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KERR-McGEE CHEMICAL LLC
POST OFFICE BOX 55 - HENDERSON, NEVADA 89009

February 5, 1999

Ms. Brenda Pohlmann
Remediation Branch Supervisor
Nevada Division of Environmental Protection
555 E. Washington, Suite 4300
Las Vegas, NV 89101

Dear Ms. Pohlmann:

Subject: Perchlorate Design Assessment for Remedial Action

Attached please find two copies of Kerr-McGee Chemical LLC's report, "Perchlorate Design Assessment for Remedial Action."

Kerr-McGee is committed to act responsibly and cooperate fully with local, state, and federal officials in determining appropriate remedial actions. Please feel free to contact me at (702) 651-2200 if you have any questions related to this information. Thank you.

Sincerely,

SM Crowley

Susan M. Crowley
Staff Environmental Specialist

Enclosures (2)
By certified mail

cc: LKBailey
PSCorbett
ALDooley
WOGreen
RHJones
EMSpore
TWReed
JReichenberger
JBWorthington
Robert Kelso (NDEP)
Doug Zimmerman (NDEP)
Jeanne-Marie Bruno (Metro Water District Of Southern California)
Barry Conaty (City of Henderson)
Pat Mulroy (Southern Nevada Water Authority)
Kevin Mayer (EPA Region IX)

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Perchlorate
Design Assessment
for Remedial Action

Kerr-McGee Chemical LLC
Henderson, Nevada

February 5, 1999

Prepared by:
Kerr-McGee Chemical LLC
8000 West Lake Mead Drive
Henderson, NV 89015

OVERVIEW

With the development of a new measurement technique (parts per billion levels), and detection of perchlorate at parts per billion levels in the Colorado River Basin during 1997, Kerr-McGee Chemical LLC (Kerr-McGee) began to address the perchlorate issue with the Nevada Department of Environmental Protection (NDEP). In August 1997, Kerr-McGee conducted extensive hydrogeologic characterization of the perchlorate in the shallow alluvial aquifer on the Kerr-McGee site. Concurrently, Kerr-McGee engineers began to identify possible perchlorate treatment technologies, and as an active member of the Perchlorate Study Group (PSG), Kerr-McGee sponsored independent toxicology studies to be used by EPA in setting appropriate health based standards for perchlorate.

A thorough understanding of the three aspects of the perchlorate issue is critical to identify successful remedial actions. These are:

Characterization – Onsite /Offsite
Treatment Technology, and
Toxicology –Perchlorate health based Standards

Kerr-McGee has worked to develop a better understanding in all three aspects of the perchlorate issue. As of 1997, there was no data relating to the perchlorate transport mechanism to the Las Vegas Wash, and there were no known or available perchlorate treatment or destruction technologies. No federal or national standard(s) existed for remedial actions or for perchlorate levels in drinking water.

Although there has been substantial progress made over the past year, investigations continue that add to our knowledge of perchlorate. This report summarizes our understanding of the perchlorate issues, and identifies an appropriate design for remedial action based upon the current information. Kerr-McGee believes the understanding of perchlorate issues will continue to grow as our collective knowledge of perchlorate expands.

A summary of Kerr-McGee's perchlorate reports to the NDEP include:

Reference	Date	Title
(1)	October 1, 1997	Groundwater Investigation for Perchlorate Impact at KMCLLC Henderson Nevada (On-site)

(2)	January 16, 1998	KMCLLC Perchlorate Characterization Project: Historical Review Report/Sampling Plan (Phase I Off-site)
(3)	July 15, 1998	KMCLLC Perchlorate Characterization Report (Phase II Off-site)/Supplement 10/19/98.
(4)	November 30, 1998	Henderson On-Site Groundwater Perchlorate Treatment Technology Review
(5)	December 30, 1998	Henderson Off-site Groundwater Perchlorate Treatment Technology Review

These submittals [Items (1) – (5)] are referenced throughout this report. This extensive characterization and evaluation of treatment technologies for perchlorate in groundwater has provided additional options for remedial actions. Kerr-McGee has invested about $3 million to date on characterization, treatment technology, and containment basin construction. Additionally, Kerr-McGee has contributed to the $ 2 million fund to support additional toxicology studies sponsored by the Perchlorate Study Group and the Department of Defense .

