Delisting F006 Hazardous Waste: A learning experience

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Stewart Environmental Consultants, Inc. and AAA Plating of Denver, Colorado, have successfully delisted AAA's F006/F019 listed hazardous waste. When AAA Plating moved into their new facility in 1997, several changes were made to meet the intent of the Strategic Goals Program of the Common Sense Initiative. Part of this program was to eliminate as much of the hazardous waste as possible at the facility. The first step was to separate the two major wastewater streams, zinc-containing and chromium-containing wastes. Zinc sludge is exempt under 40 CFR 261 and thus reduced the amount of hazardous waste from the facility by over 50%. The sludge derived from the chromium-containing wastewater was listed as an F006/F019 hazardous waste. The delisting process took 12 months to satisfy regulators that the heavy metals in the sludge were not available to the environment. In June 2000, this material was successfully delisted by the Colorado Department of Public Health and Environment. This paper will discuss this process, what was learned from the process, and what parameters need to be reviewed as an ongoing responsibility in the future.

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Introduction

The Common Sense Initiative (CSI) was an innovative experiment with the goal of developing cleaner, cheaper, and smarter approaches to protecting the environment and public health. This Environmental Protection Agency (EPA) initiative addressed environmental management by industrial sector rather than by environmental medium (air, water, land). One such industrial sector is the metal finishing industry, whose environmental management program has the title of the National Metal Finishing Strategic Goals Program (SGP). This voluntary program consists of goals which are slated to be achieved by 2002 and which will achieve "better than compliance" for the member facilities. As of October 1999, the program had over 300 participating facilities, 18 states, and 50 Publicly Owned Treatment Works (POTW's). As part of this program, the industry is striving to lower the amount of wastes that are generated by each facility. [1]

AAA Plating, Inc., located in Denver, Colorado, is a charter member of the SGP. When AAA moved into a new facility in October 1998, they had a goal of reducing the amount of waste generated. Their goal for wastes that could not be reduced was for them to be less toxic, thus allowing them to be delisted. This delisting process is part of the fourth, fifth, and seventh goals shown in Table 1.

Table 1

Goal	Description of SGP Goal
1	50% Water Reduction
2	25% Energy Reduction
3	90% Reduction in Organics Emissions
4	Reduction in Sludge Generation and 50% Reduction in Shipments to Land
5	98% Metals Utilization
6	50% Reduction in Metals Emissions to Water and Air
7	Reduction in Human Exposure to Toxic Materials in the Facility and the Surrounding Community

AAA approached meeting SGP goals 4, 5, and 7 through several different methods; the first was to reduce the quantity of hazardous waste. AAA performs a significant amount of zinc plating on steel; the zinc wastewater sludge is exempt from 40 CRF 261 as a hazardous waste. However, the other metal finishing wastewater sludges had a listed F006/F019 classification. In order for these sludges to be considered non-hazardous, a delisting process was required. This paper will discuss the requirements of the delisting process, including the testing program and its results, and suggestions for firms that are attempting to delist their hazardous wastewater sludges.

Wastewater Treatment Technology

A ceramic microfiltration system was installed as part of the new AAA facility. This treatment system is described in detail in other technical publications.[2] A summary of the ceramic microfiltration process for chrome-containing wastewater is provided in Figure 1. The zinc wastewater system has a similar process schematic.

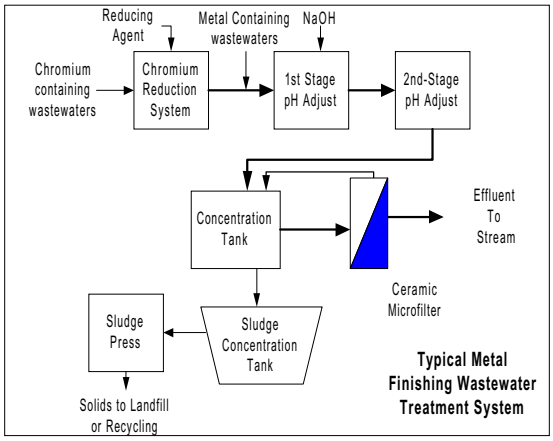

Figure 1 – Ceramic Microfiltration

Referring to Figure 1, the hexavalent chromium in the wastewater is reduced to a trivalent chromium, which was contained in the process sludge scheduled for delisting. In subsequent processes, pH is raised to a level of 8.5 to 9.5 to precipitate the remaining metals, which are removed by the ceramic microfiltration step.

