EMCSP 19.8.2
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September 4, 2002
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Ms. Amberet Green
Region 10 Project Officer
U.S. Environmental Protection Agency
1200 6th Avenue - WCM-122
Seattle, WA 98101

Subject: EPA Contract No. 68-W-02-022, Work Assignment R10210, Task 9, Off-Plant Fluoride Monitoring/Land Use Controls

Dear Ms. Green:

In response to Work Assignment R10210, Task 9 under EPA Contract 68-W-02-022, Booz Allen Hamilton Inc., is pleased to provide the Technical Position Paper for Fluoride that pertains to the Simplot Don Plant located in Pocatello, ID.

If you have any questions or comments concerning this deliverable, please contact me at (206) 386-4793.

Sincerely,

Ed Greutert
Work Assignment Manager

BOOZ ALLEN HAMILTON INC.

Enclosures

cc: Linda Meyer, EPA Work Assignment Manager
Jerome Lofton, EPA Contracting Officer (cover letter only)
BAH PMT

USEPA SF
1348961

PRELIMINARY EVALUATION OF ECOLOGICAL RISKS OF FLUORIDE AND PHOSPHOROUS NEAR THE EASTERN MICHAUD FLATS SUPERFUND SITE POCATELLO, IDAHO CONTRACT NO. 68-W-02-022

REPA3-1010-02

September 4, 2002

Documents Reviewed:

Levels of Fluoride in Vegetation Samples Collected from Pocatello Areas During the 2001 Growing Season. Prepared by BAICOR Inc. November 2001.

Levels of Fluoride in Vegetation Samples Collected from Pocatello Areas During the 1995 Growing Season. Prepared by BAICOR Inc. December 1996.

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1.0 Introduction

The Eastern Michaud Flats Superfund (EMF) site is located in Southeastern Idaho, approximately 2.5 miles northwest of Pocatello, Idaho. The EMF site includes two adjacent phosphate ore processing plants- the FMC Elemental Phosphorus Plant (FMC) and the J.R. Simplot Company Don Plant (Simplot). The Simplot plant is still an active facility while the FMC plant ceased operation in December of 2001. Both plants began operation in the 1940s. These plants occupy 2,475 acres of the site with approximately 1,450 acres associated with FMC operations and approximately 1,025 acres associated with the Simplot plant. The entire site encompasses the areal extent of contamination deemed necessary by EPA for implementation of any response action and includes both the Company Plant areas and surround Off-Plant areas.

Releases of fluoride, phosphorus, and other compounds have resulted in elevated concentrations in terrestrial and aquatic habitats near the FMC (now Astaris) and Simplot facilities in Pocatello, Idaho. The Record of Decision (ROD) for the EMF Superfund site indicated potential risks from fluoride to sage grouse, horned lark, red-tailed hawk, and coyote in sagebrush steppe habitat (EPA, 1998). Phosphorus and other elements have impacted groundwater and the Portneuf River, and the proposed total maximum daily load (TMDL) for total phosphorus in the lower Portneuf River has been exceeded (IDEQ, 2001). This document presents a preliminary evaluation of ecological risks of fluoride in terrestrial habitats and phosphorus in the Portneuf River in proximity and downgradient of EMF. Section 2 presents the methods used in evaluating

exposure and toxicity, Section 3 summarizes the preliminary risk results, Section 4 provides conclusions and recommendations, and Section 5 lists the information cited.

2.0 Methods

2.1 Fluoride in Terrestrial Habitats

Data used to evaluate wildlife exposures to fluoride included vegetation and small mammal concentrations reported in EPA (1995, 1998) and vegetation concentrations reported in BAICOR (1992, 1995, 1996, 2001).

A wildlife screening value for fluoride in vegetation (20.6 mg/kg plant) was derived from the no observed adverse effect level (NOAEL) benchmark for woodcock in Sample et al. (1996) as a surrogate for sage grouse and other birds that may consume plants in the affected area. The benchmark was adjusted to a dry weight by assuming a 50 percent moisture content of plants. A wildlife screening value for fluoride in small mammals (80.6 mg/kg tissue) was determined from the NOAEL benchmark for red-tailed hawk (Sample et al., 1996), which occurs in the affected area.

