

## Permit Review 14

### ALLEGHENY VALLEY RESOURCES, INC., RUSSELTON MINE (PERMIT # 02930201)

#### Site Summary

The Russelton refuse reprocessing operation is located in West Deer Township, Allegheny County, Pennsylvania, in the Lower Allegheny River Priority Watershed 18A. About 1,500,000 tons of FBC ash from the Scrubgrass Power Plant were placed at this 56- acre site as Russelton's coal mine refuse was mined, shipped, and burned at the Scrubgrass facility. One thousand tons of coal refuse was burned each day, generating 650 tons of FBC ash for each 1000 tons of refuse, which was eventually returned and placed at the Russelton site. Ash placement commenced in 1997 and finished in 2002 or 2003. Monitoring started with sampling for background data in 1992 and continued from 1994 to 2004.

Russelton's coal mine waste pile resulted from deep mining the Upper Freeport coal seam. This coal seam is more than 200 feet below the permitted waste pile and has no effect on monitoring data. In addition, there are no pit floors or deep mine discharges at the site that could affect groundwater quality.

All of the data were collected from surface water monitoring points; no groundwater monitoring wells were drilled at Russelton. Data from three monitoring points were assessed in this analysis: an upstream point on Little Deer Creek, a downstream point on Little Deer Creek (below the waste pile site), and a direct discharge from a waste pile. These points are labeled S-1u, S-1d, and D-8, respectively. The discharge point D-8 is also a subchapter F monitoring point.

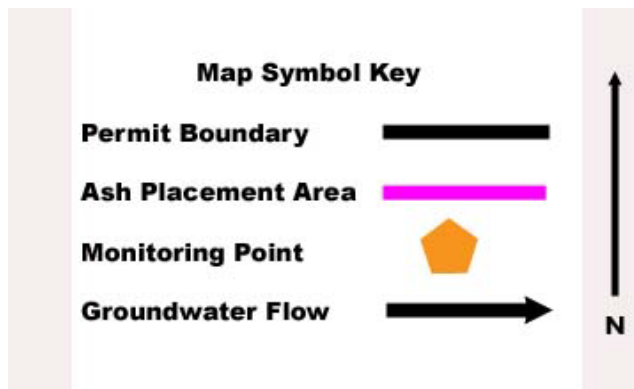
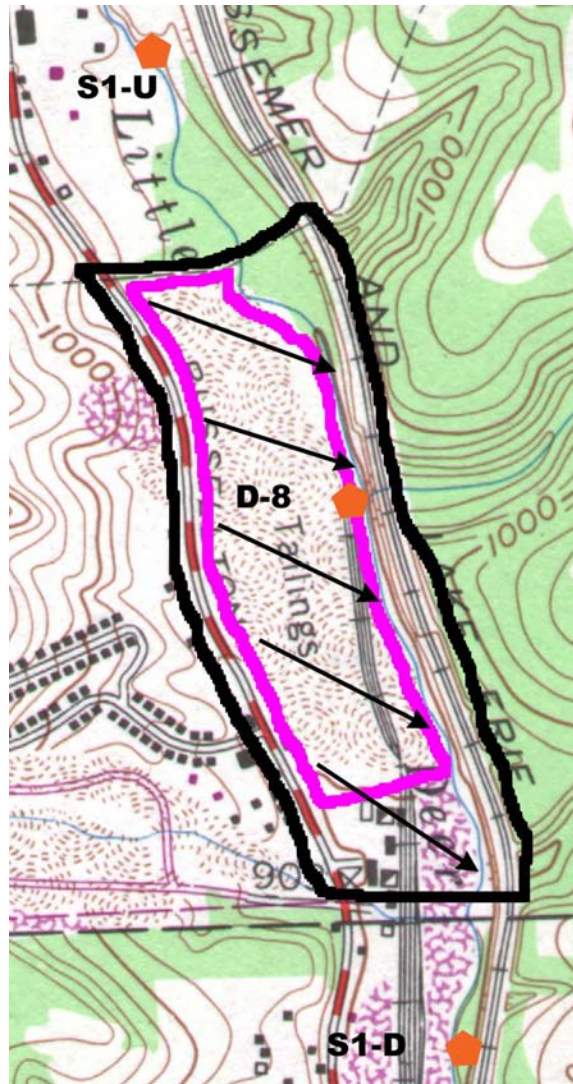
#### Geology

The bedrock at the Russelton site is in the Glenshaw Formation of the Casselman Group, Pennsylvanian geological time period. The sedimentary strata are barren of coal, except at the very bottom where the Upper Freeport seam is located. Any geological structure in the bedrock does not affect water flow relevant to the analysis of ash impacts.

#### Topography

The Russelton coal waste pile lies in a north-south trending valley in which Little Deer Creek flows (see map). The pile covers the floodplain of Little Deer Creek on the west side of the valley. The physiographic section is part of the Pittsburgh Low Plateau region. The pile elevation ranges from 890 feet above sea level (the surface of the creek on the downstream or south end of the site) to 960 feet above sea level.

**Site Map: Russelton**



**Russelton Waste Coal Operation Map (Permit # 02930201)  
Scale: 1" = Approximately 800'**

## **Groundwater**

It is assumed that most of the groundwater flow through the coal waste pile is to the east toward Little Deer Creek. All of the discharge monitoring points, including D-8, are on the east side of the pile where it borders the creek. Since the surface of the original floodplain also has a slight southerly slope, some of the groundwater is expected to flow to the southeast.

### **Groundwater monitoring data: Discussion**

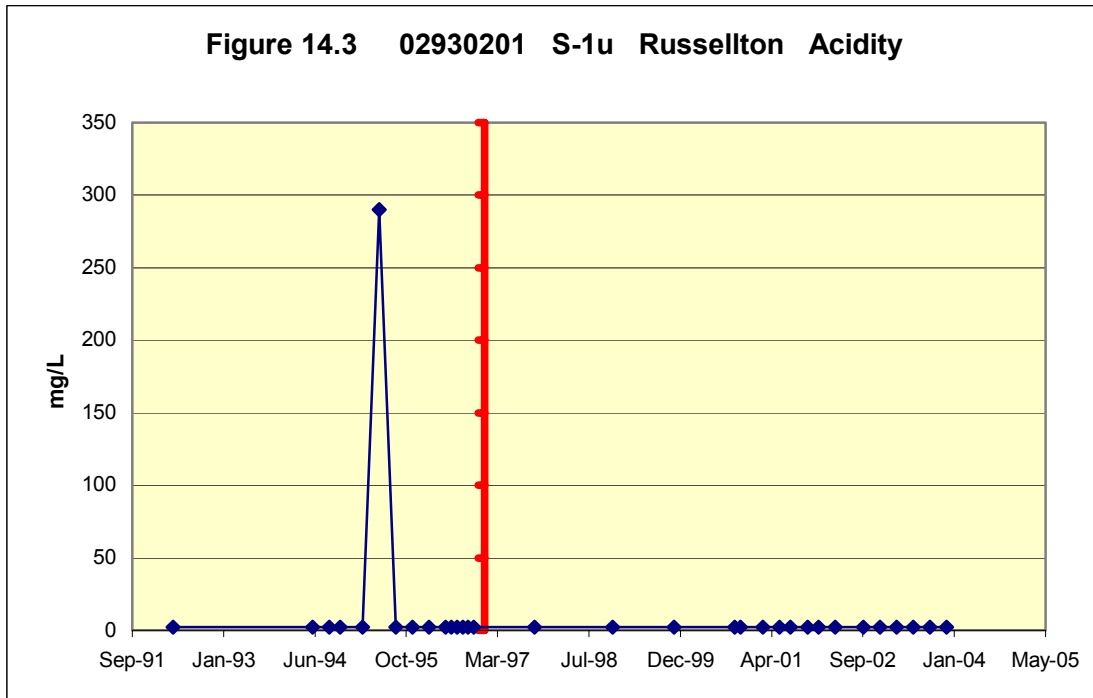
The water monitoring program and data set for this permit are comprehensive in comparison to the other permits reviewed in this report. This site has over 15 discharge sampling points, plus many in the surrounding watershed. The three selected monitoring points with the most complete data sets that best represent the entire site are upstream and downstream surface water data collecting points, S-1u and S-1d, and the waste pile discharge point, D-8, which also has with the the most complete flow data. D-8 is also a subchapter F monitoring point. For purposes of measuring impacts from ash placement, the baseline monitoring period extends to the end of 1996.