The chemistry involved in the heavy metal removal steps utilizes the high solids concentration in the precipitation process to stabilize the heavy metals.

Due to the complexed nature of the metals contained within the precipitate, the metals are bound in a metal hydroxide matrix and do not easily become soluble under TCLP conditions. The reaction is as follows:

$$M^{++} + 2OH^{-} \Leftrightarrow M(OH)_2$$

Delisting Procedure

The delisting procedure is provided under the regulations of 40 CFR 260.22 and is illustrated in Figure 2. This Federal regulation has been adopted by the State of Colorado, Department of Public Health and Environment, which administers the RCRA program for the U.S. EPA, Region 8, in Colorado. This program requires the delisting petition to contain the following items:

Determination of waste characteristics and potential for delisting of the waste stream. A statistical testing program is not necessary in the first stage, but will be required for final submittal.

Completion of the preliminary application.

Certification statement by the owner of the facility, which requires the owner to ensure that the information is true and correct to the best of their knowledge.

Information on why the material should be delisted.

Manufacturing process information, which needs to be detailed enough to allow a complete review of the chemistry involved in the generation of the hazardous waste. This process description should also discuss why the waste was listed. For example, the F006/F019 wastewater sludge was listed for its toxic characteristics. The process description also needs to identify any chemicals that might interfere with the process, thus resulting in a wastewater sludge that is a hazardous waste.

Detailed information on the laboratory and testing procedures used to determine toxicity.

Factors which might affect the future of this waste characteristic.

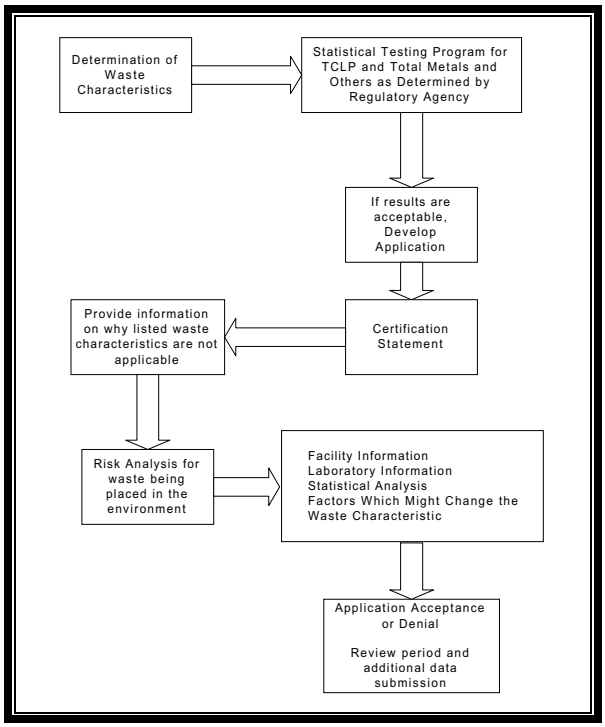

Figure 2 – Delisting Flow Diagram

The testing program is a large portion of the work performed for delisting and is an expensive portion of this process. Sampling procedures must follow a statistically valid experimental design, and sampling must be representative in order to ensure results that are reproducible. In addition, it is necessary to determine if the waste has a potential to be delisted prior to beginning the statistical portion of the process. Initial testing is performed in order to understand how the TCLP characteristics of the sludge will compare to the risk-based standards published by EPA Region 3 and 9.[3] If the TCLP results approximate residential values for groundwater extraction, then there is a good chance that the waste can be delisted and further testing should be started.

Another important factor to determine at the beginning of the delisting process is the selection of parameters. While these will probably be modified during the process, it is very important to discuss with the regulatory agency what parameters they are looking for and how these parameters can affect the delisting process. An example is cyanide.

Under cyanide testing, there are three forms that are important; these are free cyanide, reactive cyanide, and total cyanide. The form used in TCLP testing for reactivity is reactive cyanide. Free and reactive cyanide are part of the 40 CFR 261 Reactive Test (SW-846).[4] These two forms of cyanide compounds are considered simple cyanides.

