shredders/Total - 0.86
Percent Contribution of Dominant Taxon - 30%
Community Loss Index - 1.3
Hilsenhoff Biotic Index - 5.4

Table 3.

Macroinvertebrate Sampling Results

Willow Creek (Reference Stream)
Site 3
December 4, 1992

Bedrock Sample

Diptera	
Simuliidae	3
Chironomidae	
<u>Cardiocladius</u> sp.	21
<u>Diplocladius</u> sp.	6
<u>Psectrocladius psilopterus</u>	4
<u>Cricotopus sylvestris</u>	4
<u>Orthocladius obumbratus</u>	2
<u>Ablabesmyia</u> sp.	3
Trichoptera	
<u>Hydropsyche betteni</u>	24
<u>Cheumatopsyche</u> sp.	10
<u>Cyrnellus fraternus</u>	10
Ephemeroptera	
<u>Stenonema vicarium</u>	11
<u>Stenacron interpunctatum</u>	1
Plecoptera (<u>Allocapnia</u> sp.)	1

CPOM Sample

Shredders (Filipalpia and Tipulidae)	7
Non-shredders	108

BIOMETRICS

Total Number of Genera - 13
Total Number of EPT Genera - 6
Ratio of Scrapers/Filtering Collectors - 0.26
Ratio of EPT Abundance/Chironomids - 1.4
Ratio of Shredders/Total - 0.06
Percent Contribution of Dominant Taxon - 24%
Community Loss Index - 0.0
Hilsenhoff Biotic Index - 5.8

Table 4.
Macroinvertebrate Sampling Results

DUPLICATE
Willow Creek (Reference Stream)
Site 4
December 4, 1992

Bedrock Sample

Diptera		
	Simuliidae	8
	Chironomidae	
	<u>Cardiocladius</u> sp.	31
	<u>Diplocladius</u> sp.	19
	<u>Cricotopus sylvestris</u>	6
	<u>Orthocladius obumbratus</u>	1
Trichoptera		
	<u>Hydropsyche betteni</u>	14
	<u>Cheumatopsyche</u> sp.	5
	<u>Cyrnellus fraternus</u>	2
Ephemeroptera		
	<u>Stenonema vicarium</u>	9
Plecoptera		
	<u>Allocapnia</u> sp.	1
	<u>Isoperla</u> sp.	1
Coleoptera (Elmid larvae)		2
Amphipoda		1

CPOM Sample (not duplicated)

Shredders (Filipalpia and Tipulidae)	7
Non-shredders	108

BIOMETRICS

Total Number of Genera - 13
Total Number of EPT Genera - 6
Ratio of Scrapers/Filtering Collectors - 0.38
Ratio of EPT Abundance/Chironomids - 0.56
Ratio of Shredders/Total - 0.06
Percent Contribution of Dominant Taxon - 31%
Community Loss Index - 0.0
Hilsenhoff Biotic Index - 6.0

Table 5.

SUMMARY OF MACROINVERTEBRATE BIOMETRICS AND SCORING FROM EACH SITE
(Scores are based on comparison to reference site 3)

BIOMETRICS				
Site No.	1	2	3	4
No. of Genera	6	8	13	13
EPT Genera	1	2	6	6
Scrapers/Filterers Ratio	0.0	0.0	0.26	0.38
EPT/Chironomid Abundance	29.3	1.6	1.4	0.56
Percent Shredders	0.0	86	6	6
Percent Dominant Taxon	88	30	24	31
Community Loss Index	1.7	1.3	0.0	0.0
Hilsenhoff Biotic Index	6.2	5.4	5.8	6.0

SCORING				
Site No.	1	2	3	4
No. of Genera	2	4	6	6
EPT Genera	0	0	6	6
Scrapers/Filterers Ratio	0	0	6	6
EPT/Chironomid Abundance	6	6	6	2
Percent Shredders	0	6	6	6
Percent Dominant Taxon	0	2	4	2
Community Loss Index	2	4	6	6
Hilsenhoff Biotic Index	6	6	6	6
Site Score	16	28	46	40
Percent of Reference	35	61	100	87
Impairment	moderate	slight	none	none

1 = GM Receiving Stream 2 = Tributary 3,4 = Reference Sites

Conclusions

Fluoride concentrations in GM outfall 002 probably have little or no toxic effect on the aquatic community of the GM receiving stream or on the Vermilion River downstream from the outfall. This conclusion is based on both laboratory studies reported in the scientific literature (showing that 10 mg/l in hard water is not chronically toxic to the most sensitive animals tested) and this field study (showing that benthic life in the stream was not typical of toxics-affected streams).

