

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2004-0054
WASTE DISCHARGE REQUIREMENTS FOR
UNITED STATES DEPARTMENT OF THE ARMY
RIVERBANK ARMY AMMUNITION PLANT
STANISLAUS COUNTY

IN SITU CHROMIUM REDUCTION TREATABILITY PILOT STUDY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Regional Board) finds that:

1. The United States Department of the Army (hereafter collectively referred to as Discharger) submitted a Report of Waste Discharge (RWD), dated 7 April 2003, for a pilot study to evaluate the potential for in-situ treatment of groundwater containing hexavalent chromium (Cr VI) at the Riverbank Army Ammunition Plant (RBAAP). The Discharger also submitted (a) an *In-Situ Chromium Reduction Treatability Study Workplan, Revised Draft, Riverbank Ammunition Plant*, dated March 2003, (b) additional supporting information dated 2 September 2003, and (C) an *In-Situ Chromium Reduction Treatability Study Workplan Addendum, Riverbank Ammunition Plant*, dated 12 January 2004. RBAAP is on property owned by the Department of the Army, in Section 31, T2S, R10E, MDB&M, referred to as the site, as shown on Attachment A, which is attached hereto and made part of this Order by reference.
2. The RBAAP produces military ammunition projectiles and ammunition casings over 30 mm in caliber. The production lines include machining and/or heat treatment of metal products. The Plant has been in operation since 1942 in various capacities. Since 1992 the plant had been in a mode of preservation and demobilization, generating low wastewater flows resulting from periodic maintenance of the machinery and minor machining. Resumption of limited production began in 2001. Past waste discharges from industrial processes at the facility have caused soil and groundwater to be polluted with chromium and cyanide.
3. The RBAAP is on the U.S. EPA's Superfund National Priority List (NPL) under the Comprehensive Environmental Response and Liability Act (CERCLA). The Remedial Investigation and Feasibility Study conducted at the site identified waste constituents in soils and groundwater underlying the site. Soils contain cyanide, chromium, and Cr VI; groundwater contains cyanide, chromium, and Cr VI. Groundwater monitoring results from May 2003 show that total chromium concentrations are highest in well MW52 at a concentration of 252 micrograms/liter ($\mu\text{g/L}$). The Discharger is implementing a groundwater cleanup program in accordance with a Record of Decision (ROD) dated March 1994, which includes extraction and treatment of groundwater. After extraction, groundwater is treated at an on-site groundwater treatment plant (GWTP), owned and operated by the Discharger. The ROD states that the Regional Board will regulate the discharge of treated groundwater. The GWTP is regulated under separate Waste Discharge Requirements.
4. The objective of the pilot study is to evaluate the (a) efficacy of in-situ hexavalent chromium reduction using sodium dithionite application, (b) assess the secondary impacts of in-situ chemical

reduction on groundwater quality, (c) identify design and operational factors that influence the successful performance of the in-situ chemical reduction approach, and (d) generate performance, design data that can be used for design of a full-scale in-situ treatment system to supplement the current groundwater extraction and treatment system.

5. The soil and groundwater remediation activities at the site have included installation of a clay cap at the landfill site in the northeastern corner of the facility, 24-hour operation of a cyanide and chromium groundwater treatment system, construction of the Riverbank City water system extension to residents nearby the RBAAP facility to replace domestic wells, and excavation and removal of approximately 3,600 cubic yards of zinc contaminated soil from the evaporation/percolation (E/P) ponds.
6. Groundwater is pumped from eight on and off-site extraction wells for a total of approximately 218 gallons per minute (gpm), and treated in the GWTP, and discharged in accordance with Board Order No. 5-01-200 to unlined evaporation/percolation (E/P) ponds. This permit does not rescind Order No. 5-01-200.
7. The Discharger proposes to inject sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$), a chemical reductant, into the aquifer at two locations (Site 17 and Site 21) during the pilot study as shown on Attachment B, which is attached hereto and made part of this Order by reference. The site names are based on the existing monitoring wells (MW17 and MW21) located at each site. The Pilot Study will be conducted in two phases (Phase I and Phase II). Phase I of the Pilot Study will consist of the Pilot Study at Site 17. Phase II, the Site 21 application, will be delayed pending evaluation of the results from Phase I and additional information on in-situ oxidation specifically for cyanide remediation.

During the Pilot Study, the Discharger proposes to inject 3,800 gallons of 1,700 mg/L sodium dithionite solution into IW17 in Phase I and IW21 in Phase II to form a reductive treatment zone. Batches of 2,000-gallons of solution will be injected at a rate of approximately 1gpm followed by a two-week monitoring period. Up to two additional 2,000-gallon batch solutions may be injected depending on the results of field monitoring for dissolved oxygen concentration. If necessary, batch injections will occur at two-week intervals. Injections will end when either dissolved oxygen levels drop to zero or 6,000 gallons of $\text{Na}_2\text{S}_2\text{O}_4$ solution have been used. Zero DO levels indicate the formation of reducing conditions.