#### **S-1u**

Elemental concentration plot graphs for the upstream sampling point, S-1u, are shown in figures 14.1, 14.2, and 14.4. The data for iron (figure 14.1) show a high value of 3.99 mg/L in November 1994 and an anomalously high value of 10.4 mg/L in June 1995 before the Russellton permit's replacement of gob with ash began. The highest iron value after the operation started was 1.14 mg/L in June 2003. The highest manganese value before ash placement was 1.16 mg/L in September 1995 while the highest manganese at S-1u after ash placement was 0.85 mg/L in September 2002. There were modest rises in the upstream surface waters in both iron and manganese from 2001 onward. The iron spike in June 1995 may be an outlier resulting from sampling difficulties or could have resulted from disturbance at an upstream site or from another event(s) not connected with the activities at the Russellton site. There were peaks in sulfate and acidity in this sampling and a much higher peak in iron at S-1d (to be discussed) also in the same sampling.

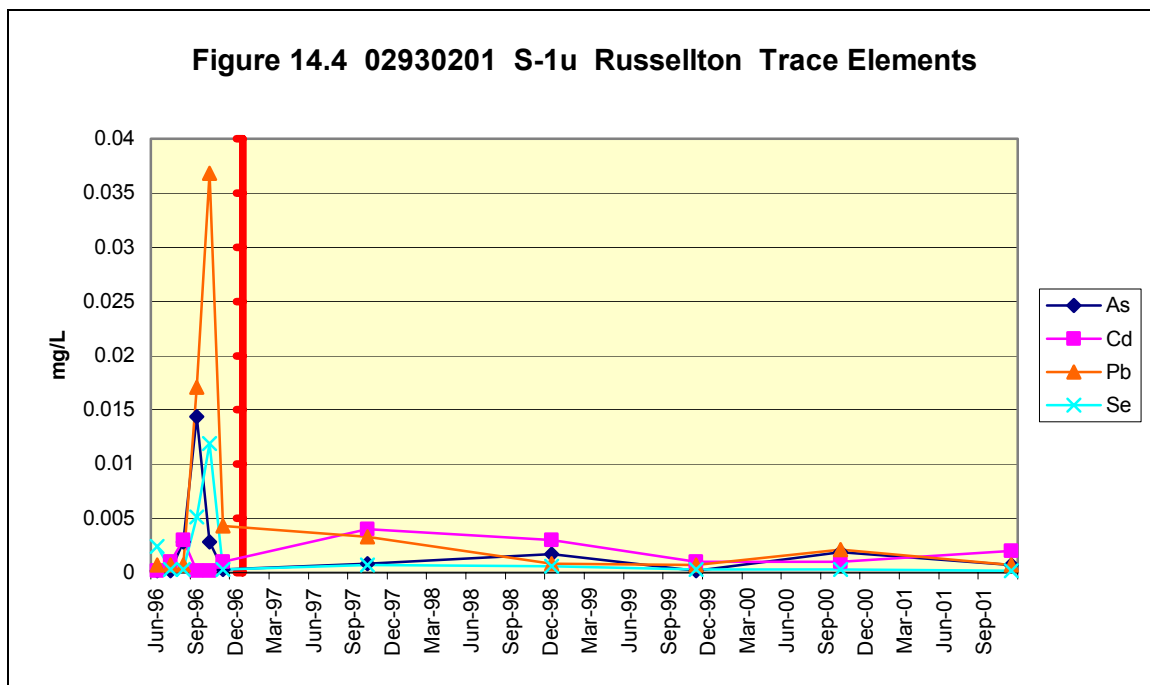
As stated, a spike in sulfate (figure 14.2) also occurred in June 1995 at 1890 mg/L. Sulfate concentrations rose until May 1999, fell until March 2001, and then rose again to a high of 182 mg/L in December 2002 before falling again in 2004. The overall concentrations of sulfate slowly increased during the life of this operation but did not surpass the water quality standard of 250 mg/L that applies in surface waters used for public drinking water supply.





The trace elements, arsenic, lead, and selenium (figure 14.4) at S-1u peaked during the baseline measurement period in September and October 1996 although the highest value for cadmium, 0.004 mg/L, was measured in October 1997. Otherwise, concentrations for these trace elements were relatively flat and about half of the measurements at detection limits below 0.001 mg/L.

The data from S-1u depicts stream water not impacted by the Russelton operation.