ATTACHMENT E

LETTER FROM SHEPARD ENGINEERING, INC.

TO IEPA, DATED JULY 3, 2002

Shepard Engineering, Inc.

719 E. Crawford • Salina, KS 67401 • (785) 825-1855 • Fax: (785) 825-5925

July 3, 2002

Bureau of Water
Illinois EPA
c/o Scott Twait - # 15
1001 N. Grand Ave. East
P.O. Box 19276
Springfield, IL 62794-9276

Re: 5/29/02 City of Effingham Draft Petition for Site-Specific Regulation
Additional Information
SEI File No. 01-022

Dear Scott:

This letter will provide additional information relative to the 5/29/02 draft petition for Site Specific Regulation. This information was discussed in a June 10, 2002 conference call between Illinois EPA and Blue Beacon International representatives.

1. Protection of Flora Water Supply.

Demonstrating that the City of Flora water supply will be protected is one of the primary objectives of the Petition. The Environmental Protection Agency (EPA) has established a Maximum Contaminant Level (MCL) of 4.0 mg/L with respect to fluoride for community water systems (40 CFR § 141.62 (b)). Also, the EPA has established a Secondary MCL for fluoride of 2.0 mg/L (40 CFR § 143.3). According to the EPA, the Secondary MCL "represent reasonable goals for drinking water quality." In order to insure a conservative approach, the Petition is proposing that the water quality standard for that stream segment, which is used by the City of Flora, will be 2.0 mg/L fluoride, i.e., the more stringent secondary MCL.

A water balance and fluoride balance on the stream segments in question will demonstrate that the proposed standards will insure that the Flora water supply will not exceed 2.0 mg/L fluoride, even under low flow (i.e., 7Q10 conditions).

Refer to the attached Map 9 (Little Wabash Region). This map shows the 7Q10 values for the various stream segments. Various key points along the stream segments are shown on the attached Map. These stream segments are summarized below:

Stream Segment	Length (Stream Miles)	Description
A-B	11.1	Effingham WWTP discharge point to Salt Creek then to confluence of Salt Creek and Little Wabash River
B-C	26.1	Confluence of Salt Creek and Little Wabash River to point on Little Wabash River approximately 2.8 miles downstream of Louisville
C-D	7.0	Point on Little Wabash River approximately 2.8 miles downstream of Louisville to the confluence of the Little Wabash River with Buck Creek

The City of Flora water supply intake is located on stream segment C-D of the Little Wabash River. As proposed by the Petition, the fluoride water quality standard for this stream segment would be 2.0 mg/L, which is equal to the secondary MCL for fluoride. Thus, the proposed WQS would be protective of the City of Flora water supply.

Next, it will be demonstrated that a fluoride water quality standard of 5.0 mg/L in stream segment A-B (which receives the discharge from the City of Effingham POTW) will result in concentration, which does not exceed 2.0 mg/L in stream segment C-D, even during low-flow (i.e., 7Q10) conditions.

As a conservative approach, it will be assumed that the loss of water in stream segment A-B during low flow conditions, occurs due to evaporation and recharge from the stream to the groundwater. For that case, a water balance over stream segment A-B yields:

$$Qin = Qout + E + R \qquad (I)$$

Where:

Qin = 2.1 cfs

Qout = 0.84 cfs

E = evaporation (in cfs)

R = recharge to groundwater (in cfs)

Evaporation will be estimated using pan evaporation data taken from the Illinois State Water Survey web site. The data were collected by the Illinois state Climatologist office. The closest location to the stream segment is Carlyle, which is located approximately 60 miles from Effingham. In order to produce a conservative number, the highest monthly evaporation rate will be used from the subject data – 10.32 inches/month, which occurred in June of 1988 (monthly data are provided from 1980 through 2001). As indicated in the introduction of the data, most textbooks recommend that pan evaporation should be reduced by 25 percent to obtain a more accurate value for evaporation from a water body. Therefore, a daily evaporation rate of:

(10.32 in./month) * (0.75) * (1 mo./30 days) = 0.258 in./day

It is estimated that the width of Salt Creek would be in the range of 10 ft during low flow conditions for purposes of calculating evaporation losses.