8. In order to monitor the fate and transport of the sodium dithionite solution, nine wells were installed down-gradient of existing monitoring wells MW17 and MW21. One injection well (IW17) and four down-gradient monitoring wells MW17-1 through MW17-5 installed at Site 17. One injection well (IW21) and three monitor wells (MW21-1 through MW21-3) were installed at Site 21. The tests at Sites 17 and 21 have been designed to evaluate the feasibility of using injection wells at 12-foot intervals. The anticipated extent of treatment zone is 8 to 10 feet from the injection wells. Attachment C illustrates the location of the injection point and monitoring wells.
9. The Discharger performed baseline sampling in all existing Site 17 wells and background sampling in MW68A'. The groundwater monitoring, conducted in January 2004, showed that baseline groundwater constituent concentrations are characterized by the ranges listed in Table 1. Also listed are water quality objectives (WQOs) for each constituent.

TABLE 1 -- Initial Baseline Sampling - Site 17

In-Situ Chromium Reduction Treatability Study									
Riverbank Army Ammunition Plant									
Analyte	Units	MW17A	IW17A	MW17A-1	MW17A-2	MW17A-3	MW17A-4	MW68A'	WQO
January 2004 Sample Event									
Chromium (Total)	µg/L	27.3	293	11.2	16.4	192	359	< 5	50 *
Chromium (Hexavalent)	µg/L	72.4	278	1.06	10.3	190	360	2.59	0.2 [^]
Iron (total)	µg/L	< 150	346	1,450	2,020	2,940	1,790	< 150	300**
Iron (dissolved)	µg/L	< 150	< 150	< 150	< 150	< 150	< 150	< 150	n/a
Cyanide	µg/L	5	< 5	< 5	12	5	< 5	< 5	200*
Alkalinity	mg/L	390	305	475	450	485	405	225	n/a
Chloride	mg/L	7.91	7.02	5.81	7.34	7.37	7.6	20.4	250**
Sulfate	mg/L	35	17.9	20	15.9	17.7	19.6	16.3	250**
Nitrate	mg/L - N	19.2	6.43	3.12	3.67	3.57	5.66	4.11	n/a
Nitrate	mg/L - NO3	85.1	28.5	13.8	16.3	15.8	25.1	18.2	45*
TDS	mg/L	623	433	638	558	590	517	369	500**
TSS	mg/L	2.8	6.8	37.2	216	82.4	81.2	1.6J	n/a
pH		5.89	6.74	6.76	6.78	6.83	6.86	6.78	6.5 to 8.5
Conductivity	umhos	0.96	0.484	0.97	0.637	0.95	0.604	0.408	n/a
Temperature	deg C	19.2	19.8	20.5	20.5	21	20.4	19.1	n/a
Turbidity	ntu	29	8	20	10	49	18	1	5
DO	mg/L	0.48	2.04	0.56	1.07	0.7	0.93	6.68	n/a

Notes

- WQO Water Quality Objective
- * California Primary maximum contaminant limit (MCL)
- ** California Secondary (MCL)
- [^] Public Health Goal (PHG)
- µg/L micrograms per liter
- mg/L milligrams per liter
- umhos micro mhos
- deg C degrees celcius
- ntu nephelometric turbidity units
- n/a None available

10. During injection of the Na₂S₂O₄ solution, groundwater will be monitored for dissolved oxygen (DO), and pH using down-hole probes. Na₂S₂O₄ application will be discontinued when monitoring shows that the chemical reaction of hexavalent chromium has developed a zone of reducing conditions, as demonstrated by the absence of dissolved oxygen within the anticipated 8 to 10-foot radius of influence. Monitoring will continue to assess long-term potential geochemistry changes.
11. As Na₂S₂O₄ is oxidized, aqueous reduction byproducts that may occur are expected to include sulfate/sulfite and sodium chloride. In addition, aqueous chromium hydroxide may also be produced during the direct injection of Na₂S₂O₄. Chromium hydroxide precipitate Cr(OH)_{3(s)} will occur as Cr VI is reduced to less toxic trivalent chromium (Cr III) by the ferrous iron [Fe(II)]-rich reducing

sediments. Monitoring for the formation of chloride and sulfate/sulfite aqueous byproducts will be conducted frequently during $\text{Na}_2\text{S}_2\text{O}_4$ injection until baseline conditions are re-established.