2.2 Phosphorus in the Portneuf River

Data used to evaluate phosphorus impacts in the Portneuf River included phosphorus levels in groundwater and the river, and aquatic vegetation metrics that were reported by the Idaho Department of Environmental Quality (IDEQ, 2001).

3.0 Results

3.1 Fluoride in Terrestrial Habitats

Figure 1 below shows fluoride in grass and alfalfa collected between 1992 and 2001 at three locations north and east of the site (BAICOR, 1992, 1995, 1996, 2001). Figure 1 also shows multiple exceedences of a wildlife screening value derived from Sample et al. (1996) including the last year of available data (2001). Fluoride concentrations were extremely high in vegetation prior to 1996, then apparent level off from 1996 to 2001 (Figure 1).

Figure 2 shows fluoride in sagebrush collected in 1992 and 1995 at locations southeast of the site (BAICOR, 1992, 1995); no BAICOR sagebrush data were available after the 1995 sampling. Figure 3 shows fluoride in grass and alfalfa collected in 2000 and 2001 at sample locations between one and five miles from the site (BAICOR, 2001). No decline in fluoride levels are apparent between 2000 and 2001, and exceedences of the wildlife screening value occur within three miles of the site.

Table 1 compares average fluoride concentrations in affected wildlife habitat in Bannock Hills and Michaud Flats to background concentrations and ecological screening values. This table shows that fluoride levels in soil, sagebrush, and small mammals exceed background

concentrations (EPA, 1998) and ecological screening values (determined for the current document). For example, average small mammal concentrations of fluoride were 128 mg/kg at Bannock Hills and 90.9 mg/kg at Michaud Flats, whereas small mammals from the reference area (Ferry Butte) had an average of 6.8 mg/kg. These concentrations also exceed a screening value for red-tailed hawks (80.6 mg/kg prey; Sample et al., 1996).

Table 2 shows that the average soil levels of fluoride determined in the remedial investigation/feasibility study (RI/FS) for the EMF were greater than the exposure point concentrations used to quantify risks in the ecological risk assessment (ERA) (EPA, 1995). This suggests the possibility that risks in proximity to the site (e.g., three-mile radius) may have been underestimated because contaminated soils are a significant determinant of wildlife exposure. For example, ingestion of contaminated soil comprised 78% of the estimated exposure of sage grouse in Michaud Flats (EPA, 1995). Table 2 also indicates that the highest fluoride contamination may be southeast of the site (e.g., 307 mg/kg in sagebrush compared to 86 mg/kg in Bannock Hills southwest), but the southeast area was not specifically considered in the ERA. Comparison of 1994 fluoride levels in wheatgrass collected one mile north northeast of the site to BAICOR samples of grass (1995) and alfalfa (2001) collected north and east of the site suggest that fluoride levels may not have declined significantly below the levels evaluated in the ERA (Table 2).

Uncertainties in evaluating potential wildlife risks from fluoride include an absence of reported moisture content for grass and alfalfa in the BAICOR reports. Sagebrush and other native plants may have lower concentrations of fluoride than the grass and alfalfa routinely measured. For example, BAICOR (1992) reported an average fluoride concentrations of 1024 mg/kg in grass compared to 430 mg/kg in sagebrush collected approximately 1.6 miles SE of the site. The use of conservative benchmarks and sample data prior to 1996 likely overestimate exposure and risks. Incidental soil ingestion by wildlife, not evaluated in this preliminary assessment, are likely an important contributor to site risks because of substantially higher soil concentrations of fluoride than in biota.

3.2 Phosphorus in the Portneuf River

IDEQ monitored phosphorus and nitrogen compounds in groundwater and the Portneuf River in 2000 (IDEQ, 2001). IDEQ concluded the following:

- Groundwater under the Astaris and Simplot facilities is contaminated with nitrate and orthophosphate (1 to >100 mg/L), concentrations are elevated above background, and appear to be increasing over time at multiple well locations (IDEQ, 2001).

