



Continuous Arsenic Monitoring at the Vineland Chemical Company Superfund Site.

6 month evaluation of the OVA5000.

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This report is a follow up to case study CS005: "Evaluation of the OVA5000 for continuous arsenic monitoring at the Vineland Chemical Superfund Site".

Introduction

Vineland Chemical Company caused a large scale arsenic contamination of a 54-acre site in Vineland, New Jersey by improper raw material storage and depositing waste herbicide material in untreated piles and lagoons over a period of 44 years. In 1994 the plant ceased activity and the site was put on the National Priorities List (NPL) of sites under the Superfund remediation program. The total extent of contamination has not fully been determined, but the runoff from the manufacturing site has contaminated an area river and lake, as well as a large area of groundwater. Arsenic from the site has been detected as far away as 36 miles downstream, near where the Maurice River empties into the Delaware Bay.

The remediation process as a US EPA superfund site began in the 1990's. In late 2001, the United States Army Core of Engineers (USACOE – Site managers) and an engineering company contracted by Severson Environmental Services (plant operators) were responsible for the soil remediation.

The treatment of the contaminated area consists of a soil fraction separation and washing process, in which approximately 200,000 cubic yards of sandy soil from the manufacturing site is excavated and treated.

The contaminated groundwater is pumped using an array of 13 extraction wells. The contaminated groundwater and wastewater from the soil washing process is treated through a chemical precipitation/sludge collection process. The wastewater is then discharged to a local river when below the current discharge limit of 10 parts per billion (ppb). The groundwater remediation operation is expected to last for 30 years, beginning in 2000.

A GFAA (graphite furnace atomic adsorption) has also been used to determine whether the plant is under its discharge limit during the hours of staffing. All of the treatment equipment in the plant is automated and the operating efficiency is monitored remotely by an operator when no one is present at the plant, both after the general work day, and on the weekends. The existing system, however, did not

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provide a value for arsenic in the wastewater, thus the operators relied on other measurements to monitor plant operation.

The OVA5000 was chosen for the trial to try and resolve this problem in that, the instrument is automated and has the capacity to communicate the results of analysis to an external location. The premise being that if the trial was successful the OVA5000 could be incorporated into the plant control system thus providing an arsenic concentration to the remote monitoring station, which is similar to the rest of the equipment in the treatment facility.

The 60 day trial proved successful with data comparisons and correlations between the OVA5000, GFAA and a reference laboratories' ICP-MS (inductively coupled plasma – mass spectrometry) presented in CS005. The net result of the trial was the purchase of the OVA5000 by Severson Environmental Services which now provides real-time continuous monitoring 24 hours a day, 7 days a week with remote reporting to operators. The use of the OVA5000 also allowed the closure of the laboratory outside of normal working hours, thus providing considerable financial savings.

This report details the results obtained since the initial trial. It highlights the increased efficiency at which the plant is able to operate through the incorporation of feedback systems, along with the benefits that continuous monitoring has brought for the company.

Results

Summary of readings from 175 days of operation

The sample treatment and analysis of Arsenic in the effluent of the wastewater treatment plant takes approximately 63 minutes to complete. The process time includes pretreatment of the sample through an acid and ultraviolet digestion unit. The data in Figure 1 represents 4000 data points, or 175 days of operation. The red line in figure one shows the maximum level allowed in the discharge, and the yellow line is the action level set point (20 ppb and 17 ppb respectively). Upon reaching the 17ppb level the effluent is rerouted back through the process for further arsenic removal before release.