12. If concentrations of reaction byproducts exceed baseline conditions, after 2 weeks of monitoring, extraction will be performed at the injection wells and in monitoring wells exhibiting elevated concentrations. Extracted water will be containerized and sampled to determine an appropriate disposal location. Monitoring will take place in accordance with the attached MRP No. R5-2004-0054. Extraction will proceed until concentrations of sulfite/sulfate and chloride drop to the baseline levels tabulated in Table 1.
13. Extracted groundwater will be containerized and sampled from the tank(s) for laboratory analysis for metals, minerals, TSS, and TDS. Additional characterization parameters that will be recorded in the field include pH, specific conductance, and turbidity. The extracted groundwater will be transported off-site to a permitted disposal facility.
14. The Discharger's contingency plan for capturing any chemical that moved beyond the pilot study treatment zone includes pumping of groundwater using the existing extraction and treatment system.
15. The objective of the pilot study will be accomplished when sufficient data are obtained to demonstrate (a) effective delivery of the injected solutions to chromium polluted groundwater, (b) effective reduction of hexavalent chromium, and (c) establishment of reducing conditions in the treatment zone when monitoring indicates that dissolved oxygen concentrations in the treatment zone have decreased to zero. Monitoring will continue to assess long-term geochemistry changes.
16. The pilot study will conclude when aquifer conditions are re-established to the baseline levels presented in Table 1.
17. The injection of chemicals into the waters of the State is subject to regulation under the California Water Code. This Order authorizes the Discharger to inject sodium dithionite into the groundwater subject to specific discharge requirements.
18. *The Water Quality Control Plan, Sacramento River and San Joaquin River Basins, Fourth Edition*, (Basin Plan) designates beneficial uses, establishes Water Quality Objectives (WQOs), contains implementation plans and policies for protecting waters of the basin, and incorporates by reference plans and policies adopted by the State Water Resources Control Board (State Board). Pursuant to Section 13263(a) of the California Water Code, waste discharge requirements must implement the Basin Plan.
19. Surface water drainage is to the Live Oak Canal which drains to the Sacramento River. The designated beneficial uses of the Sacramento River between Shasta Dam and the Colusa Basin Drain are municipal and domestic supply; agricultural supply; industrial service supply; power generation; navigation; water contact recreation; non-contact water recreation; warm and cold freshwater habitat; migration of warm and cold freshwater species; spawning, reproduction and/or early development of warm and cold freshwater species; wildlife habitat; and navigation
20. The designated beneficial uses of the underlying groundwater are municipal and domestic supply, industrial, agricultural supply and industrial service and process supply.
21. Immediately surrounding land uses are industrial, agricultural and residential.

22. State Board Resolution No. 68-16 – “Statement of Policy with Respect to Maintaining High Quality of Water in California” (hereafter Resolution 68-16) requires the Board, in regulating the discharge of waste, to maintain high quality waters of the state unless it is demonstrated that a change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and potential beneficial uses, and will not result in water quality less than that described in plans and policies (e.g., quality that exceeds water quality objectives). Temporal, short-term degradation of the groundwater at this site by sodium dithionite injection may occur. The temporary degradation allowed by the Order is consistent with Resolution 68-16 since (1) the purpose of the discharge is to accelerate and enhance cleanup of groundwater pollution and such remediation will benefit the people of the State; (2) the degradation is limited in scope and duration; (3) best practicable treatment and control, including adequate monitoring and contingency plans to assure protection of water quality, are required and (4) the discharge will not cause groundwater to exceed water quality objectives to be exceeded beyond the treatment area described in Finding No. 8. Following treatment elevated levels of constituents are expected to return to levels that do not exceed water quality objectives or baseline concentrations.

23. Section 13267(b) of California Water Code provides that:

In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste outside of its region that could affect the quality of the waters of the state within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the board requires. The burden, including costs of these reports, shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.

The technical reports required by this Order and the attached Monitoring and Reporting Program No. R5-2004-0054 are necessary to assure compliance with these waste discharge requirements. The Discharger operates the facility that discharged the waste subject to this Order.

24. The California Department of Water Resources sets standards for the construction and destruction of groundwater wells, as described in *California Well Standards Bulletin 74-90* (June 1991) and *Water Well Standards: State of California Bulletin 74-81* (December 1981). These standards, and any more stringent standards adopted by the State or County pursuant to CWC Section 13801, apply to all monitoring wells.

25. Issuance of this Order is an action to assure the restoration of the environment and is, therefore, exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.), in accordance with Section 15308 and 15330, Title 14, California Code of Regulations (CCR).

26. This discharge is exempt from the requirements of *Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste*, as set forth in Title 27, CCR, Division 2, Subdivision 1, Section 20005, et seq., (hereafter Title 27). The exemption pursuant to Section 20090 (d), are based on the following:

- a. The cleanup and abatement action is under the direction of a public agency;
- b. Wastes removed from the immediate place of release will be discharged according to the Title 27 regulations; and
- c. The remedial actions intended to contain wastes at the place of release shall implement the Title 27 regulations to the extent feasible.

27. Pursuant to California Water Code Section 13263(g), discharge is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.
28. All the above and the supplemental information in the attached Information Sheet, which is incorporated by reference herein, were considered in establishing the following conditions of discharge.
29. The Discharger and interested agencies and persons were notified of the intent to prescribe waste discharge requirements for this discharge and provided an opportunity for a public hearing and an opportunity to submit written views and recommendations.
30. In a public meeting, all comments pertaining to the discharge were heard and considered.

IT IS HEREBY ORDERED, pursuant to Sections 13267 and 13263 of the California Water Code, The U.S. Army, River bank Army Ammunitions Plant, its agents, successors and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted there under, shall comply with the following while conducting the above-described pilot study:

A. Discharge Prohibitions:

1. Discharge of wastes to surface waters or surface water drainage courses is prohibited.
2. The injection of other than sodium dithionite into groundwater is prohibited.
3. Discharge of waste classified as 'hazardous' under Section 2521, Chapter 15 of Title 23 or as defined in Section 13173 of California Water Code is prohibited.
4. The discharge of waste at any location or in a manner different from that described in Findings No. 7 is prohibited.

B. Discharge Specifications

1. The Discharger shall not cause the permeability of the aquifer, either inside or outside of the treatment area to be affected.
2. The discharge of sodium dithionite shall be limited to the project scope described in Finding Nos. 4 and 7.