**S-1d**

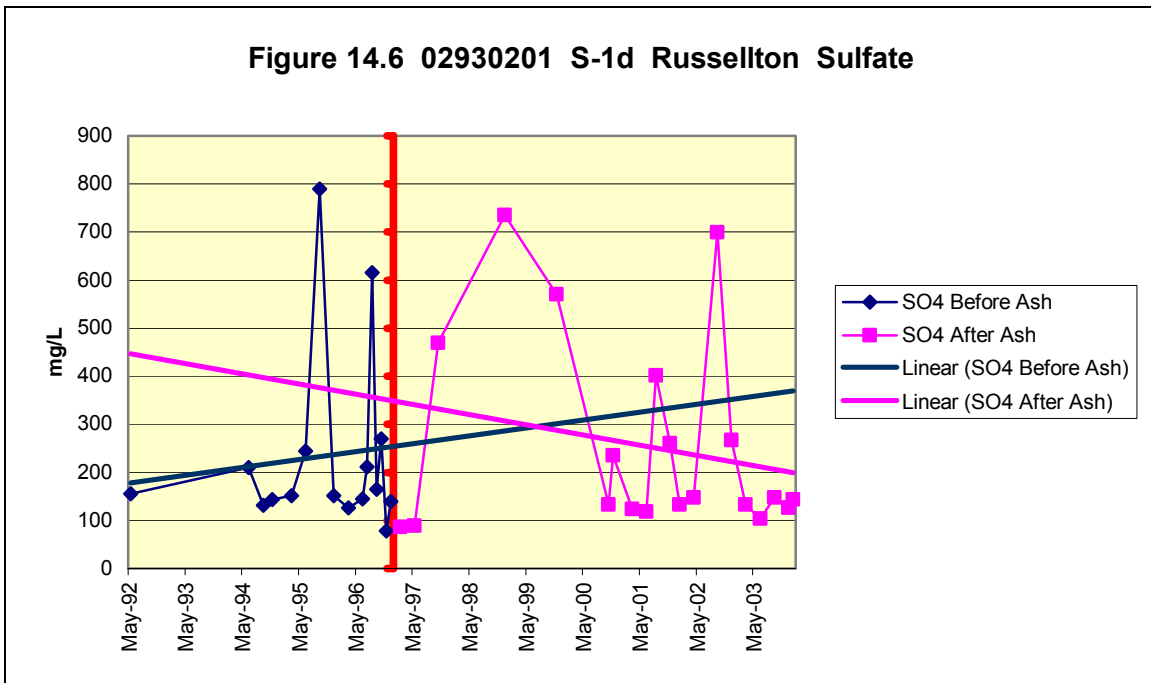
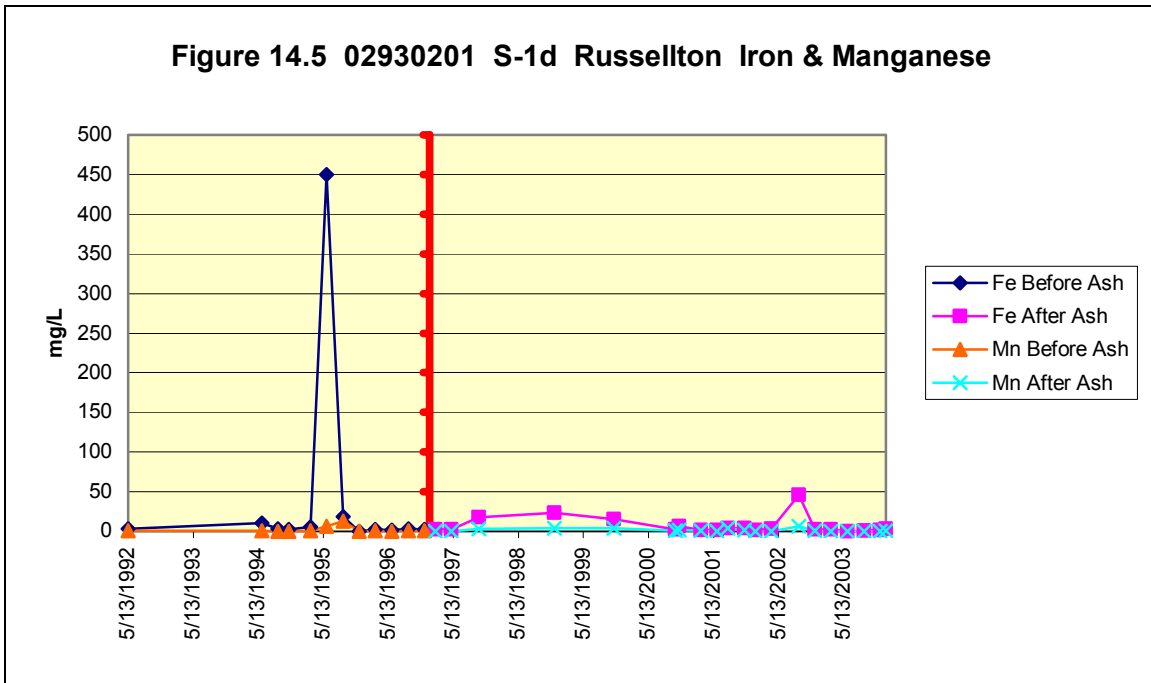
The concentrations for iron, manganese, and sulfates (figures 14.5 and 14.6) for the downstream surface sampling point S-1d were much greater than those for S-1u, reflecting pollution from the Russelton site. The iron concentrations (figure 14.5) included a spike in the same June 29, 1995 sampling in which a spike occurred at S-1u, but the S-1d measurement was about 40 times as high as occurred at the upstream point, (450 mg/L vs. 11 mg/L). Unlike the spike at S-1u, the spike at S-1d was not accompanied by spikes in sulfate or acidity (although peak concentrations of both of these parameters were measured in the subsequent September 1995 sampling at S-1d). There were also concentration peaks of iron in October 1997 (17.85 mg/L), December 1998 (23.4 mg/L), November 1999 (15 mg/L) and September 2002 (45.9 mg/L) at S-1d that were absent at S-1u. Manganese (figure 14.5) rose to 6.7 mg/L in June 1995 and 12.8 mg/L in September 1995 before falling back to levels below 1 mg/L for the rest of the baseline period and two thirds of the measurements during the gob remining and ash placement at Russelton. After these activities started, there were seven measurements of manganese over 1 mg/L at S-1d compared to none over 1 mg/L at S-1u. However the highest measurement at S-1d, 6.2 mg/L in September 2002, occurred when the highest manganese after the baseline period at S-1u was measured (0.85 mg/L).

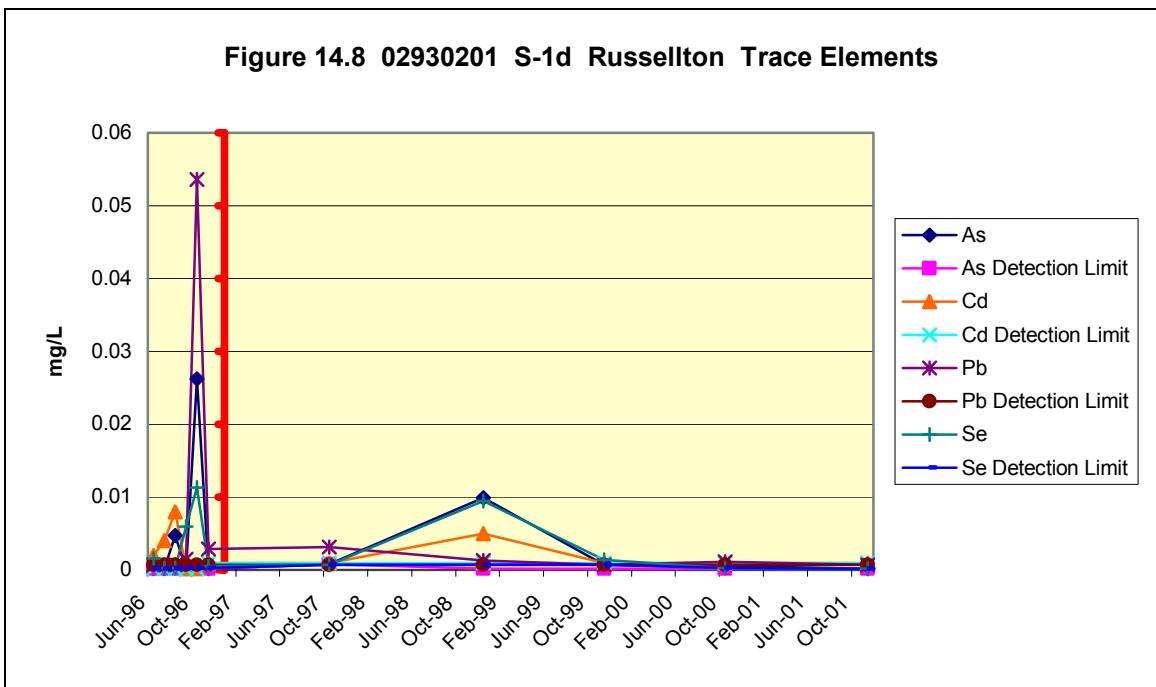
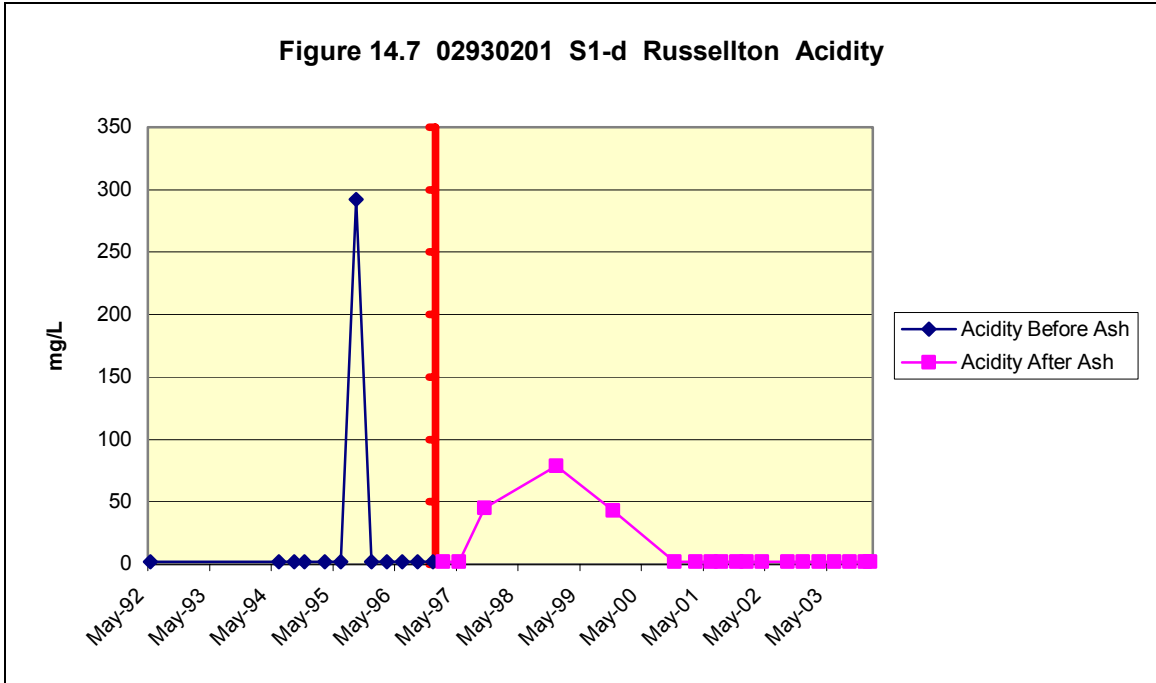
Although the highest concentration of sulfate at S-1d, 790 mg/L, occurred before ash placement on the pile in September 1995, sulfate concentrations were generally higher after gob remining and ash placement began, with an average concentration before ash placement of 233 mg/L compared to an average concentration of 256 mg/L after ash placement (figure 14.6). Nonetheless there was overall declining trend for sulfate during ash placement. Exceptions included a notable rise from 1997 through 1999 peaking at