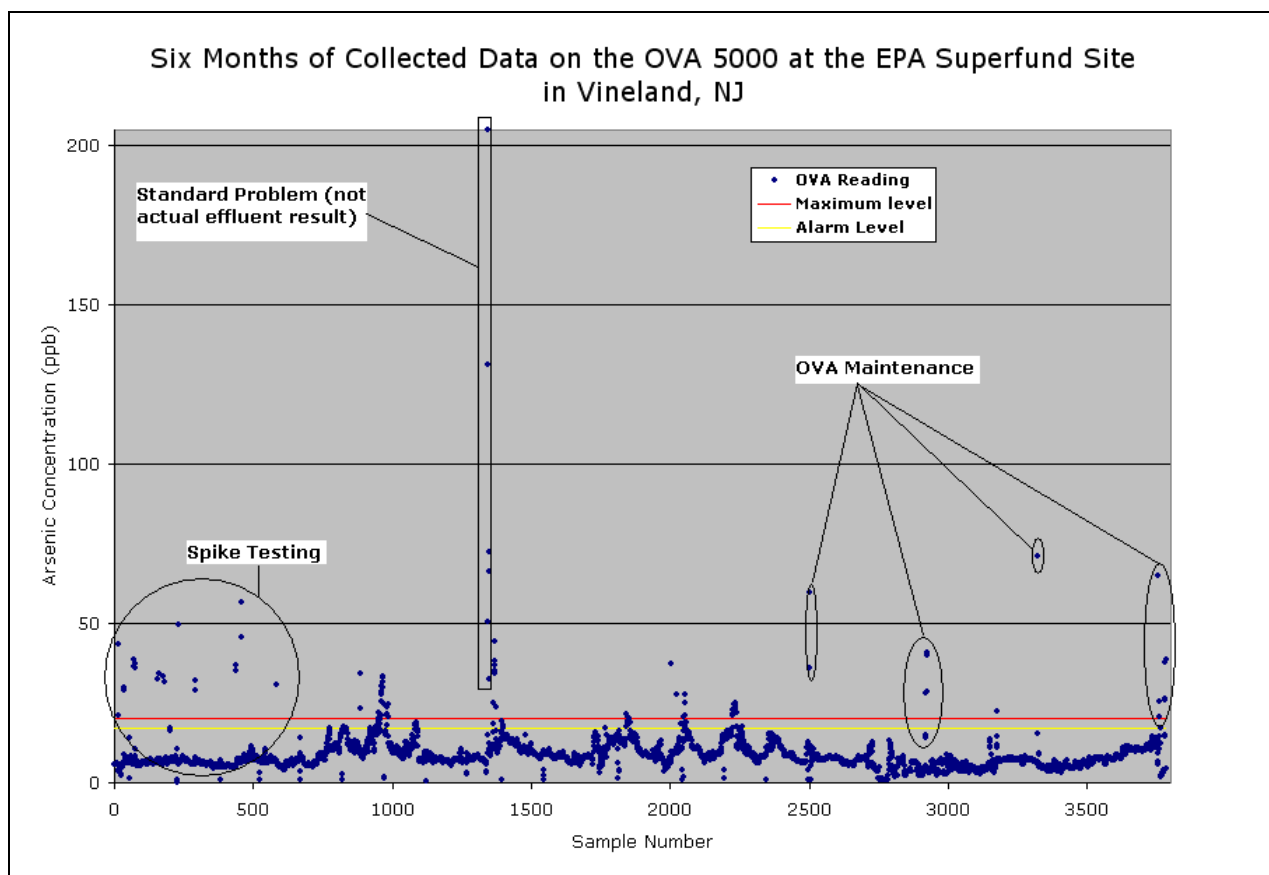


Figure 1 4000 collected data points from the OVA5000 automated on-line monitor. The red line indicates the allowed discharge limit (20ppb) and the yellow line the action level set (17ppb)

Figure 1 shows that there are several elevated concentration responses in the data, the most significant being the group indicated by the Standard Problem comment. This was caused when a standard bottle emptied. Unfortunately, the replacement was standard was significantly low resulting in high values calculated by the OVA5000. Upon realization that the problem was the standard concentration, the operator replaced the container and the instrument then calculated the correct value. The other significant elevated events were a result of maintenance and testing of response times (indicated in the comments).

The OVA5000 responding to an alarm event

There are a few events to note that were actual effluent results that either reached or exceeded the action level set for the wastewater. The OVA5000 is now connected to the wastewater plant Supervisory Control And Data Acquisition (SCADA) system through a 4-20mA connection, with an interactive program on the SCADA system (NOTE: the set points for the data are in the SCADA control). The contaminant level in the discharge being monitored continuously allows for the SCADA system to trigger a recirculation of the wastewater for further treatment (an event is shown in Figure 2).

