Errata Sheet (September 2005)
Perchlorate Treatment Technology
Update -- Federal Facilities Forum Issue Paper
EPA 542-R-05-015; May 2005

This errata sheet identifies corrections to information provided in U.S. EPA 542-R-05-015 (May 2005), *Perchlorate Treatment Technology: Update*. This errata sheet highlights the updates that are being made to the issue paper based on new information provided after the original paper was developed. Revised portions of the affected text and tables are highlighted in the following pages.

The entry for the number of Ion Exchange projects and the total number of projects in Table 3-1, Number of Perchlorate Treatment Projects Discussed in Issue Paper, on page 16 of the issue paper has been changed. The revised Table 3-1 is as follows.

Table 3-1. Number of Perchlorate Treatment Projects Discussed in Issue Paper

Technology	No. of Projects	
	Full-Scale	Pilot-Scale
Ion Exchange	15	3
Bioreactor	4	5
Granular Activated Carbon	2	2
Composting	1	3
In Situ Bioremediation	1	10
Permeable Reactive Barrier	2	1
Phytotechnology	0	1
Electrodialysis	0	2
Reverse Osmosis	0	0
TOTAL	25	27

The entry for the Kerr-McGee, Henderson, Nevada site in Table 3.1-1, Ion Exchange Performance Summaries for Perchlorate Treatment Projects, on page 20 of the issue paper has been changed. Furthermore, a new project for the Kerr-McGee site has been added to Table 3.1-1. The revised and new entries for the Kerr-McGee site in Table 3.1-1 are as follows.

Table 3.1-1: Ion Exchange Performance Summaries for Perchlorate Treatment Projects

Location, Technology, Type of Media, Scale and Status	Technology Design and Operation	Technology Performance Summary	Source
Kerr McGee, Henderson, NV; Ion Exchange; Groundwater; Full-scale; Shut down. (ISEP-Perchlorate Destruction Modules [PDMs] System)	A regenerable anion exchange system initiated operation in March 2002 to treat groundwater contaminated with perchlorate. The full-scale treatment system included 30 anion exchange units mounted on a turntable attached to a rotating multi-port valve. During one turntable rotation, each resin column was subjected to a cycle of adsorption, rinsing and regeneration (with salt brine). The perchlorate removed from the ion exchange columns was then destroyed by reaction with ammonia in two high temperature catalytic Perchlorate Destruction Modules (PDM). The flow rate of the system was 825 gpm.	Period of Performance: March 2002 – October 2002 Initial perchlorate concentrations ranged up to 350,000 µg/L. Effluent perchlorate concentrations ranged from 500 to 2,000 µg/L. The removal efficiency was approximately 99%. Elevated concentrations of dissolved solids and sulfate caused maintenance problems. The system was shut down in October 2002 due to corrosion in the heat exchangers in the perchlorate destruction modules. The ISEP-PDM system was replaced by a system of 12 anion exchange columns known as the "Plant Ion Exchange System."	1. EPA Region 9. 2004. "Perchlorate in Henderson, NV – Significant controls are operating." July. 2. Cal EPA. 2004. "Perchlorate Contamination Treatment Alternatives: Draft." January. 3. EPA Region 9. 2005i. E-mail message regarding perchlorate treatment. From Larry Bowerman (EPA Region 9) to John Quander. June 24.
Kerr McGee, Henderson, NV; Ion Exchange; Groundwater; Full-scale; Shut down. (Plant Ion Exchange System and Wash Ion Exchange System)	The Plant Ion Exchange System began operation in October 2002 to treat groundwater contaminated with perchlorate. The full-scale treatment system included 12 single-use anion exchange columns configured in 4 parallel trains of 3 columns each. When the resin was saturated with perchlorate, it was removed and sent off-site for incineration. The flow rate of the system was 750 gpm. The Wash Ion Exchange System began operation in November 1999. Initially it included two single-use ion exchange columns configured in series (a third column was added in October 2002). This system treated about 350 gpm containing about 100,000 µg/L perchlorate, removing 97-99%.	Period of Performance (for Plant Ion Exchange System): October 2002 – March 2004 Initial perchlorate concentrations ranged from 80,000 to 350,000 µg/L. Effluent concentrations ranged from 500 to 2,000 µg/L. The removal efficiency was 98 to 99.8% The Plant Ion Exchange System was shut down in March 2004 when a new biologically based treatment plant (the FBR Plant) began operation. The Wash Ion Exchange System operated from November 1999 until it was shut down in June 2004.	1. EPA Region 9. 2004. "Perchlorate in Henderson, NV – Significant controls are operating." July. 2. Cal EPA. 2004. "Perchlorate Contamination Treatment Alternatives: Draft." January. 3. EPA Region 9. 2005i. E-mail message regarding perchlorate treatment. From Larry Bowerman (EPA Region 9) to John Quander. June 24.

The text in Section 3.1 on page 18 has been revised to reflect the new data. The revised text below replaces the subsection, "Type, Number, and Scale of Identified Projects Treating Wastes Containing Perchlorate" and the first five sentences of the "Summary of Performance Data" subsection.