735 mg/L in December 1998 and a peak again in September 2002 to 699 mg/L. Three out of 16 measurements before ash placement were above the PA water quality standard for public water supply intake waters of 250 mg/L, while 7 of 20 measurements after ash placement were above this standard. The two peaks in sulfate during the baseline period could have occurred from disturbance of the pile, while the peaks during the replacement of the gob with ash could have resulted from pile disturbance and/or a from a large amount of FBC ash placement.

The acidity at S-1d (figure 14.7) had a similar pattern to the sulfates with the highest value occurring in September 1995, prior to ash placement followed by a notable rise from 1997 through 1999 although acidity concentrations stayed low during higher sulfate measurements in 2001 and 2002. Sampling frequencies for the downstream major elements varied with quarterly sampling in Module 8 reports from 1994 through 1997 for parameters such as iron, manganese, and sulfate considered to be both mining and ash parameters, annual sampling for these parameters under Module 25 reports from 1998 through 2000 and quarterly sampling again from 2001 through 2003.

The highest concentrations for trace elements at S-1d (figure 14.8) were measured during the baseline period, with a peak in lead (0.0536 mg/L), arsenic (0.0262 mg/L), and selenium (0.0113 mg/L) concentrations in October 1996 and the highest cadmium in August 1996 at 0.008 mg/L. After ash placement operations were underway there was a rise in December 1998 to 0.0099 mg/L for arsenic, 0.0095 mg/L for selenium and 0.005 mg/L for cadmium and a lead measurement in October 1997 of 0.0032 mg/L, but otherwise concentrations for these trace elements stayed lower than most baseline values and below detection limits in half of the measurements. Nonetheless the highest selenium and cadmium concentrations both before and after ash placement were well over the USEPA recommended water quality standard (Fresh Water Chronic Criteria) for these elements. And the high baseline measurement for lead exceeded this water quality standard by 17 times, while the lead measurement in October 1997 was equal to this standard. The December 1998 rise in these trace element concentrations did not occur at S-1u. Nevertheless the existence of only 5 samplings over 8 years of monitoring after ash placement began limits meaningful assessment of trace elements at these monitoring points.



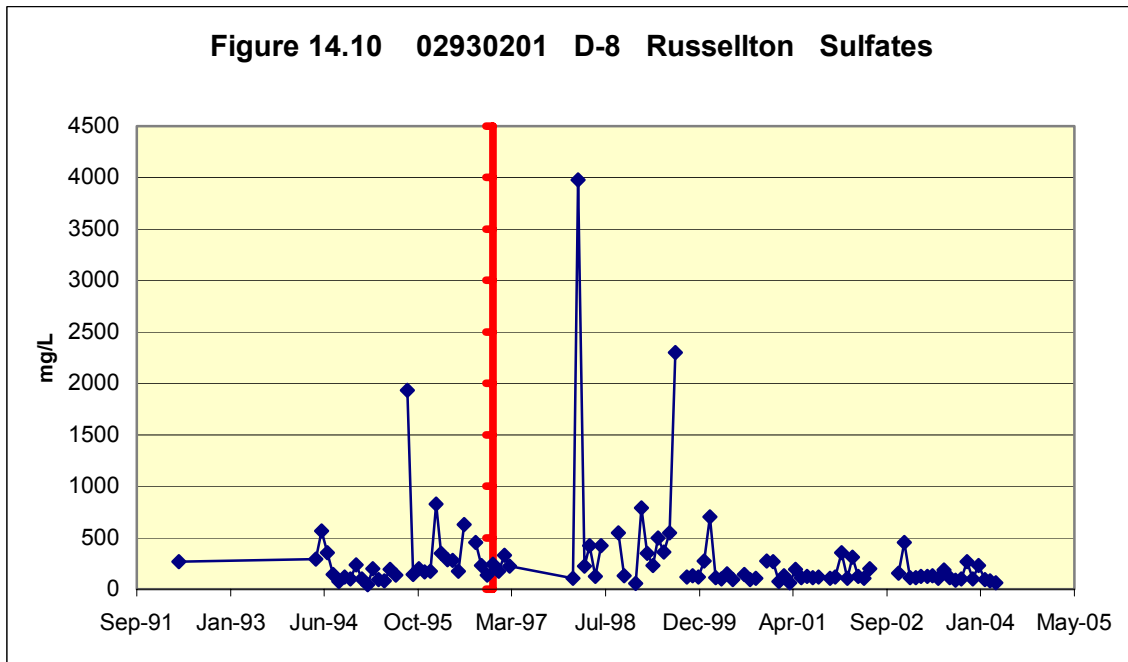
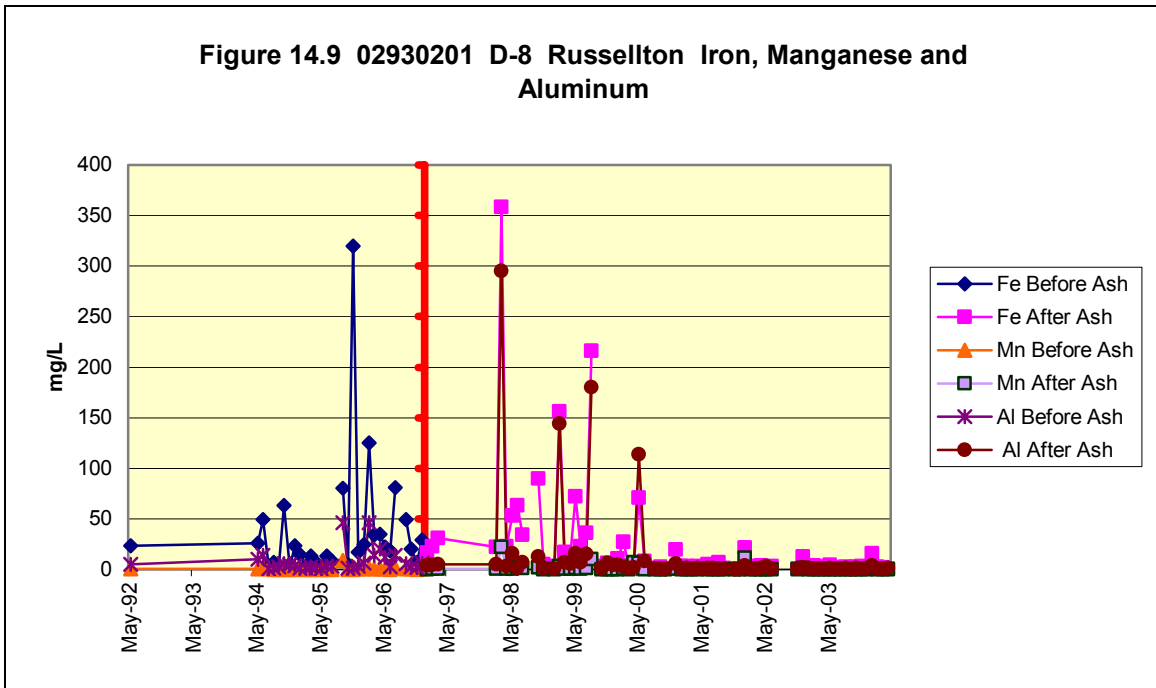