C. Groundwater Limitations:

1. The Discharger shall not cause the groundwater to contain taste and odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

2. The Discharger shall not cause groundwater to contain waste constituents greater than baseline ranges listed in Table 1, except for temporary changes in sulfite/sulfate, chloride, and TDS within the treatment zone, as defined in Finding No. 8.
3. The Discharger shall not cause the groundwater outside of the treatment area to contain concentrations of chemical constituents, including any injected substance, and any breakdown products or by-products of the in-situ treatment process, in amounts that exceed baseline concentrations.

D. Provisions:

1. The Discharger shall comply with the attached MRP No. R5-2004-0054, which is part of this Order, and any revisions thereto as ordered by the Executive Officer.
2. The Discharger shall notify the Regional Board a minimum of two weeks prior to the start of application of $\text{Na}_2\text{S}_2\text{O}_4$ solution.
3. Within two weeks of detecting concentrations of constituents above baseline in any down-gradient monitoring well, the Discharger shall extract groundwater at the maximum sustainable yield, from the injection well and from the monitoring well(s) exhibiting elevated concentrations, until baseline levels are resumed.
4. The Discharger shall comply with the "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated 1 March 1991, which are by reference, a part of this Order. This attachment and its individual paragraphs are commonly referenced as "Standard Provision(s)."
5. The Discharger shall provide an alternate water supply source as soon as practicable for any municipal, domestic or other water use, if affected by the Discharger's wastes.
6. All of the following reports shall be submitted pursuant to Section 13267 of the California Water Code. In accordance with California Business and Professions Code sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of registered professionals competent and proficient in the fields pertinent to the required activities. All technical reports specified herein that contain work plans for, that describe the conduct of investigations and studies, or that contain technical conclusions and recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately qualified professional(s), even if not explicitly stated. Each technical report submitted by the Discharger shall contain a statement of qualifications of the responsible licensed professional(s) as well as the professional's signature and/or stamp of the seal.
 - a. The Discharger will submit status reports on the implementation and data collected in Quarterly Reports prepared for the site-wide groundwater investigation and remediation.
 - b. Within 8 months after start of injection, the Discharger shall submit a report summarizing the results of the pilot test, including an assessment of sodium dithionite injection, and, if appropriate recommendations for conducting Phase II of the pilot study. The Discharger

shall submit the results and recommendations from the pilot study for Regional Board staff review and concurrence prior to implementation of the Phase II injection project.

- c. Two weeks prior to the start of injection the Discharger shall submit a technical report describing the disposal location and the procedures for disposal of extracted groundwater in the case groundwater will have to be extracted. The Report shall include sampling results.
7. Should the evaluation of the pilot test data reveal adverse effects, including movement of chemical constituents, any injected substance, and any breakdown products or by-products of the in-situ treatment process outside of the treatment area, or aquifer clogging on the underlying aquifer due to sodium dithionite solution application, the Discharger shall notify the Regional Board within 24 hours, followed by a written summary within two weeks. The Discharger shall clean up and abate these effects, including extraction of any byproducts. The Discharger shall implement the contingency plan and provide a status summary report within two months detailing the effectiveness of cleanup operations utilizing the existing base-wide groundwater extraction system.
8. The Discharger shall comply with all conditions of this Order, including timely submittal of technical and monitoring reports. Violations may result in enforcement action, including Regional Board or court order requiring corrective action or imposing civil monetary liability, or in revision or rescission of this Order.
9. The Discharger shall maintain records of all monitoring information including all calibration and maintenance records, copies of all reports required by this Order, and records of all data used to complete the application for this Order. Records shall be maintained for a minimum of three years from the date of the sample, measurement, or report. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Executive Officer.
10. The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control that are installed or used by the Discharger to achieve compliance with this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are to be installed by the Discharger only when necessary to achieve compliance with the conditions of this Order.
11. While this Order is in effect, and prior to any change in ownership of the Site or management of this operation, the Discharger shall transmit a copy of this Order to the succeeding Owner/Operator, and forward a copy of the transmittal letter and proof of transmittal to the Board.
12. A copy of this Order shall be kept at the discharge facility for reference by operating personnel. Key operating personnel shall be familiar with its contents.
13. The Regional Board will review this Order periodically and will revise requirements when necessary.

I, THOMAS R. PINKOS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 23 April 2004.

THOMAS R. PINKOS, Executive Officer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2004-0054

FOR
UNITED STATES DEPARTMENT OF THE ARMY
RIVERBANK ARMY AMMUNITION PLANT
STANISLAUS COUNTY

IN SITU CHROMIUM REDUCTION TREATABILITY PILOT STUDY

This monitoring and reporting program (MRP) describes requirements for monitoring the progress of the in-situ Chromium Reduction Treatability Pilot Study (Pilot Study). This MRP is issued pursuant to California Water Code Section 13267. The United States Department of the Army (Discharger), is required to comply with this MRP. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. In addition to this MRP, groundwater monitoring and reporting outlined in MRP No. R5-01-200 is still required. The Pilot Study project consists of injecting sodium dithionite into groundwater.

All samples shall be representative of the volume and the nature of the discharge and matrix of the sampled medium. The time, date, and location of each sample shall be recorded on the sample chain of custody form.