- Considerable nitrogen and phosphorus loading to the Portneuf River occurs in the eastern Michaud Flats. This likely occurs from the influx of site contaminated groundwater between transect T-1 and slightly north of Batiste Spring (see Table 3).

- Nitrogen and phosphorus concentrations increase in the Portneuf River dramatically between transects T-1 and T-3 (see Figure 4). For example, dissolved ortho phosphorus

increases from 0.008 mg P/L to 1.93 mg P/L below FMC/Astaris facilities (Table 3). IDEQ loading calculations indicated that 75 percent of the phosphorus load and 90 percent of the nitrogen load in the river is from the shallow aquifer discharging from the Astaris/Simplot area between transects T-1 and T-2.

- The Simplot wastewater and land application site and City of Pocatello waste water treatment plant (WWTP) were not considered to be likely significant sources of phosphorus and nitrogen loading to the Portneuf River.

Concentrations of phosphorus and nitrogen compounds measured in the Portneuf River in September 2000 are summarized in Table 3. Figure 4 shows that dissolved ortho phosphorus concentrations substantially increase below FMC/Astaris facilities then decline below the WWTP, Batiste Spring trout farm, and Papoose Springs. Along with the hydrological investigation of IDEQ (2001), this information indicates that the EMF is causing significant elevation of phosphorous and other compounds in the Portneuf River.

Of additional concern, the aquatic habitat in the Portneuf River may be impacted by nitrogen and phosphorus discharges. Figure 5 shows that the percentage of aquatic stream vegetation increases form less than 20 percent above FMC/Astaris facilities to greater than 60 percent below the site. Figure 6 shows that an increase in aquatic stream vegetation is associated with an elevation of both nitrite/nitrates and ortho phosphorus. It is uncertain whether the elevation in aquatic vegetation is reducing the quality of aquatic habitat in the Portneuf River, such as reducing spawning substrate or benthic invertebrate production. Although ortho phosphorus and total phosphorus were measured in the Portneuf River during the RI/FS for the EMF, the ERA for the site (EPA, 1995) did not consider the risks of phosphorus in the river.

4.0 Conclusions and Recommendations

4.1 Conclusions

- Fluoride concentrations substantially exceed background concentrations in terrestrial habitats and biota in proximity to the EMF. The available data indicates that there is no apparent decline in fluoride concentrations after 1996.

- Fluoride levels monitored by BAICOR were highest at locations southeast of the site, but sampling was apparently discontinued after 1995. It is unclear from the available information if this area may be suitable as pasture, but it likely provides areas of wildlife exposure. Additional sampling in the Bannock Hills area may be warranted (e.g., Bureau of Land Management and Fort Hall Reservation lands).

- Our review indicates that wildlife in the Michaud Flats and Bannock hills are at potential risk from fluoride concentrations in plants and small mammals, consistent with previous assessments (EPA, 1998).

- However, the ERA for EMF (EPA, 1995) may have underestimated risks of fluoride and other compounds because wildlife risks were initially screened using toxicity benchmarks for community receptors (e.g., plant toxicity benchmarks were used to screen contaminants of potential concern for food chain risks to wildlife). Also, high exposure areas in the southeast were not adequately considered in the ERA (1995). Additional concerns include: (1) risks to special status species (e.g., big-eared bat, bald eagle, pygmy rabbit) may not have been adequately addressed; and (2) risks to fish and water-dependent wildlife were not comprehensively evaluated.

- A more definitive assessment of site data would provide a refinement in risk estimates, including a comprehensive re-evaluation of the ecological risk assessment cited in the ROD. A re-evaluation may identify additional ecological receptors that may be exposed to contaminants released from the EMF, and additional contaminants and exposure pathways that may pose risks.

- The proposed TMDL target for total phosphorus (0.075 mg/L) is substantially exceeded in the Portneuf River, and phosphorus and nitrogen compounds are elevated below Astaris/Simplot facilities.