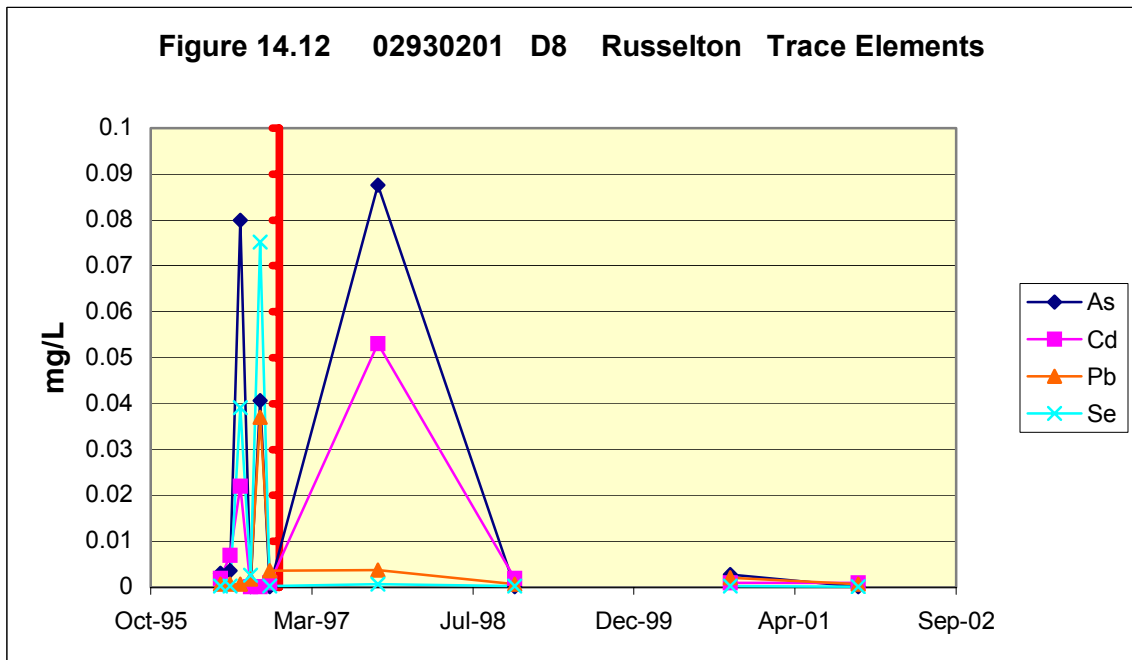
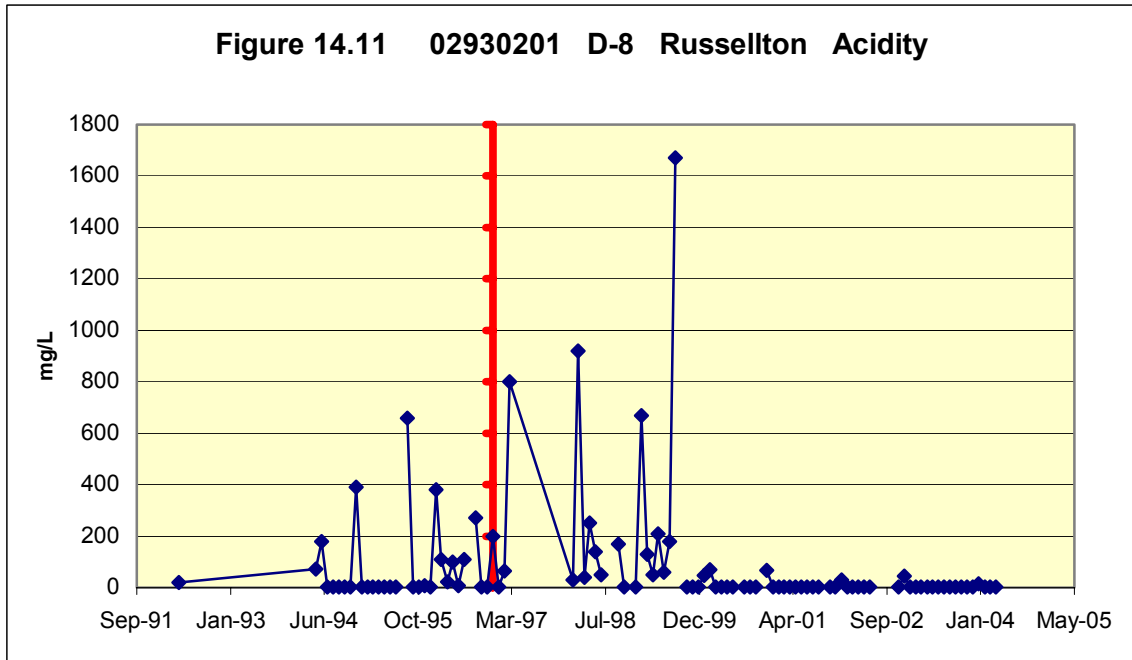
### **Point D-8**

Figure 14.9 shows iron, manganese and aluminum concentrations at Subchapter F point D-8, a discharge from the waste pile into Little Deer Creek. The data sets for these major elements are comprehensive, as samples were taken monthly over the active time span of the site. There are two gaps, one from June 1993 to April 1994 and one from March 1997 to February 1998. The concentrations at D-8 were higher than iron, manganese and aluminum concentrations at either stream point (with the exception of the June 1995 peak in iron at S-1d) but fluctuated to a large degree. High peaks in the latter half of 1995 and in 1998 and 1999 dominated the trends depicting a bimodal distribution. All three elements have very similar patterns often peaking and dropping at the same time. Each peak may reflect an ash placement event or greater disturbance of the waste coal pile. While the highest concentrations for iron, manganese and aluminum all occurred after ash placement started, after June 2000, concentrations of these pollutants decrease notably and flatten, probably due to the end of the remaining disturbance. This suggests that the remaining may have been more responsible for the rises in these elements than the ash placed at the site.