Using these values, the estimated evaporation loss for stream segment A-B is:

(11.1 mi.)*(5280 ft/mi.)*(10 ft)*(0.258 in/day)*(1 ft/12 in)*(1 day/86400 sec)

= 0.146 cfs = E

Solving equation (I) for R yields

R = 1.114 cfs

Letting C_{A-B} = the fluoride concentration leaving stream segment A-B, and assuming that the fluoride concentration that is being recharged to groundwater is equal to the average of the initial fluoride concentration in the stream segment (5.0 mg/L) and the final fluoride concentration in the stream segment, allows a fluoride mass balance to be completed:

$(5.0)*(2.1) = (0.84*C_{A-B}) + (1.114)*(5.0 + C_{A-B})/(2)$

Solving for C_{A-B} yields:

$C_{A-B} = 5.52$ mg/L

Thus, there could theoretically be is a slight increase in the fluoride concentration in stream segment A-B, if the Effingham POTW discharged 5.0 mg/L.

With respect to stream segment B-C, it will be assumed that the fluoride would simply be diluted as the flow traverses the Little Wabash River.

As shown on Map 9, the 7Q10 flow just downstream of the confluence of Salt Creek and the Little Wabash River is 1.3 cfs. A fluoride mass balance at the confluence of these streams yields (where C_{B-C} = fluoride concentration just downstream of the confluence):

$(0.84)*(5.52) = (1.3)*(C_{B-C})$

$C_{B-C} = 3.57$ mg/L

Finally, with respect to stream segment C-D, the 7Q10 flow just upstream of the City of Flora water supply intake is 2.1 cfs. Again, the fluoride concentration will be reduced as a result of the flow increase from 1.3 cfs to 2.1 cfs. The fluoride concentration at the end of stream segment C-D is designated as $C_{C\text{-}D}$, and is calculated as follows:

$(1.3)\cdot(3.57) = (2.1)\cdot(C_{C\text{-}D})$

$C_{C\text{-}D} = 2.21$ mg/L

These calculations show that there is a potential for the Flora water supply to exhibit a fluoride concentration slightly above the secondary MCL, considering evaporation losses in stream segment A-B. However, this can be addressed by regulating the City of Effingham POTW discharge to a value, which is slightly less than 5.0 mg/L, i.e., 4.8 mg/L. In that way, the maximum fluoride concentration at the various points shown on Map 9 would be (under 7Q10 conditions):

A – 4.5 mg/L
B – 5.0 mg/L
C – 3.2 mg/L
D – 2.0 mg/L

This would insure continuous protection of the City of Flora water supply, even under low (i.e., 7Q10) flow conditions.

2. Environmental Impact on Receiving Stream.

A bioassessment was completed on June 20, 2002 by Commonwealth Biomonitoring in order to provide additional information with respect to the environmental impact on the subject receiving stream. This assessment concluded that there is no evidence that the fluoride in the Effingham wastewater treatment plant effluent is harming the aquatic community immediately downstream from the discharge. The study methods and results are summarized in Attachment A.

3. Economic Impact of Fluoride Wastewater Treatment on Truck Wash Operations.

As set forth in the subject petition, the estimated annual operating cost for a wastewater treatment system designed to remove fluoride to the level of 10 to 20 mg/L is $ 200,000 per year. If the attempt was made to recoup this annual operating cost by increasing prices, the price of a truck wash would increase by approximately $ 5.00 per truck. This represents an increase of roughly 13 %. Such increases would cripple the truck wash operations in Effingham, particularly since there are a number of truck wash competitors within close proximity.

4. Evaluation of Reduced Treatment Requirements.

The IEPA requested that the Petitioners review the potential for discharging only partially treated wastewater to the City of Effingham POTW, thereby reducing the capital cost of a fluoride-removal treatment system. As a brief review, a fluoride-removal treatment system would consist of a wastewater equalization tank, a rapid mix tank, a slow-mix tank (for flocculation), a flash mixer, a flocculation (slow) mixer, wastewater transfer pumps, chemical feed pumps, chemical storage systems, an inclined plate clarifier, a sludge thickener, and a filter press. The IEPA requested that an evaluation should be made of the scenario whereby the wastewater is discharged directly to the City POTW following the addition of the calcium-based precipitation chemicals. For that case, the underlined equipment items would not be needed, thus reducing the system capital cost. However, the following analysis shows that eliminating the solids removal/de-watering steps would not be feasible.