CHARACTERIZATION

Originally sited and operated by the U.S. Government as a magnesium production facility, the BMI complex operated from 1942 – 1944 in support of the war effort. In 1945, Western Electrochemical Company (WECCO) acquired a lease from the government and began producing chlorates, perchlorates, and manganese dioxide at this location. The U.S. Navy owned and operated a portion of this facility for the production of perchlorate from 1951 until 1962. Subsequent mergers followed, and Kerr-McGee ultimately acquired the plant by merger in 1967.

Kerr-McGee has worked with the NDEP to assess perchlorate in the shallow alluvial aquifer on the Kerr-McGee site (Phase I). Additional work (Phase II) was done to: 1) identify the subsurface pathway of the perchlorate containing groundwater moving downgradient from the facility, and 2) quantify the presence of perchlorate in the alluvial groundwater system.

In October 1997, Kerr-McGee submitted the analytical results of 47 on-site groundwater monitoring wells (1). Analyses were performed to evaluate perchlorate concentrations at the Henderson site. These results confirmed the perchlorates in the alluvial aquifer were not due to current operations but represent past practices at this manufacturing site.

The on-site sampling established the concentration gradient and identified a decline in perchlorate concentrations toward the north boundary of the facility. Concentrations of perchlorate move with the groundwater flow to the north. At the facility boundary, concentrations were about 1500 mg/l perchlorate. This work provided an understanding of the properties of the perchlorates on-site in the alluvial aquifer (1).

To extend the knowledge of perchlorates in the alluvial aquifer, beginning in January 1998 Kerr-McGee conducted a thorough review of historical hydrologic information in the area of the manufacturing site and Las Vegas Wash (2). Mapping, based upon the evaluation of the existing and historical subsurface information, pinpointed areas suitable for additional assessment north and northeast of the facility. Additional groundwater sampling and analyses were proposed in a Phase II work plan submitted to NDEP (2).

The Phase II groundwater perchlorate investigation report described the drilling and evaluation of 69 additional soil borings and 27 monitor wells. A pump test was also conducted. The work identified the subsurface pathway of perchlorate-impacted groundwater moving downgradient from the Kerr-McGee facility and quantified the perchlorate presence in the alluvial groundwater system.

Pump test results in the alluvial channel at the Pittman Lateral indicated a groundwater velocity of up to 4000 ft/year and a perchlorate concentration range of 100 to 300 mg/l. Perchlorate concentrations in the alluvial groundwater system range from about 1500 mg/l along the northern boundary of the Kerr-McGee property to around 100 mg/l north of the City of Henderson's sewage treatment plant Rapid Infiltration Basins (RIBs). At the northern point below the RIBs, the plume is diluted by infiltration of RIBs' treated water and fans out into a broad trend just south of the Las Vegas Wash (3).

In the original pump test, organic contaminants were encountered in the alluvial groundwater at the Pittman Lateral and possibly downgradient. However, subsequent pump testing and sampling did not confirm the presence of the organics. A higher total dissolved solids (TDS) concentration plume was also encountered west of the perchlorate plume. At the Pittman Lateral, the perchlorate plume begins to merge with the higher TDS plume.
The Henderson Industrial Site Steering Committee (HISSC) is made up of current and past operators of the BMI properties. The HISSC has been assessing environmental conditions on

the common areas previously used for waste disposal of production effluent. High TDS values in the alluvial aquifer have resulted in a recent NDEP request to the HISSC member companies (including Kerr-McGee) to address this issue. Kerr-McGee is working with NDEP and the other HISSC companies to meet this request. While the perchlorates do add to the TDS, they contribute less than 2-3% of the total TDS near the Las Vegas Wash. Additional sampling is currently being conducted by the HISSC to characterize this TDS plume.