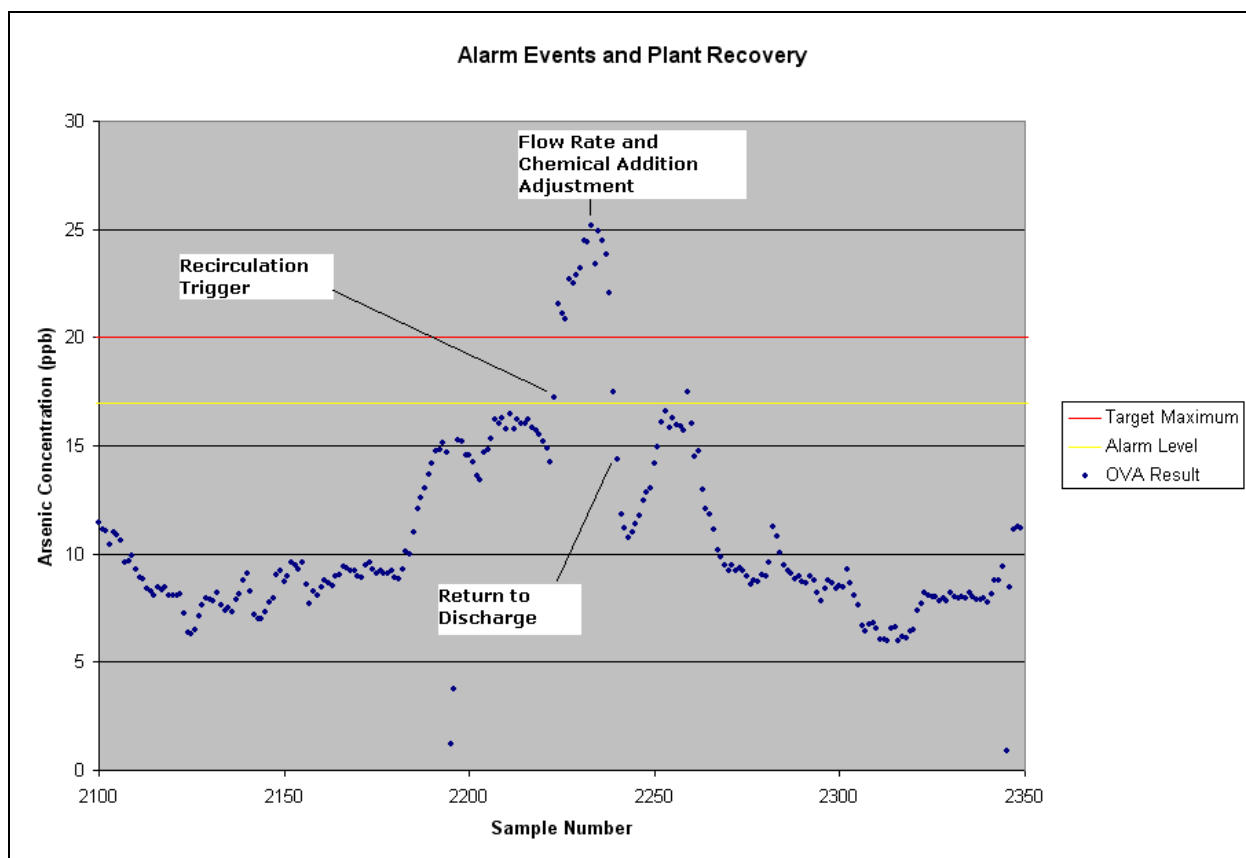


Figure 2 Example of an alarm level event in the SCADA control loop.

Chemical additions and flow rate adjustment further treat the water until levels below the alarm level are returned. It is of interest to note the cyclic nature of this event (note each data point is 63 minutes). This cyclic elevation is most likely a result of the incoming wastewater from the soil washing facility, and indicates the solids being treated were more contaminated than the previous days of operation. A storm event could also cause increases in the incoming contaminant level by increasing the hydraulic head on the well array, in essence forcing the contaminants through the aquifer more rapidly. The example in figure 2 is most likely a result of the influent from the solids facility due to the fact that each "peaks" in the result (4 significant peaks are shown in the center of Figure 2) over a 24 hour period. Around sample number 2175 a steady increase in concentration is noted, and drops.

Then almost 24 hrs later a second rise and fall is seen (note the mean increase in discharge). On the third day there was an immediate increase in concentration above the action level set point, and then the SCADA system sent a signal to begin recirculation of the wastewater to the treatment system. No wastewater was being discharged as the adjustments in chemicals and flow was being made, and over time the levels circulating through the system dropped to an acceptable level and began discharging again until another event was triggered around 24 hours later (this event was much shorter in duration and discharge returned to the river in only an hour).

Focus on 1000 hours of continuous monitoring

The continuous monitoring of the OVA5000 also allows the benefit of examining the discharge over extended time periods as shown in Figure 3. In other circumstances this can have the added benefit of relating the data to the process occurring at that same time enabling a much better treatment of the effluent in the future. The mean discharge level for the plant was approximately 6 ppb over the 1000 hours of operation shown.

The data points shown can easily be exported into a spreadsheet package for further data manipulation as well as being viewed on the OVA5000 system. This is useful information to show to a governing agency upon their inspection.