As documented in Attachment D of the subject petition, some fluoride removal is possible, at great expense. For example, one might expect to achieve fluoride removal from 57 mg/L down to the range of 20 mg/L. However, for the sake of illustration, it will be assumed that all three truck wash facilities in Effingham would be able to precipitate all of the fluoride in their wastewater, and that the initial fluoride concentration for each facility is 57 mg/L (which is the average fluoride concentration as measured by the City for the three facilities). In addition, it will be conservatively assumed that the precipitated fluoride will be in the form of calcium fluoride. Finally, a daily flow rate of 24,000 gpd will be used for each truck wash facility and a total POTW flow rate of 2.0 MGD will be used.

The total mass of fluoride discharged from the three truck wash facilities (in the form of calcium fluoride solid) would be:

$(24{,}000 \text{ gal/day}) \cdot (3) \cdot (100 \text{ mg/L}) \cdot (3.785 \text{ L/gal}) = 1.55 \times 10^7 \text{ mg Fluoride/day}$

The theoretical (i.e., minimum) solubility of calcium fluoride is 15 mg/L (The Merck Index, 11th Edition, Merck & Co., 1989, pg. 253). Therefore, the minimum amount of fluoride that would be in solution is:

$(15 \text{ mg/L } CaF_2) \cdot (0.48 \text{ mg } F^- / \text{mg } CaF_2) = 7.2 \text{ mg/L } F^-$

The total concentration of fluoride in the City POTW would be:

$(1.55 \times 10^7 \text{ mg } F^-)/[(2 \times 10^6 \text{ gal}) \cdot (3.785 \text{ L/gal})] + 1.0 \text{ mg/L (background)}$

$= 3$ mg/L fluoride (which is well below the minimum solubility of calcium fluoride)

Thus, all of the fluoride that is discharged to the City POTW as insoluble calcium fluoride, would re-dissolve once it was mixed with all of the other wastewater in the POTW (2 MGD). For this reason, it would not be possible to only partially treat the wastewater at the respective truck washes. Solids removal and de-watering would be required as part of the pretreatment system at each location.

5. Ability to Remove Fluoride by Precipitation.

The IEPA requested clarification regarding the reported difficulty of fluoride removal via precipitation, in view of the follow statements set forth in Attachment C – Review of Fluoride Toxicity Data:

"For example, Smith, et al. (Reference 8) observed that "combinations of high fluoride and moderate to high hardness caused rapid precipitation of finely divided solid, which spectrographic analysis indicated to consist of calcium and magnesium salts." In their tests with water of an initial hardness of 256 mg/L, the hardness dropped to 12 mg/L within a few hours after the addition of 400 mg/l fluoride (as sodium fluoride). Vallin (reference 16) noted a formation of calcium fluoride precipitate in his fluoride tests with hardness values of 320 mg/L. Apparently, fluoride combines easily with calcium in high-hardness water to form the relatively insoluble compound calcium fluoride. Once out of solution, the fluoride precipitate is in a form which is not readily available as a toxicant."

It should be noted that the initial fluoride concentrations discussed above were in the range of 181 mg/L as F^- (400 mg/L as sodium fluoride). Based on literature solubility values for calcium fluoride, as well as, empirical data (e.g., Blue Beacon laboratory bench tests), it is certainly expected that some calcium fluoride would precipitate with an initial fluoride concentration of 180 mg/L. However, Smith et al. did not indicate a final fluoride concentration. Most certainly there would be a residual fluoride concentration in solution – probably in the range of 20 to 30 mg/L. Therefore, the information set forth in Attachment C in no way conflicts with the conclusion set forth in the petition, that removal of fluoride to levels below 10 to 20 mg/L is neither technically nor economically feasible.

6. Pollution Prevention/Recycle Efforts.

The truck wash petitioners implement pollution prevention activities to the greatest extent possible as described below. The fluoride anion is present in the truck wash wastewater effluent by virtue of its presence in the chemical that is used to brighten aluminum – logically referenced as "brightener". The brightener chemical constitutes a significant portion of the truck wash operational cost. Therefore, the truck wash facilities are driven by operational costs to use no more brightener than necessary to achieve the desired finished product. All truck wash operators are given extensive training with respect to chemical application procedures and rates. Also, management personnel track chemical use on a weekly basis. Specifically, chemical use is compared to total revenue (which is directly related to truck volume). Therefore, if excessive use of brightener was occurring, it would be quickly identified and corrected.