Complexed cyanides are common in the metal finishing industry. However, their presence can only be determined by running the Total Cyanide Test.[5] Complexed cyanides are not able to convert to a hazardous form (hydrogen cyanide) under typical environmental conditions; therefore, complex cyanide is not normally considered in the risk analysis. However, the regulatory review for delisting AAA Plating's sludge required testing all three different forms of cyanide, and required a detailed explanation of why total cyanide was not an issue for land disposal.

Once the application is submitted, a technical review is performed by the regulatory agency. This normally results in a request for additional information. An example is the cyanide previously referenced.

AAA performs various kinds of plating, including electroless nickel plating. Because of these additional processes, additional parameter selection issues were encountered. The State of California raised a concern about nickel concentrations in the air and in drinking water and wastewater discharges.[6-7] The State of Colorado followed California's lead and required additional information on nickel, as well as copper and zinc for the delisting petition. While nickel, copper, and zinc are not included in RCRA metals testing, they can have a potential harmful effect on human health and the environment. An important item to understand on any delisting application process is the potential for the regulatory agency to add parameters to the list to meet the goal of no effect on human health or the environment.

Upon completion of the technical review, the State of Colorado provided information to the Hazardous Waste Commission. This commission reviewed the material submitted as well as the technical review performed by the State. The Commission's review took approximately two months and AAA received a favorable response. The State of Colorado placed a public notice both on the Internet and in the two main state newspapers, the *Denver Post* and *The Rocky Mountain News*. The public comment period was 45 days. There were no public comments, so the delisting was approved.

AAA's F006/F019 sludge is now a non-hazardous material within the State of Colorado. Therefore, AAA was able to meet one of the goals of the SGP by lowering the toxicity of their sludge through the wastewater treatment process. There are, however, several restrictions placed on the handling of F006/F019 sludge:

1. This material will need to be either recycled or placed in a subtitle D landfill.

2. Waste accounting must be maintained for inspection. Records of the amount of material generated and final disposal of this material must be kept on a yearly basis for at least three years.

3. The delisting of this material is not recognized in other States. Therefore, it is important to contact any other state where a recycling option might be pursued. AAA Plating is presently investigating this issue to obtain better utilization of the metals.

4. If the process within the facility changes significantly or if additional metals are added to the process, retesting might be required to re-qualify for the delisting status.

Conclusions

AAA Plating is attempting to meet the goals and the intent of the Strategic Goals Program of the U.S. EPA, along with The American Electroplaters and Surface Finishers Society and other organizations. One of these goals is to reduce the amount of toxic material being generated by the metal finishing industry. Another goal is to increase utilization of the heavy metals from the metal finishing industry. AAA found that by delisting their wastewater sludge, they were able to accomplish the following:

1. A decrease in disposal costs from $300 per cubic yard to $35 per cubic yard. This is over a 90% reduction of the overall cost for disposal.

2. Create a potential for metal recovery from the wastewater sludge at a primary smelter. This will increase the amount of metal utilization, thereby meeting the SGP goals.

The delisting process has some drawbacks in that retesting may be required and record keeping will increase. However, the drawbacks are much lower than the benefits of the overall delisting process.

References

[1] US EPA Common Sense Initiative, National Metal Finishers Strategic Goals Program, http://www.epa.gov/opei/

[2] Stewart, David R., Thoen, Paul and Grove, Tom, "Ceramic Microfiltration for Metal Finishing Wastewater Treatment: Lower Costs with Better Removal Efficiency," Presented at the AESF-EPA Conference January, 2000

[3] EPA Website: http://www.epa.gov/

[4] Test Method 9012, SW-846, USEPA, "Test Methods for Evaluating Solid Waste," Volume Two, Third Edition, September, 1986

[5] Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

[6] High, Dean, M., "Update on Chromium and Nickel Regulations in California," AESF – EPA Conference for Environmental Excellence, January, 1999

[7] USEPA, "Draft Technical Support Document – Control of Emissions of Hazardous Air Pollutants from Motor Vehicles and Motor Vehicle Fuels," EPA 420-D-00-003