- Aquatic vegetation is elevated in the Portneuf River that is likely related to loadings of phosphorus and nitrogen compounds from the site. Additional investigation is warranted, including an evaluation of potential adverse impacts of phosphorus and TMDL issues.

4.2 Recommendations

The following actions are recommended to identify current risks and impacts from fluoride, phosphorus, and other emissions from EMF:

1) Additional samples of unwashed vegetation (e.g., grass and/or sagebrush) and soil samples should be collected because they provide routes of exposure to terrestrial plants, invertebrates, and wildlife.

- Locations that are southeast and southwest of the site should be sampled because the area south of the site has not been sampled since 1995, but had the highest historical levels of fluoride in vegetation.

- Surface soil samples should be collected at selected areas north and east of the site to complement the ongoing BAICOR vegetation monitoring program. Analysis of fluoride in these samples is recommended because incidental soil ingestion is a significant pathway to wildlife such as sage grouse (e.g., 78 percent of fluoride exposure; EPA, 1995).

- Fluoride concentrations determined in vegetation and soil, and modeled wildlife ingestion doses should be compared to ecological screening values to evaluate current ecological risks.

2) The ecological impacts of elevated phosphorus and nitrogen compounds should be evaluated in the Portneuf River.

- Phosphorus (total and ortho forms) and nitrogen compounds (e.g., ammonia, nitrite/nitrate) should continue to be monitored in the river at selected locations (e.g., transects used by IDEQ, 2001).

- Salmonid habitat should be evaluated for potential degradation from phosphorus and nitrogen releases from Simplot/Astaris, such as loss of spawning and feeding habitat from excessive vegetation growth.

5.0 Information Cited

BAICOR. 2001. *Levels of Fluoride in Vegetation Samples Collected from Pocatello Areas During the 2001 Growing Season.* Prepared by BAICOR Inc. November 2001.

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Efroymson, R. A., Will, M. E., Suter II, G. W., and Wooten, A. C. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 revision.* Oak Ridge National Laboratory. ES/ER/TM-85/R3. http://www.hsrd.ornl.gov/ecorisk/reports.html

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Sample, B. E., Opresko, D. M., and Suter II, G. W. 1996. *Toxicological Benchmarks for Wildlife: 1996 revision.* Oak Ridge National Laboratory. ES/ER/TM-86/R3. http://www.hsrd.ornl.gov/ecorisk/reports.html

Suter, G. W. II. 1996. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Freshwater Biota.* Environ. Toxicol. Chem. 15:1232-1241.

Table 1. Comparison of average media and biota concentrations to ecological risk screening values or background concentrations.[1]

Matrix	Affected Habitat	Exposure (mg/kg)	Background[2]	Benchmark (mg/kg)
soil	Bannock Hills	1454	363	200[4]
	Michaud Flats	1793		
sagebrush	Bannock Hills	74.2	12.1[3]	20.6[5]
	Michaud Flats	55.6		
small mammal (whole body)	Bannock Hills	128	6.8[3]	80.6[5]
	Michaud Flats	90.9		

1. Data from Tables 8, 9, and 10 of EPA (1998).
2. Background data Ferry Butte reference area.
3. Fluoride was not detected; value is one half of the detection limit.
4. From Efroymson et al. (1997).
5.Derived from Sample et al. (1996); see text.

Suter, G. W. II. 1996. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Freshwater Biota.* Environ. Toxicol. Chem. 15:1232-1241.

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3. Fluoride was not detected; value is one half of the detection limit.
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5.Derived from Sample et al. (1996); see text.

Table 2. Comparison of exposure point concentrations (EPC) used in the ecological risk assessment (ERA) to RI/FS average soil concentrations and BAICOR (1995, 2001) reported vegetation samples.