PILOT STUDY GROUNDWATER MONITORING

As shown on Attachment C, there are 6 monitoring wells (MW17A' and MW17A1 through MW17A5) associated with Site 17 and 3 monitoring wells (MW21-1 through MW21-3) associated with Site 21. The groundwater monitoring for Phase I of the Pilot Study begins with laboratory analysis of baseline groundwater samples collected from Site 17 wells (IW17, MW17A'-1, MW17-1, MW17-2, MW17-3, MW17-4, and MW17-5). Table 1 lists the baseline sampling schedule. Table 2 lists the Pilot Study sampling schedule required for both Site 17 and Site 21. Groundwater monitoring for the Site 21 wells (IW21, MW21-1, MW21-2, and MW21-3) will be delayed pending performance of the Phase I. Analytical methodologies and detection limits are outlined in Table 3. These analyses shall be completed by a California State certified laboratory and shall follow standard EPA protocol. The field parameter monitoring schedule is listed in Table 4.

A. Laboratory Analysis

Tables on following page

Sampling Area	Wells	Frequency	Analytes
Baseline	All Site 17 and Site 21 wells	Twice before test commences with a thirty day lapse between sampling events	total chromium
			cyanide
			hexavalent chromium
			sulfate
			arsenic
			total iron
			dissolved iron
			manganese
			alkalinity
			major cations
			major anions
			total dissolved solids
			pH
			specific conductance
turbidity			
dissolved oxygen			
water level			

Parameter	Wells*	Frequency
Dissolved oxygen, pH, specific conductance, turbidity	IW-17, MW17'A-1, MW17A-1 through MW17A-5 and IW21, MW21-1 through MW21-3	Weekly during sodium dithionite injection
pH and specific conductance,	IW17, MW17'A-1, MW17A-1 through MW17A-5 and IW21, MW21-1 through MW21-3	Weekly during extraction of reduction byproducts
Soluble iron Fe (II) and manganese (Mn)	MW17A'-1, MW17A-1 through MW17A-5 and MW21-1 through MW21-3	At the end of the final two-week observation period
Total suspended solids (TSS)	MW17A'-1, MW17A-1 - MW17A-5 and MW21-1 - MW21-3	At the end of each two week observation period
Chloride (Cl ⁻)	IW-17, MW17'A-1, MW17A-1 through MW17A-5 and IW21, MW21-1 through MW21-3	Weekly during sodium dithionite injection and extraction of reduction byproducts
sulfate/sulfite	IW17, MW17A'-1, MW17A-1 through MW17A-4 and IW21, MW21-1 through MW21-3	biweekly during sodium dithionite injection and weekly during xtraction of reduction byproducts
Cr VI, total Cr, cyanide, iron, total alkalinity, major cations, major anions, TSS, and TDS	IW-17, MW17'A-1, MW17A-1 through MW17A-5 and IW21, MW21-1 through MW21-3	At the end of the final two-week observation period, during waste characterization, monthly for three months and quarterly thereafter.

* Monitoring of Site 21 wells (MW21-1 through MW21-3 and IW21) is required only if Phase II of the Pilot Study is conducted.

Table 3 – Analytical Methodology		
Constituents	Method¹	Maximum Detection Limit²
Hexavalent Chromium ³	EPA 7199 or 7196	2 or 5µg/l, respectively
Total Chromium	EPA 6010	10µg/l
Cyanide	EPA 9010	10 µg/l
Iron	EPA 6010	5 µg/l
Manganese	EPA 6010	5 µg/l
Arsenic	EPA 7060 A	5 µg/l
chloride	EPA 300.0	1 mg/l
Sulfate/sulfite	EPA 300.0	1 mg/l
Total Alkalinity	SM-17 2320 B	1 mg/l
Major Cations	EPA 600	1 mg/l
Major Anions	EPA 300.0	1 mg/l
Total Suspended Solids	EPA 160.2	--
Total Dissolved Solids	EPA 160.1	--

1 Non-proprietary, performance based analytical methods may be used with approval of by the Executive Officer

2 For non-detectable results

3 For wells with concentrations >5 µg/l, EPA Method 7196 with a detection limit may be used

B. Field Measured Parameters

Monitoring of the Pilot Study will include field measurement of groundwater parameters in samples collected from Site 17 wells (IW17, MW17A'-1, MW17-1, MW17-2, MW17-3, MW17-4, and MW17-5). Field measurement of groundwater parameters must be collected from Site 21 wells (IW21, MW21-1, MW21-2, and MW21-3) if Phase II of the Pilot study is implemented.

Field testing instruments (such as those used to test conductivity, pH, and dissolved oxygen) may be used provided that:

1. The operator is trained in proper use and maintenance of the instruments;
2. The instruments are calibrated prior to each monitoring event;
3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are provided with the appropriate monitoring report.

Table 4 – Field Parameters			
Constituents	Units	Type of Sample	Sampling Frequency
Ground Water Elevation	Feet, Mean Sea Level (MSL)	Grab	Each time well is sampled
Conductance	Millivolt	Grab, In-situ	See Table 2

Table 4 – Field Parameters (cont.)			
Constituents	Units	Type of Sample	Sampling Frequency
pH	pH units	Grab	See Table 2
Dissolved Oxygen	mg/l	Grab, In-situ	See Table 2
Turbidity	NTUs	Grab	See Table 2

REPORTING

In reporting monitoring data, the Discharger shall arrange the data in tabular form so that the date, sample type (e.g., influent, effluent, groundwater, etc.), and reported analytical result for each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with waste discharge requirements and spatial or temporal trends, as applicable. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall also be reported to the Regional Board.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all Reports shall be prepared under the direct supervision of a Registered Engineer or Geologist and signed by the registered professional.