The sulfates (figure 14.10) have a trend similar to these three elements but with much higher concentrations. The correlation of the high sulfate values with high aluminum concentrations, implies the source of the leachate could be FBC ash. The sulfate numbers are higher than those of the downstream samples. The acidity at D-8 has a higher average value than points S-1d and S-1u (figure 14.11). The acidity pattern is somewhat similar to the sulfates, except acidity drops more decisively and levels off in the fall of 1999. Higher sulfate measurements in January 2001, March 2002, and November 2003, exceeding the 250 mg/L secondary DWS and water quality standard, occur when acidity stays below a 2 mg/L detection limit.

Trace elements, arsenic, cadmium, lead, and selenium (figure 14.12), reach peak concentrations at D-8 before and after ash placement starts with lead and selenium peaking at 0.037 mg/L and 0.0752 mg/L respectively in October 1996 and arsenic and cadmium reaching 0.0876 mg/L and 0.053 mg/L respectively in October 1997. These are the highest levels of arsenic, cadmium and selenium recorded at any of the three monitoring points examined in this review. In addition, the D-8 concentrations are more than several times the water quality standards for lead, cadmium, and selenium and more than 8 times the drinking water standard for arsenic. There are no other levels exceeding standards after the October 1997 measurement. However D-8 was recorded as “DRY” in the annual sampling for trace elements in 1999, and there are no data for 2002. Thus four measurements for trace elements from the beginning of 1997 until 2004 does not allow those assessing this site to know how mobile these elements are at D-8 with much degree of confidence.



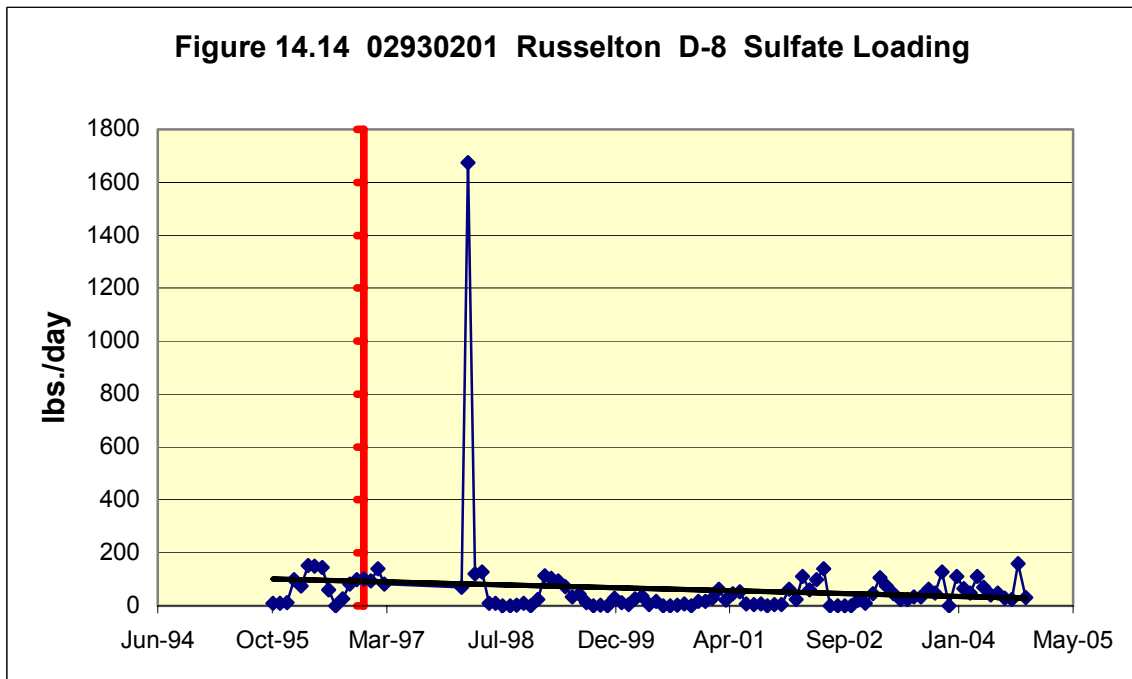
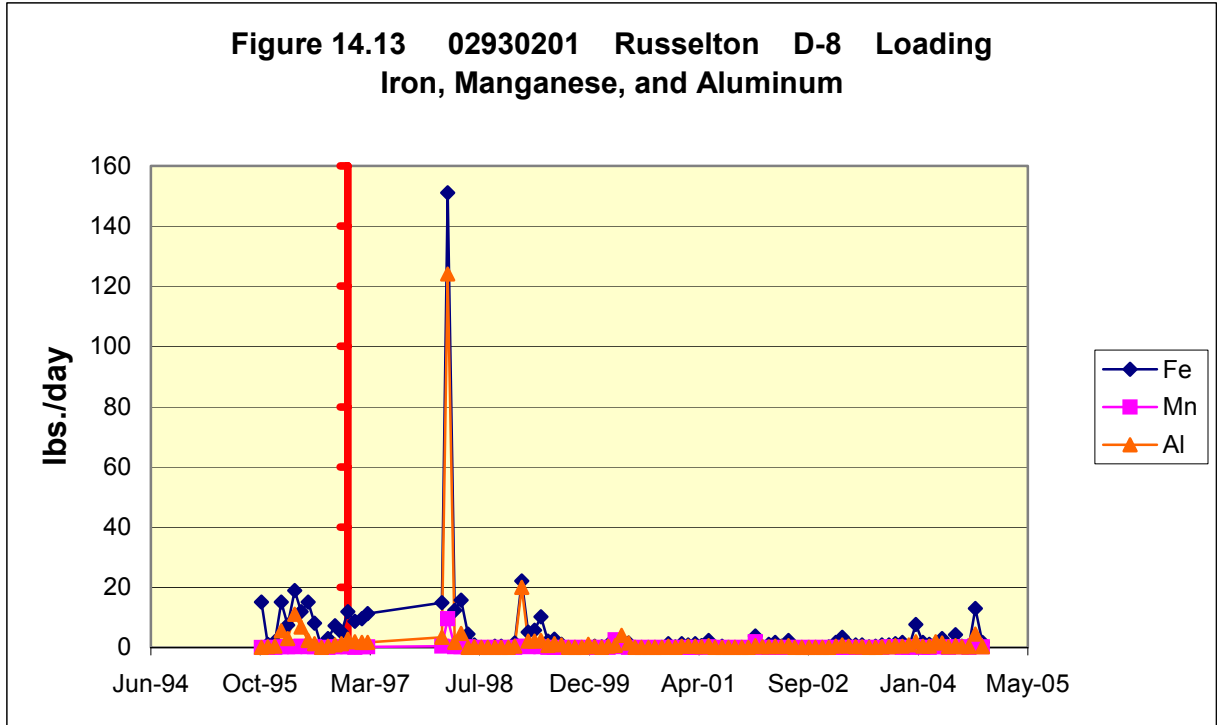