3.1 Ion Exchange

Type, Number, and Scale of Identified Projects Treating Wastes Containing Perchlorate

Ion exchange of perchlorate in environmental media and drinking water is commercially available. Information is available on 15 full-scale applications, including 11 applications for environmental media, and 4 applications for drinking water. Three pilot-scale applications for groundwater also have been identified.

Summary of Performance Data

Table 3.1-1 summarizes available performance data for this technology. For the 14 groundwater projects (11 full scale and 3 pilot scale), influent perchlorate concentrations ranged from 10 µg/L to 350,000 µg/L. Effluent concentrations of perchlorate ranged from non-detect at a detection limit of 0.35 µg/L (Project 16, Table 3.1-1) to 2,000 µg/L. Of the four drinking water projects, performance data were available for only one project. The initial concentration of perchlorate in this project ranged from 20 to 50 µg/L, while the final concentration was below the detection limit of 4 µg/L.

The text on page 26 of Section 3.2 has been revised to reflect the new data. The revised text below replaces the first three sentences of the second paragraph in the subsection titled Summary of Performance Data.

3.2 Bioreactor

Summary of Performance Data

Information is available on four full-scale applications, including three applications for environmental media and one for drinking water. Five pilot-scale applications, including four applications for environmental media and one for drinking water, have also been identified. For the seven groundwater projects, influent concentrations of perchlorate ranged from 55 to 200,000 µg/L, while the effluent concentration ranged from 2 to 18 µg/L.

The entry for the Kerr-McGee, Henderson, Nevada site in Table 3.2-1 Bioreactor Performance Summaries for Perchlorate Treatment Projects, on page 27 has been changed. The revised entry for the Kerr-McGee site in Table 3.2-1 is as follows.

Location, Technology, Type of Media, Scale, and Status	Technology Design and Operation	Technology Performance Summary	Source
Kerr McGee, Henderson, NV; Bioreactor; Groundwater; Full-scale; Ongoing	A fluidized-bed reactor (FBR) with a maximum capacity of 1,000 gpm successfully completed a 30-day Performance Test in November 2004. It is currently treating approximately 1,000 gpm of perchlorate contaminated water. The treatment system consists of four primary and four secondary FBRs, using sand and granulated activated carbon, respectively, as media.	Period of Performance: January 2004 – Ongoing Influent perchlorate concentration in groundwater entering the FBR system is approximately 200,000 µg/L. Perchlorate concentrations in the FBR effluent are less than 18 µg/L.	1. EPA Region 9. 2004. "Perchlorate in Henderson, NV – Significant controls are operating." July. 2. EPA Region 9. 2005i. E-mail message regarding perchlorate treatment. From Larry Bowerman (EPA Region 9) to John Quander. June 24.

The entry for the AMPAC Facility, Nevada in Table 3.5-1, In Situ Bioremediation Performance Summaries for Perchlorate Treatment Projects, on page 48 has been changed. The revised entry for the AMPAC Facility in Table 3.5-1 is as follows.

Location, Technology, Type of Media, Scale, and Status	Technology Design and Operation	Technology Performance Summary	Source
AMPAC Facility, NV (Pepcon Facility); In Situ Bioremediation; Groundwater; Pilot-scale; Completed December 2002 – May 2003 (injection) Test area approximately 200 by 150 feet	Groundwater recirculation and citric acid addition. Recirculation design consisted of a single groundwater extraction well and a single reinjection well. Citric acid (quantity/concentration not provided) was injected daily over 41 days for 1 hour each day to the extracted water prior to reinjection. Ethanol was used as the original carbon source, but citric acid was substituted to reduce biofouling. Chlorine dioxide was also used to control biofouling. The system operated at 5 to 7 gallons per minute (gpm).	Period of Performance: December 2002 – May 2003 Prior to injection of citric acid, perchlorate concentrations were as high as 530,000 µg/L. Soon after addition of citric acid, perchlorate concentrations were less than 100 µg/L, and rapidly decreased to less than 10 µg/L. Perchlorate concentrations appeared to reach an asympototic level of approximately 4 µg/L after 1 month of treatment and remained at that level following cessation of citric acid addition (based on 1 month of post-treatment data). Over this 6-month monitoring period, concentrations of nitrate were reduced from 45 mg/L to less than 1 mg/L, chlorate from 60 mg/L to less than 1 mg/L, dissolved oxygen from 8 mg/L to less than 1 mg/L, and sulfate was reduced from 350 mg/L to less than 100 mg/L.	1. Rosen, Jamey (GeoSyntec). 2003. "Successful In Situ Bioremediation of Perchlorate in Groundwater." Poster presented at the SERDP Technical Symposium and Workshop, Washington, DC. November 30 – December 2. 2. EPA Region 9. 2005i. E-mail message regarding perchlorate treatment. From Larry Bowerman (EPA Region 9) to John Quander. June 24.

Section 3.9 on page 67 has been changed. The subsection, "Private Sector" has been deleted from Section 3.9.