Matrix	ERA EPC[1] (mg/kg)	RI/FS Average[2] (mg/kg)	BAICOR, 1995[3] (mg/kg)	BAICOR, 2001[4] (mg/kg)
soil	BH: 1585	2470	NR	NR
	MF: 2207			
sagebrush	BH: 85.7	NR	SE: 307	NR
	MF: 60.8		NR	
wheatgrass	BH: 86.9	NR	S: 507 (grass)	NR
	MF: 38.1		NE: 78 (grass)	NE: 15 - 40 (alfalfa)

1. Table 4-3 of EPA (1995). Samples collected in 1994. BH: Bannock Hills (1 to 2 miles southwest of site); MF: Michaud Flats (1 mile north northeast of site).
2. Table A-3 of EPA (1995). Samples collected between 1992 and 1994. NR: vegetation samples not reported.
3. Figure 7 of BAICOR (1995). SE: Data are for sagebrush collected at BAICOR location18a approximately 1.7 miles southeast of the site. S: Data are for grass collected at BAICOR location 18 approximately 1.7 miles south of the site. NE: Data are for grass collected at BAICOR location 2 approximately 2 miles northeast of the site. NR: samples not reported south of the site.
4. Table 4 of BAICOR (2001). NE: Data are for alfalfa collected at BAICOR locations 2 and 3 approximately 2 miles northeast of the site. NR: samples not reported south of the site.

Table 3. Concentrations of nitrogen and phosphorus in the Portneuf River[1]

Transect	Location Description[2]	Total ammonia (mg/L)	Total nitrite/nitrate (mg/L)	Total phosphorus (mg P/L)	Dissolved ortho phosphorus (mg P/L)
T-1	above site	0.014	0.014	0.044	0.008
T-2	below site	0.114	1.14	1.3	0.893
T-3	above WWTP	0.417	2.53	2.07	1.93
T-4	below WWTP	0.377	2.6	2.06	1.88
T-6	above BSTF	0.382	2.71	1.9	1.8
T-7	below BSTF	0.292	2.62	1.47	1.36
T-8	between BSTF and PS	0.23	2.7	1.45	1.33
T-9	above PS	0.275	2.71	1.44	1.35
T-10	below PS	0.167	2.71	1.21	1.18

1. Data collected in September 2000 by IDEQ (2001).
2. WWTP: City of Pocatello waste water treatment plant; BSTF: Batiste Springs trout farm; PS: Papoose Springs.

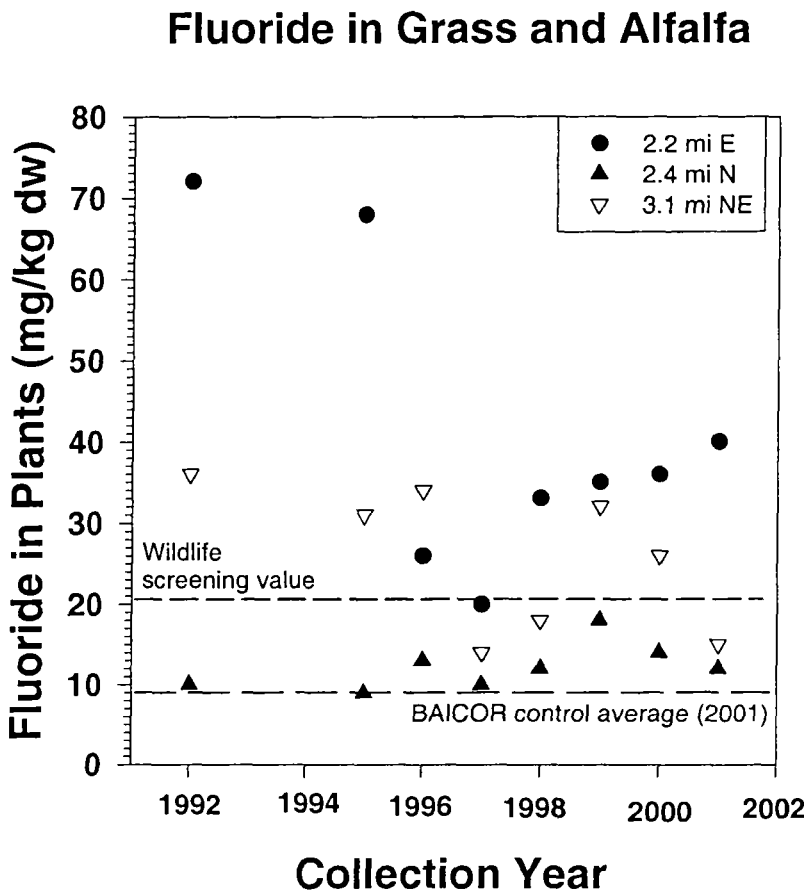

Figure 1. Fluoride in grass and alfalfa collected between 1992 and 2001 at three locations north and east of the site. Data source: BAICOR (1992, 1995, 1996, 2001). The wildlife screening value was derived from Sample et al. (1996); see text.