A. Quarterly Reports

Quarterly reports shall be submitted to the Board by **1st day of the second month following the end of each calendar quarter (i.e., by 1 February, 1 May, 1 August, and 1 November)**. These reports will provide a status update on the progress of the Pilot Study. These reports may be combined with the corresponding reports required by MRP No. R5-01-200. At a minimum, the quarterly reports shall include the following minimum information:

1. An assessment of calcium $\text{Na}_2\text{S}_2\text{O}_4$ solution discharge to the aquifer, including injection flow rates, and total volume of calcium $\text{Na}_2\text{S}_2\text{O}_4$ solution injected, parameter measurements and results of all sampling;
2. A calibration log verifying weekly calibration of any field monitoring instruments (e.g., pH, dissolved oxygen meter, etc) used to obtain data;
3. An evaluation of the changes in aquifer geochemistry including the extent of hexavalent chromium reduction, assessment of changes in mobility of other metals including arsenic, and changes in sulfate concentrations;
4. An analysis of whether the injected calcium $\text{Na}_2\text{S}_2\text{O}_4$ solution and any breakdown or byproducts is being captured by groundwater extraction or is moving outside of the treatment area;
5. Cumulative data tables containing the water quality analytical results.

6. A description and discussion of the groundwater sampling event and results, including trends in the concentrations of pollutants and groundwater elevations in the wells, how and when samples were collected;
7. Field logs that contain, at a minimum, water quality parameters measured before, during, and after purging, method of purging, depth of water, volume of water purged, etc.; and
8. Concentration isopleth maps showing residual occurrences of the applied reductant and associated by products for all groundwater zones, if applicable;
9. A table showing well construction details of Site 17 and 21 wells including well number, groundwater zone being monitored, coordinates (longitude and latitude), ground surface elevation, reference elevation, elevation of screen, elevation of bentonite, elevation of filter pack, and elevation of well bottom;
10. A copy of the laboratory analytical data report.

B. Annual Report

An Annual Report shall be submitted to the Board by **1 February** of each year. This report shall contain an evaluation of the long-term effects on the aquifer of the injected material, effectiveness and progress of the investigation and remediation, and may be submitted with the fourth quarter monitoring report. The Annual Report shall contain the following minimum information:

1. Tabular and graphical summaries of all data obtained during the year;
2. Groundwater contour maps and pollutant concentration maps containing all data obtained during the previous year;
3. Discussion of long-term trends in the concentrations of the pollutants in the groundwater monitoring wells;
4. An evaluation of the performance of the sodium dithionite and an analysis of its effectiveness in reducing the pollutants;
5. Analysis of whether the injected reductant, and any breakdown or byproducts is being captured by groundwater extraction or is moving outside of the treatment area;
6. Anticipated date for completion of the Pilot Study;
7. Identification of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program and the anticipated date for an effectiveness evaluation of the Pilot Study;
8. if applicable, a proposal and rationale for any revisions to the groundwater sampling plan frequency and/or list of analytes.

A letter transmitting the self-monitoring reports shall accompany each report. Such a letter shall include a discussion of violations found during the reporting period, and actions taken or planned for correcting noted violations, such as operation or facility modifications. If the Discharger has previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain the penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

The results of any monitoring done more frequently than required at the locations specified in the MRP also shall be reported to the Board. The Discharger shall implement the above monitoring program as of the date of the Order.

Ordered by: _____
THOMAS R PINKOS, Executive Officer

_____ 23 April 2004 _____

INFORMATION SHEET

WASTE DISCHARGE REQUIREMENTS R5-2004-0054
UNITED STATES DEPARTMENT OF THE ARMY
RIVERBANK ARMY AMMUNITION PLANT
STANISLAUS COUNTY
IN SITU CHROMIUM REDUCTION TREATABILITY PILOT STUDY

The Riverbank Army Ammunition Plant (RBAAP) produces military ammunition projectiles and ammunition casings, over 30 mm in caliber. The production lines include machining and/or heat treatment of metal products. RBAAP is on property owned by the Department of the Army (Discharger), in Section 31, T2S, R10E, MDB&M, as shown on Attachment A. Past waste discharges from industrial processes at the facility have caused soils and groundwater to be polluted with chromium and cyanide. The RBAAP is on the EPA's Superfund National Priority List (NPL) under the Comprehensive Environmental Response and Liability Act (CERCLA). Groundwater monitoring results from May 2003 show that the total chromium concentrations are highest in well MW52 at a concentration of 252 micrograms/liter ($\mu\text{g/l}$). However, many wells with suspected higher concentrations could not be sampled due to low groundwater levels.

The Army is implementing a groundwater cleanup program in accordance with a Record of Decision dated March 1994, which includes extraction and treatment of groundwater from eight (8) on- and off-site extraction wells at approximately 218 gallons per minute (gpm). After extraction, groundwater is treated at an on-site groundwater treatment plant (GWTP), owned and operated by the Army. The GWTP is regulated under separate Waste Discharge Requirements.