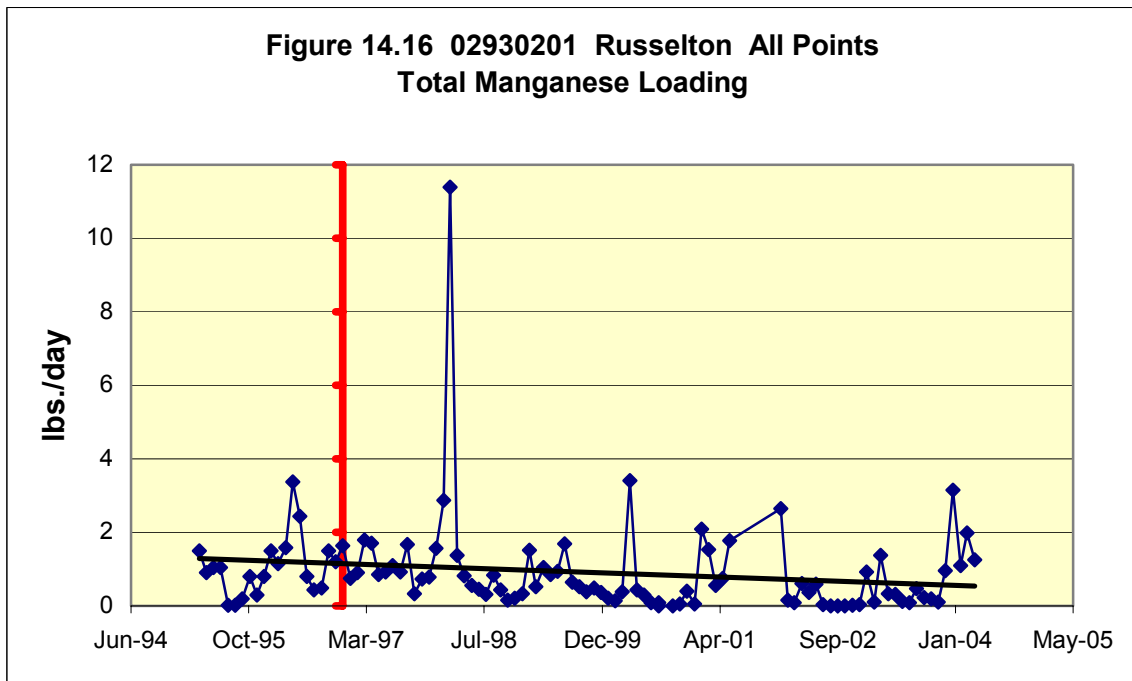
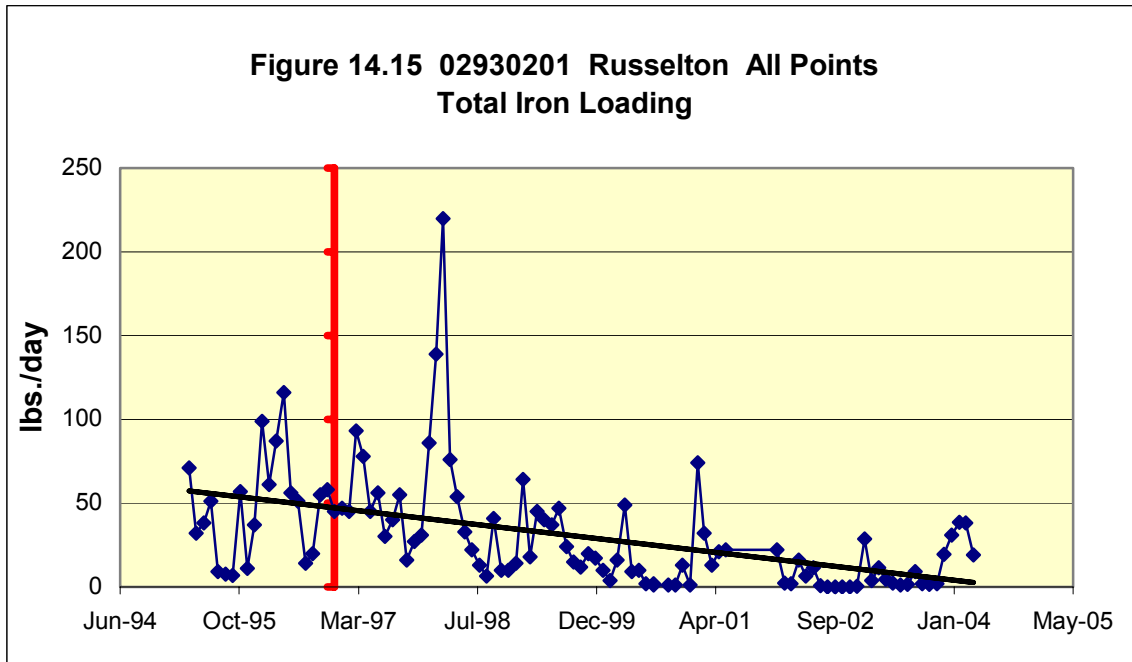
### **Loading Data**