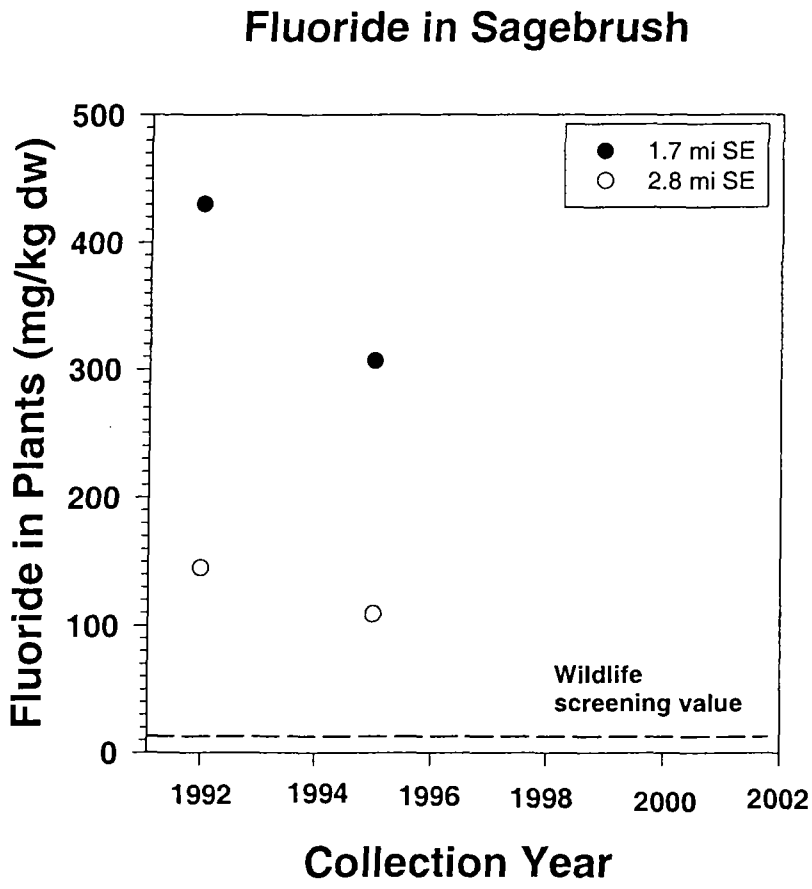

Figure 2. Fluoride in sagebrush collected in 1992 and 1995 at locations southeast of the site. Data source: BAICOR (1992, 1995). The wildlife screening value was derived from Sample et al. (1996); see text.