The Discharger is proposing to conduct an In-Situ Chromium Reduction Treatability Study (Pilot Study) to demonstrate that injecting sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$) solution into groundwater will effectively reduce Cr VI to trivalent chromium (Cr III). The $\text{Na}_2\text{S}_2\text{O}_4$ solution is intended to quickly alter the oxidation/reduction state of the groundwater and reduce hexavalent chromium to trivalent chromium in the aquifer and to precipitate it out of solution, thereby immobilizing chromium.

The pilot study will target groundwater in the uppermost water-bearing zone. The objective of the in-situ groundwater pilot study is to evaluate the (a) ability of in-situ hexavalent chromium reduction using $\text{Na}_2\text{S}_2\text{O}_4$ solution injection, (b) assess the secondary impacts of in-situ chemical reduction on groundwater quality, (c) identify design and operational factors that influence the successful performance of the in-situ chemical reduction approach, and (d) generate performance, design and cost data that can be used for evaluation as a possible alternative to the current groundwater extraction and treatment system. The pilot study will be conducted in two phases; both consisting of the injection of the $\text{Na}_2\text{S}_2\text{O}_4$ solution into groundwater. Phase I will be conducted first at Site 17. Phase II will follow at Site 21.

Temporal, short-term degradation of the groundwater by $\text{Na}_2\text{S}_2\text{O}_4$ solution injection may occur in a limited portion of the aquifer near the injection points. Such degradation is consistent with Resolution 68-16 since (a) the purpose of the discharge is to implement the cleanup of groundwater pollution and such remediation will benefit the people of the State; (b) the discharge

as allowed in this Order is a pilot project to evaluate the effectiveness and is limited in scope and duration; (c) this Order requires use of best practicable treatment, including adequate monitoring and contingency plans to assure protection of water quality; and (d) this Order does not allow discharges of waste to exceed water quality objectives other than those temporarily permitted by these WDRs.

The discharger will remove injected waste constituents and byproducts from the injection well and down-gradient monitoring wells in the event groundwater degradation occurs as a result of the discharge. As a contingency, the existing base-wide extraction system will capture any chemicals that move beyond the pilot study treatment zone.

The proposed Order prohibits the discharge of wastes in any manner other than that described in the Findings of the Order, including prohibiting discharge of waste to surface waters or discharge of hazardous waste. The Order requires monitoring and reporting on the progress of the pilot study.



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Attachment A Site Location Map