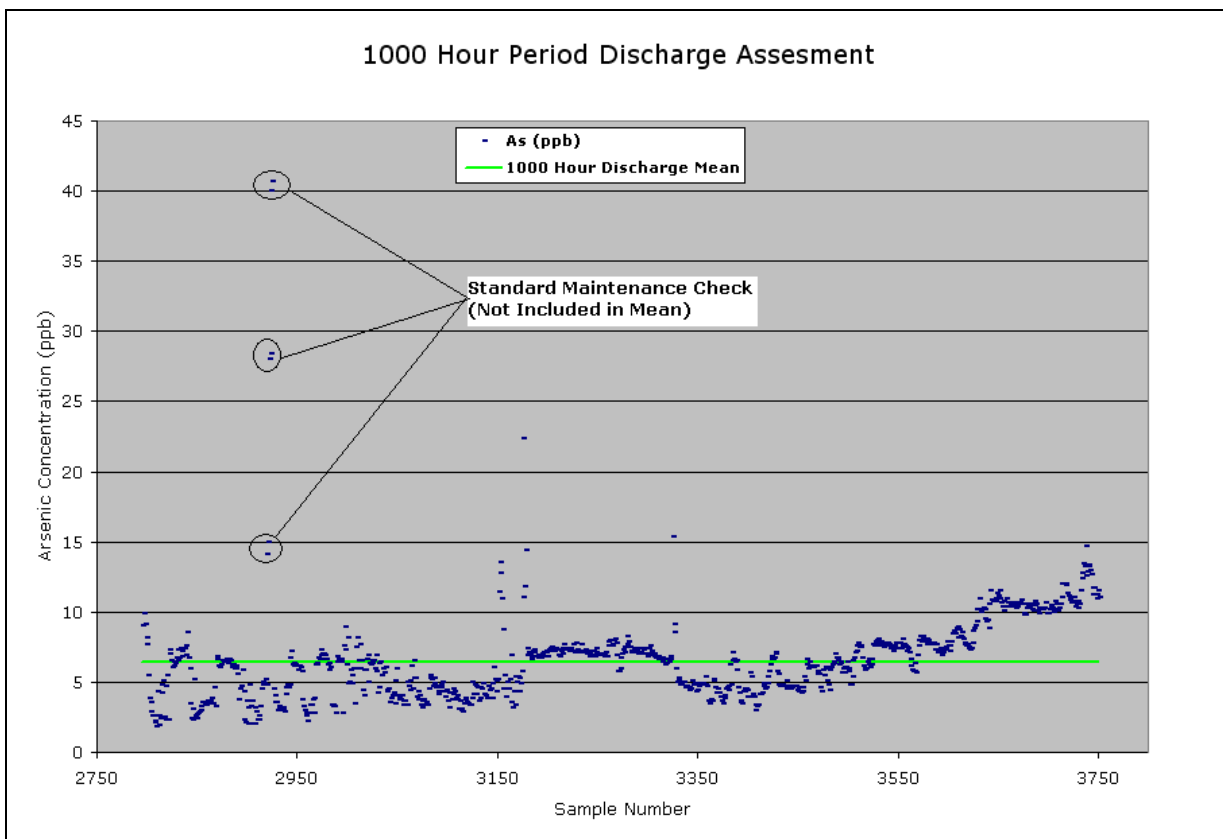


Figure 3 Examination of the mean discharge over 1000 hours.



Conclusions

The data highlights the specific benefits that the online monitoring system has brought to the Vineland Superfund site. It allows the plant to take into account different solids which may be more heavily or more lightly contaminated than on a previous day. Natural events such as storms can also alter the amount of arsenic entering the process. During the period of the last six months there have been several occurrences where the arsenic concentrations have exceeded the action limits.

By having the OVA5000 connected to the SCADA system when such events occur or the efficiency of the process declines the system automatically switches to re-circulation for further treatment. This prevents any chance of an accidental release above the consent limit of 10ppb.

This use of the OVA5000 in conjunction with the SCADA system has provided Severson Environmental Services with an intelligent system for 24 hour a day monitoring and control of the low level arsenic species in their wastewater. This has prevented any accidental releases and potentially, therefore, costly EPA fines and damages to reputation, allowed a reduction in laboratory work, provided financial savings and offered increased protection to the local people and environment.

Bibliography

The following document is referred to in this report and can be found on the Lab21 Environmental webpage:

http://www.lab21.com/environmental/online_monitoring.php

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"Evaluation of the OVA5000 for continuous arsenic monitoring at the Vineland Chemical Superfund Site"