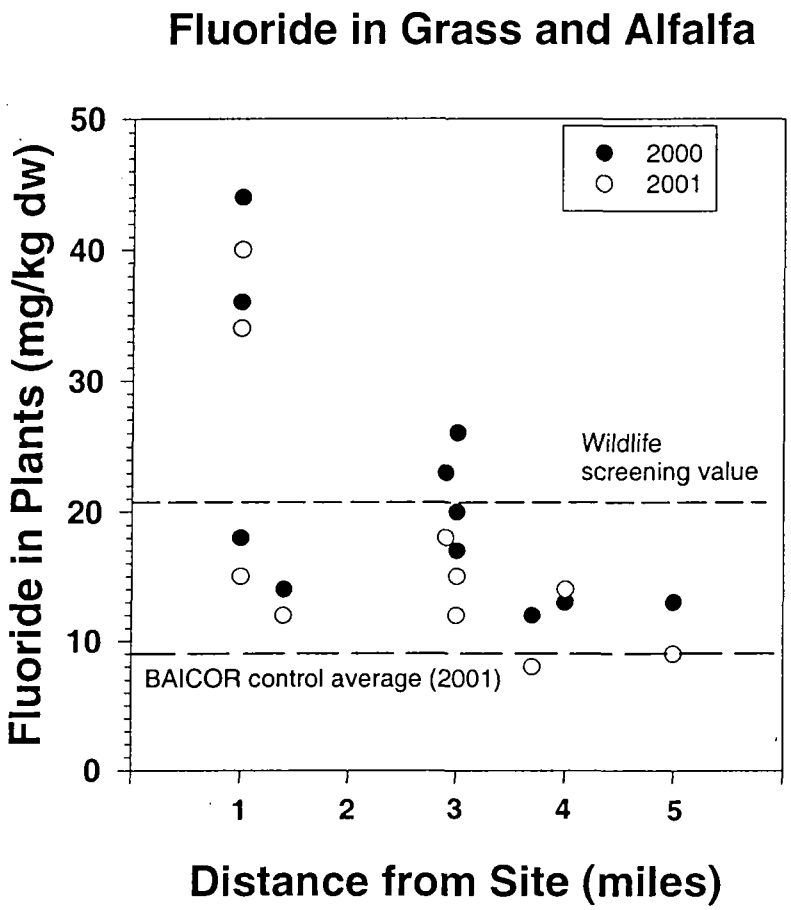

Figure 3. Fluoride in grass and alfalfa collected in 2000 and 2001 at sample locations between 1 and 5 miles from the site. Data source: BAICOR (2001). The wildlife screening value was derived from Sample et al. (1996); see text.

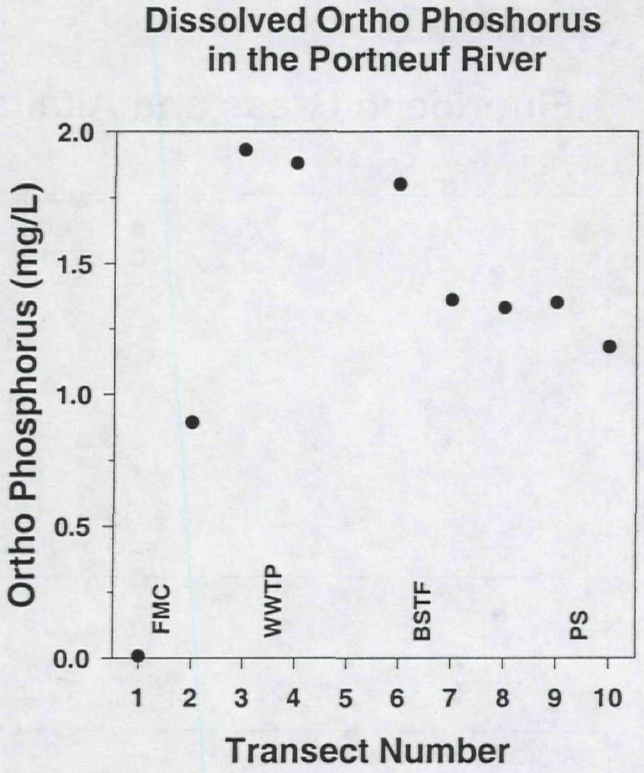

Figure 4. Dissolved ortho phosphorus in the Portneuf River at IDEQ (2001) transects; see Table 3 for location definitions.