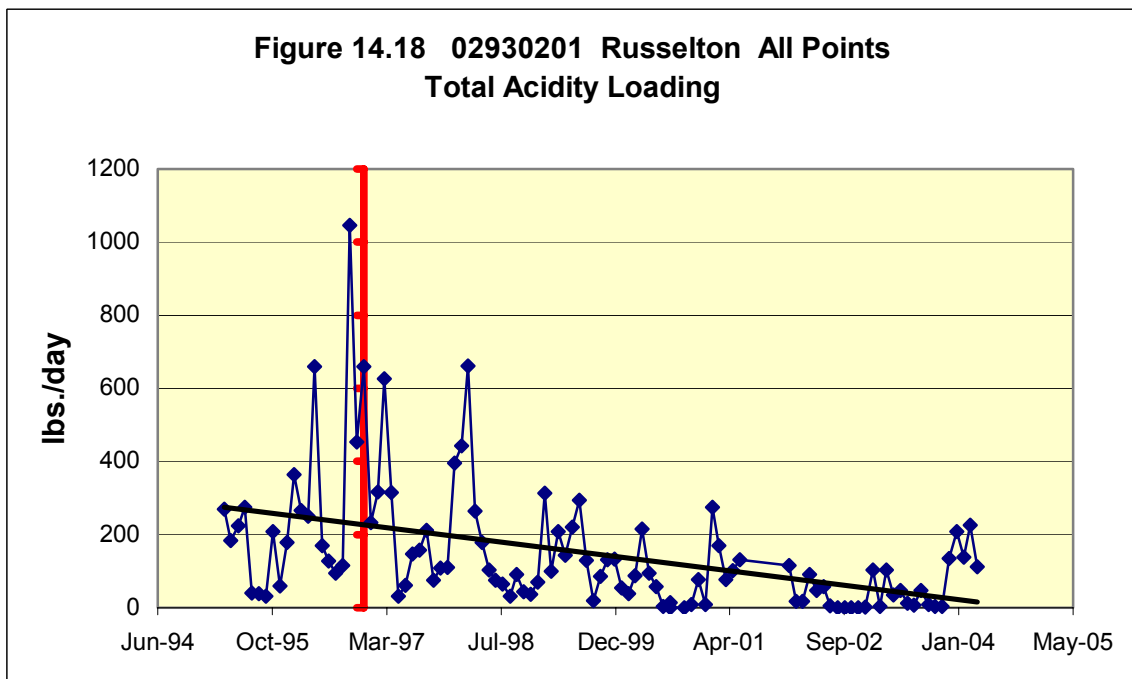
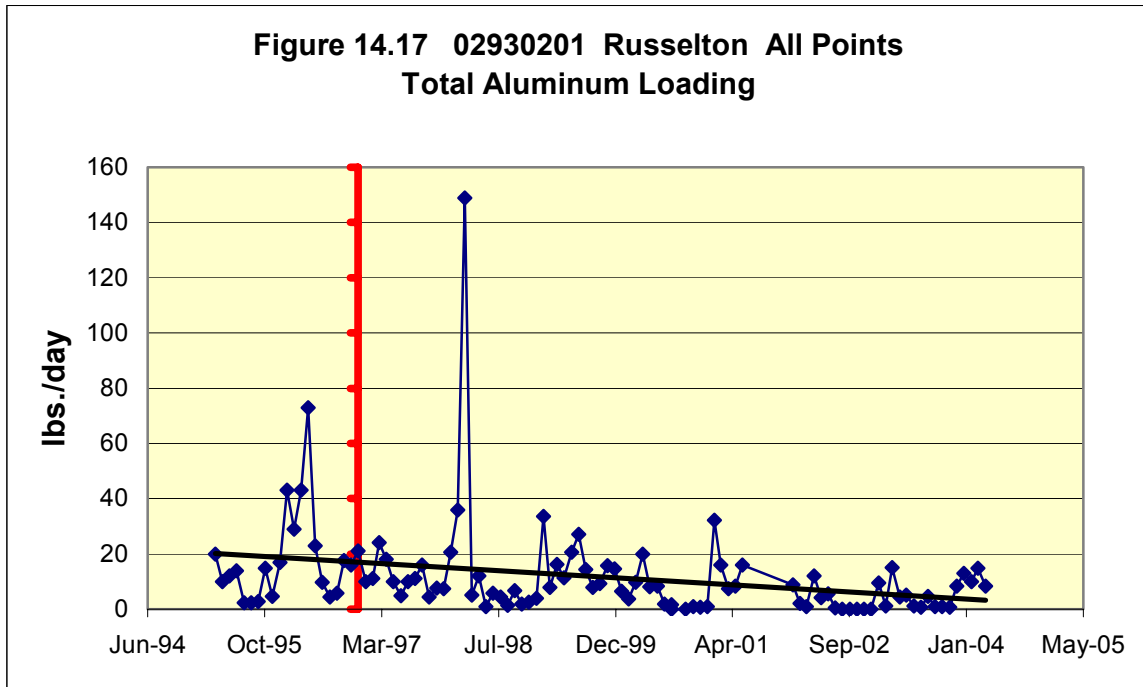
Loading data, expressed in pounds of contaminant per day, were recorded for subchapter F monitoring point D-8. The total loading, which is the sum of all the discharge points at the site, was also recorded.

Figure 14.13 illustrates loading at D-8 for iron, manganese, and aluminum. The patterns for these three elements are similar, with iron having the highest average concentration, followed by aluminum and manganese. Although the highest loading levels occurred after remining and ash placement were underway for more than a year, the amount of iron, manganese and aluminum released into the environment decreased slightly over time at D-8. Figure 14.14 shows the sulfate loading data for D-8; by far the highest loading value occurred in March 1998 at 1674 lbs of sulfate exiting D-8 per day when a peak also occurred in loading for iron, manganese and aluminum, but the average loading of sulfate also decreased gradually over time. Of note however is that one of the last loading measurements available (in October 2004) found 159 lbs of sulfate leaving the site per day at D-8, a larger amount than any loading measured during the baseline period, which was occurring after reclamation would have been in its advanced stages at the site.

The total loading data for these parameters from all subchapter F discharge points at the Russellton site are almost complete and span monthly measurements from April 1995 to April 2004. Only the data from July 2001 to December 2001 is missing. Figure 14.15 is a graph of total iron loading for the whole Russellton site; the average starting value was about 55 lbs/day and dropped to fewer than 10 lbs/day. The manganese loading data (figure 14.16) shows a less dramatic decrease, averaging 1.5 lbs/day decreasing to about 0.75 lbs/day. The variations in the graph curve pattern are regular and repeating and suggest seasonal water flow variations. The aluminum loading graph (figure 14.17) is similar to that of iron although with a more gradual average decrease from about 18 lbs/day to 5 lbs/day. The total acidity loading for the site (figure 14.18) shows a noticeable decrease of nearly 200 lbs/day in the average amount of acidity leaving the site over the entire period of monitoring at the Russellton site. However it should be noted that total acidity loadings increased from under 5 lbs/day in the fall of 2003 to values between 112- 225 lbs/day from December 2004 through April 2004 in the last five measurements available for this report.







## **Conclusion**

The Russelton site has a relatively complete data set compared to other permits, but there are still significant gaps, particularly in trace element values. Despite the measurement in December 1998 of dissolved arsenic and cadmium in the discharge at the base of the gob pile (D-8) that were higher than any baseline concentrations and substantially above federal water quality and drinking water standards, only two more sampling events for trace elements were taken from this discharge in 2000 and 2001

It appears that the stream (Little Deer Creek) has been suffering water quality degradation from major elements due to the Russelton waste coal mining operation, and possibly FBC ash placement, and other sources of contamination upstream but that this degradation has been abating over the past four years. Notwithstanding this improvement, all of the major elements graphed at D-8 and at downstream monitoring point S-1d have readily exceeded federal and state safe drinking water standards and ambient water quality criteria for iron, manganese, aluminum and sulfate on numerous occasions. The increases in concentrations from the upstream to the downstream data are considerable, even though the contaminants flowing from the site were presumably diluted by the increasing volume of stream flow. Concentrations of iron, manganese, aluminum, sulfate and acidity also underwent slight increases after re-mining and ash placement started at S-1d and D-8. However significant decreases in concentrations of these constituents in the last four years of monitoring (2000-2004) are what is most noticeable in the data.

Loading data trends also indicate an improvement in discharge contaminant levels over the life of the site. The amount of iron, manganese, aluminum, and acidity leaving the site in pounds per day over the life span of the operation has been clearly decreasing, indicating an improvement with regard to AMD pollutants. Thus, re-mining and reclamation with FBC ash appears to have been successful in addressing AMD.

The trace element data showed declines in concentrations of trace elements (lead and selenium) from baseline measurements at the monitoring points. The measurement of dissolved arsenic at 0.0876 mg/L (more than 8 times the DWS) and dissolved cadmium at 0.053 mg/L (more than 10 times the DWS) at D-8 in October 1997, after ash placement was underway at the site, were notable exceptions. The latter concentration is 212 times the federal freshwater chronic water quality standard, “the Criterion Continuous Concentration” for cadmium, which is a more relevant standard given the D-8 point is a discharge to Little Deer Creek. However a paucity of data for trace elements (only five measurements after the baseline period at S1-d and S1-u and four measurements after the baseline period at D-8 over an eight year period) prevents definitive conclusions about trends in their concentrations. As there is no trace element loading data, it was also not possible to assess the actual amount of trace element material carried by Little Deer Creek from the Russelton Site. Given the volume of FBC ash

placed at Russellton (approximately 1,500,000 tons), monitoring should continue at this site, and additional monitoring for trace elements and other constituents that would be reliable indicator parameters for ash contamination (based on an adequate characterization of the ash placed here) such as boron, molybdenum, calcium and magnesium should be undertaken.