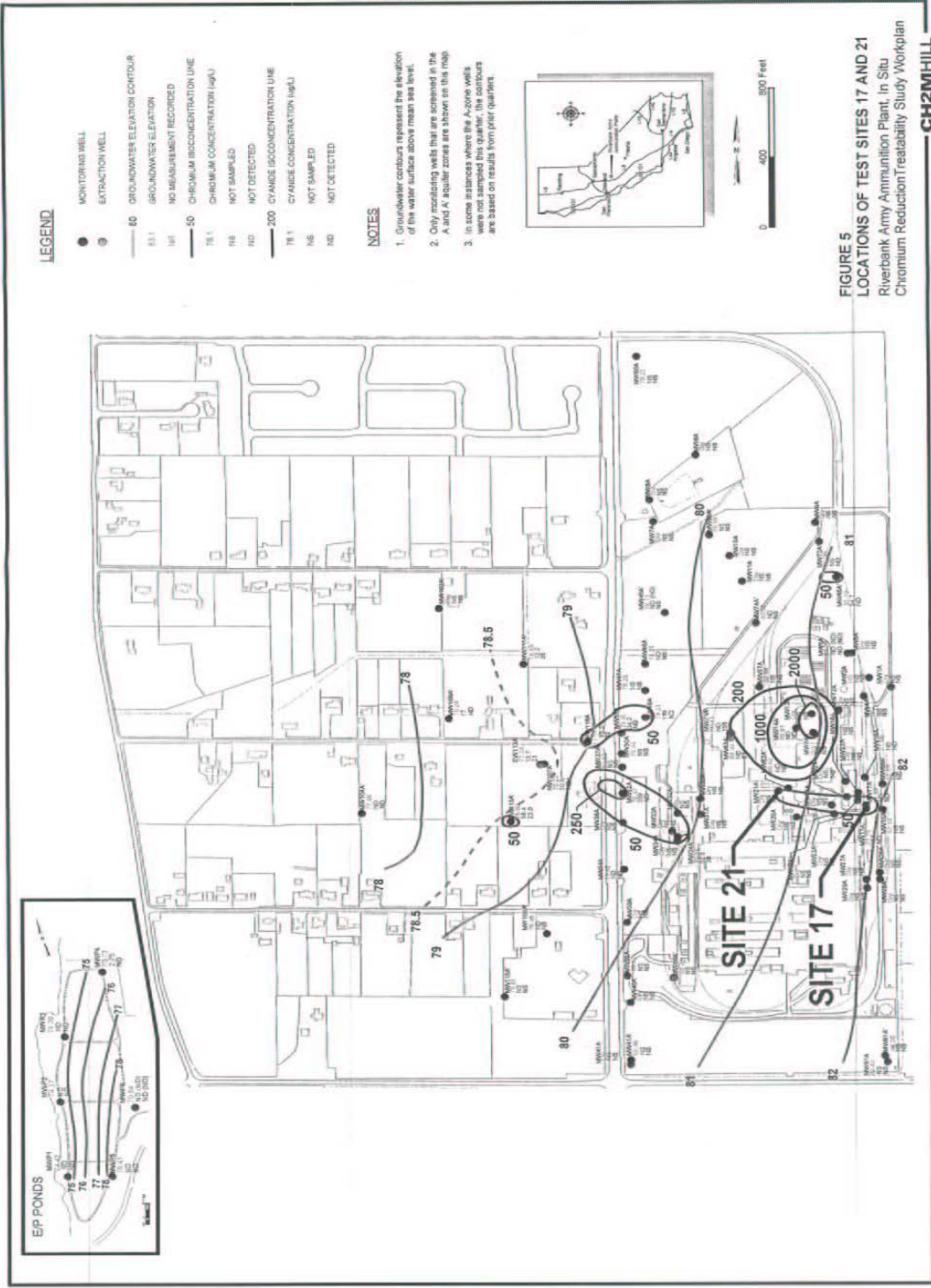


FIGURE 5
LOCATIONS OF TEST SITES 17 AND 21
 Riverbank Army Ammunition Plant, In Situ
 Chromium Reduction/Treatability Study Workplan

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Attachment B Site 17 and Site 21

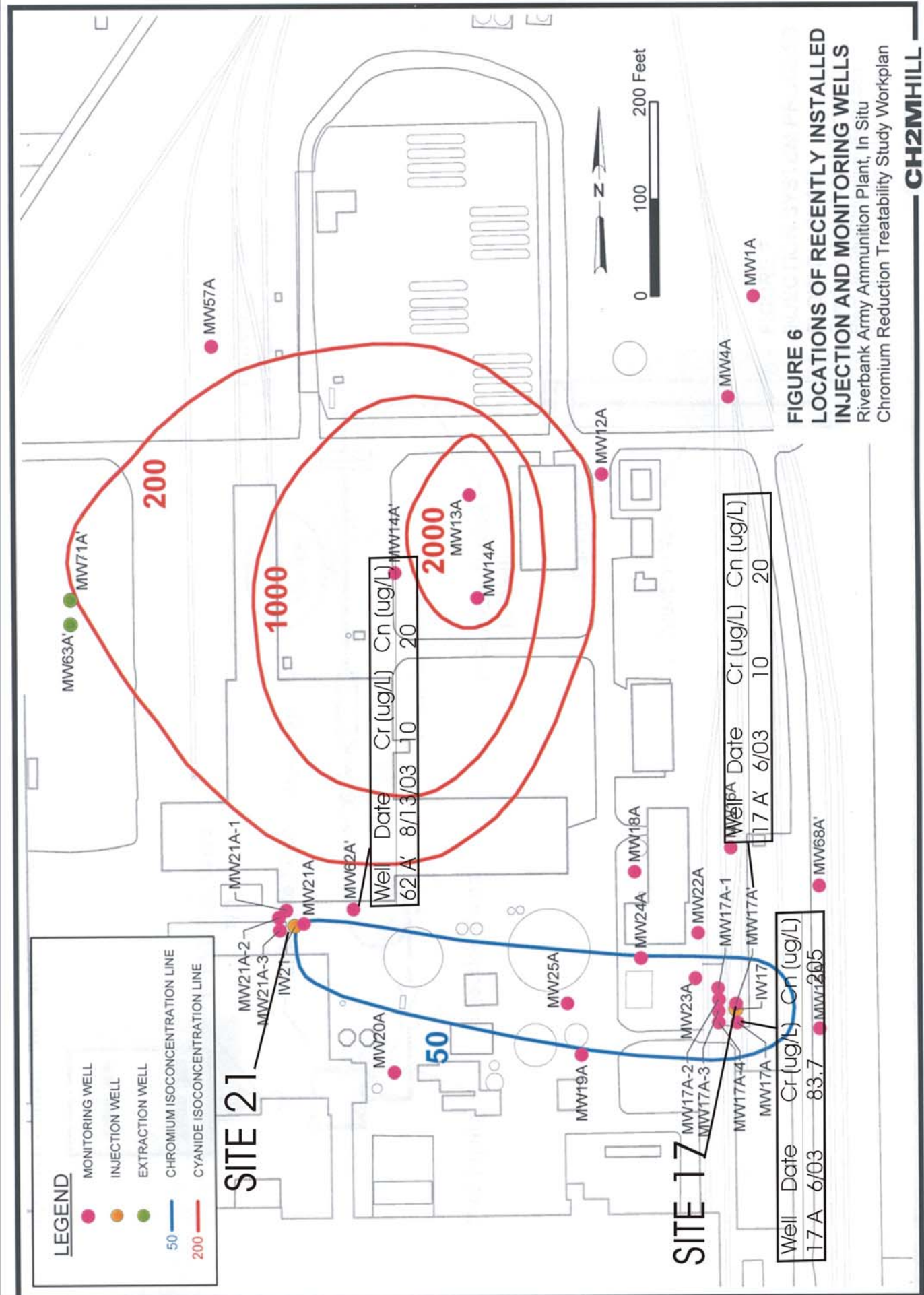


FIGURE 6
LOCATIONS OF RECENTLY INSTALLED
INJECTION AND MONITORING WELLS
 Riverbank Army Ammunition Plant, In Situ
 Chromium Reduction Treatability Study Workplan

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Attachment C Sodium Dithionite Injection Wells at Site 17 and Site 21

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