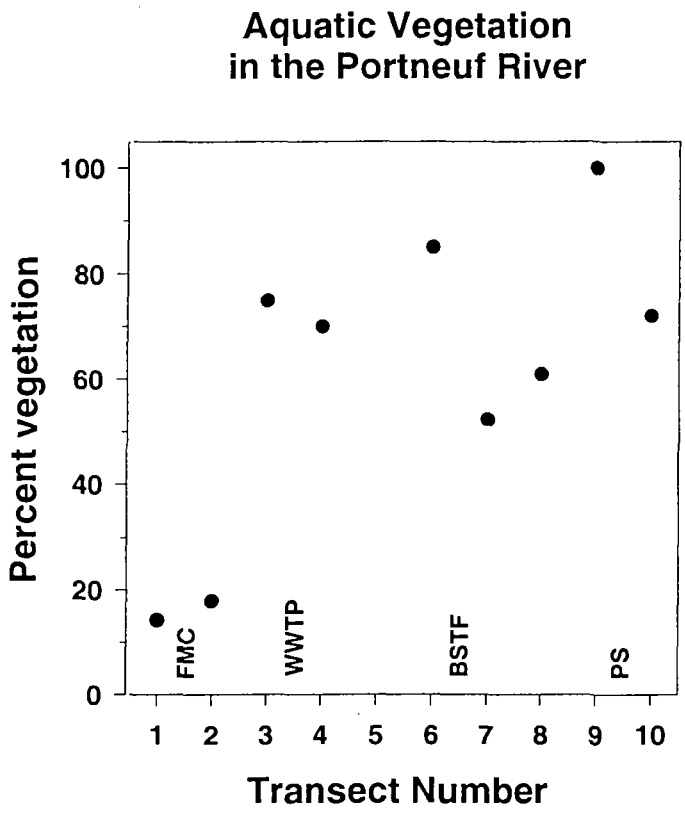

Figure 5. Percentage of stream aquatic vegetation in the Portneuf River at IDEQ (2001) transects; see Table 3 for location definitions.

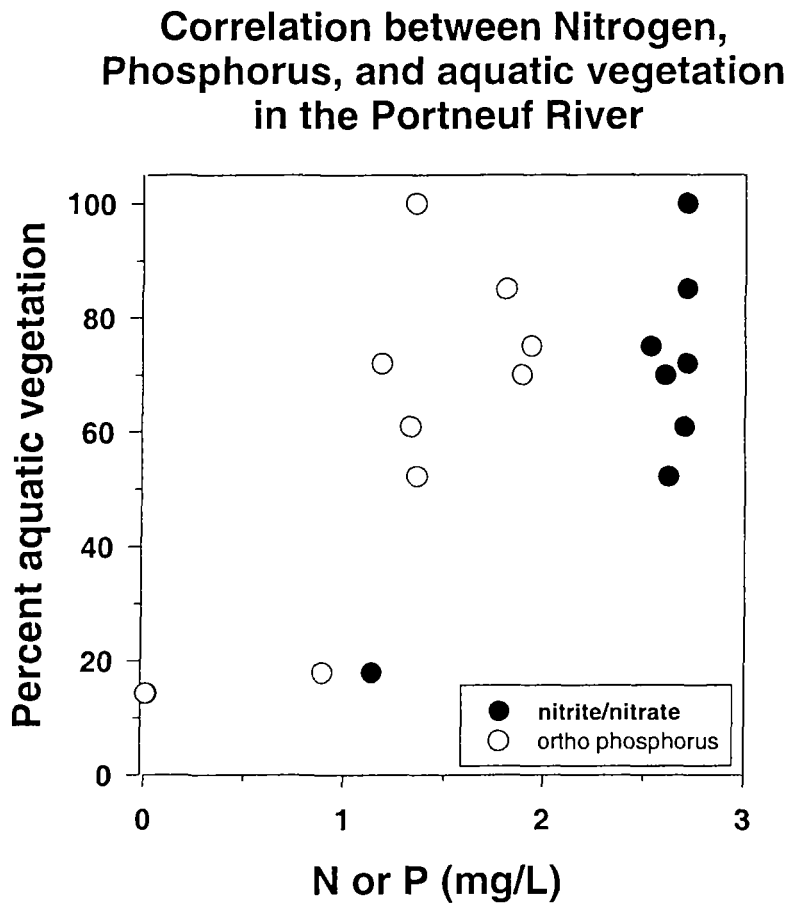

Figure 6. Correlation between dissolved ortho phosphorus, nitrite/nitrate and percent aquatic vegetation in the Portneuf River at IDEQ (2001) transects.