It should also be noted that Blue Beacon is conducting extensive research in the area of wastewater recycle and re-use. Unfortunately, recycle systems do not reduce the total mass loading of soluble parameters such as fluoride. That is, if Blue Beacon was able to recycle 50 percent of their wastewater effluent, the fluoride concentration in the discharge would double and the total mass loading in the effluent would remain the same.

I trust that the additional information set forth in this letter has adequately addressed the technical and economic issues that have been raised by the Illinois EPA.

Please contact me if you have any questions or need additional information.

SHEPARD ENGINEERING, INC.

M/ Shepard

Max Shepard, P.E.
President

cc: Steve Miller – City of Effingham (letter and attachments)
Mike Rose – Blue Beacon Management, Inc. (letter and attachments)
Rodney Pugh – Truckomat Corporation (letter and attachments)
LaDonna Driver – Hodge Dwyer Zeeman (letter and attachments)
Greg Bright – Commonwealth Biomonitoring (letter and attachments)

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ATTACHMENT A

RAPID BIOASSESSMENT OF A TRIBUTARY OF SALT CREEK
EFFINGHAM, ILLINOIS

Conducted by

Commonwealth Biomonitoring
Indianapolis, Indiana

June, 20, 2002

RAPID BIOASSESSMENT OF A TRIBUTARY OF SALT CREEK EFFINGHAM, ILLINOIS - June 20, 2002

INTRODUCTION - As part of an environmental risk assessment, Commonwealth Biomonitoring presented evidence from laboratory toxicity test information published in the scientific literature that current fluoride concentrations in Effingham, Illinois wastewater treatment plant (WWTP) effluent were not high enough to harm aquatic life in the receiving stream (a small, unnamed tributary of Salt Creek). The literature predicts that negative effects from fluoride would first be seen by the absence of net-spinning caddisflies (Hydropsychidae).

An Illinois EPA bioassessment conducted on the Effingham WWTP discharge streams in 1999 found that net-spinning caddisflies were abundant at site C-5, approximately 3.7 miles downstream from the WWTP during a period in which the WWTP effluent made up the entire flow of the stream. This helps support the prediction that fluoride was not causing any harm to this sensitive group. However, caddisflies were absent at several intervening sites. It should be noted that low dissolved oxygen concentrations were observed in the tributary stream segment immediately downstream from the Effingham WWTP discharge.

Were net-spinning caddisflies absent in 1999 because of fluoride or because of some other water quality characteristic? During the Illinois EPA bioassessment, the Effingham WWTP effluent had a relatively high BOD and the dissolved oxygen concentration of the effluent was low. Since then, the WWTP has been upgraded and effluent quality has improved. To help clarify the risk assessment, Illinois EPA asked for updated information on the aquatic community of the receiving stream.

METHODS - Commonwealth Biomonitoring collected a benthic sample from the WWTP receiving stream on June 20, 2002. The sample was collected from a riffle at Illinois EPA site C-1 (immediately downstream from the WWTP) using a timed kick-net technique, returned to the lab, sorted, and identified.

RESULTS - A comparison of the benthic samples collected at site C-1 in 1999 and 2002 is shown below:

	1999	2002
Chironomidae (non-bloodworm midges)	24	124
Chironomidae (bloodworm midges)	58	3
Simulidae (blackflies)		5
Physidae (pouch snails)	19	
Hydropsychidae (net-spinning caddisflies)		18
Baetidae (mayflies)		7
Oligochaetes (segmented worms)		9
Hirudinea (leeches)		2
Total Abundance	101	168
Taxa Richness	3	7
MBI	9.4	6.2

The benthic community has improved since the WWTP expansion. More taxa are present and a decline in the MBI (macroinvertebrate biotic index) is indicative of decreased environmental stress. Net-spinning caddisflies are relatively abundant (11% of the total benthic community) in an area immediately downstream from the WWTP discharge.

CONCLUSION - The absence of caddisflies at site C-1 in 1999 was probably due to low dissolved oxygen rather than excessive fluoride. Since the WWTP expansion, the macroinvertebrate community has improved and net-spinning caddisflies are relatively abundant. There is no evidence that fluoride in the Effingham WWTP effluent is harming the aquatic community immediately downstream from the discharge.

ATTACHMENT F

RAPID BIOASSESSMENT OF A

TRIBUTARY OF SALT CREEK, EFFINGHAM, ILLINOIS

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