Kerr-McGee has characterized the perchlorate in the alluvial aquifer both on-site and off-site of the company's property (1-3). Past operations of AMPAC and the U.S. Navy also contributed to the perchlorate levels. Kerr-McGee has contacted both parties regarding their contributions to the perchlorates present in the Las Vegas Wash and Colorado River system. Any Consent Agreement relating to perchlorate remedial activities would need to consider all responsible parties. Kerr-McGee will continue to work with all parties to reach satisfactory resolution of these off-site issues.

TREATMENT TECHNOLOGY

In August 1997, Kerr-McGee began work to evaluate technologies which could:

- Provide storage of perchlorate groundwater.
- Separate perchlorate from groundwater.
- Destroy perchlorate in groundwater.

In August 1997, there were no commercially demonstrated technologies to remove or destroy perchlorate. While several separation technologies showed promise, only one technology has yet demonstrated potential for commercial scale perchlorate destruction: biochemical reduction of perchlorate. Both laboratory and pilot scale units have been investigated and the units have treated the alluvial groundwater containing perchlorates from the Kerr-McGee site.

Based upon work performed to date, biochemical destruction of perchlorate appears to be the most effective (yields the lowest perchlorate concentrations) and is among the lower cost alternatives. The complete results of treatment technology reviews were recently submitted to NDEP (4,5).

Aerojet has done additional biochemical reduction testing in California. This included bench scale tests that have demonstrated the ability of the Aerojet technology to tolerate the higher perchlorate and salt concentrations present in Kerr-McGee's on-site groundwater. Aerojet has recently commissioned (mid-December 1998) and is operating a large (several thousand gallon per minute) plant in California to treat low concentration perchlorate groundwater.

Kerr-McGee will continue to review the technology(s) available to treat and destroy perchlorates. Work is on-going and interest in treatment technology for perchlorates has developed in both private and public sectors.

PERCHLORATE STANDARDS

In July, 1997, no official Federal perchlorate standards existed for drinking water. California adopted an Environmental Protection Agency (EPA) provisional standard of 18 ug/l in water. Until mid-1997, no analytical technique existed to identify perchlorates at the ug/l (parts per billion) level in the ground or surface water.

The Environmental Protection Agency (EPA) is working to identify an appropriate Reference Dose for perchlorates. The Perchlorate Study Group (PSG), which includes aerospace, manufacturers, and users of perchlorates, had petitioned EPA in the mid 1990's to develop such standards for perchlorates. The PSG, in conjunction with the Department of Defense, has sponsored independent laboratory studies to better determine perchlorate health effects.

With these additional studies and the information already available on perchlorate health effects, the EPA recently issued an internally peer reviewed Reference Dose for perchlorates. The Reference Dose will be reviewed by an independent panel of experts, and their comments will go back to EPA for consideration in setting the final Reference Dose. The final Reference Dose will be used to set a Maximum Concentration Level (MCL) for perchlorates in drinking water. The initial Reference Dose number from EPA translates into a recommended water concentration limit of 32 ug/l. Although not final, the internally reviewed EPA Reference Dose provides an early indication for perchlorate mitigation/remediation.

REMEDIAL ACTIONS

In 1998, Kerr-McGee completed the construction of an 11-acre retention basin to store the impacted groundwater recovered from the on-site chromium treatment system (see Figure 1). In December 1998, this 11-acre retention basin began receiving impacted groundwater. The recovery wells and chromium treatment system have been in operation since the 1980's and effectively capture the on-site alluvial groundwater and site contaminants (including perchlorates). At current pumping rates, this containment system is removing approximately 1200 lbs/day of perchlorate from the alluvial groundwater below the facility.

Based upon the perchlorate delineation and technology assessment work already performed, Kerr-McGee proposes a four-part remedial action which incorporates the work already performed and is based upon the information currently available. This four-part program includes:

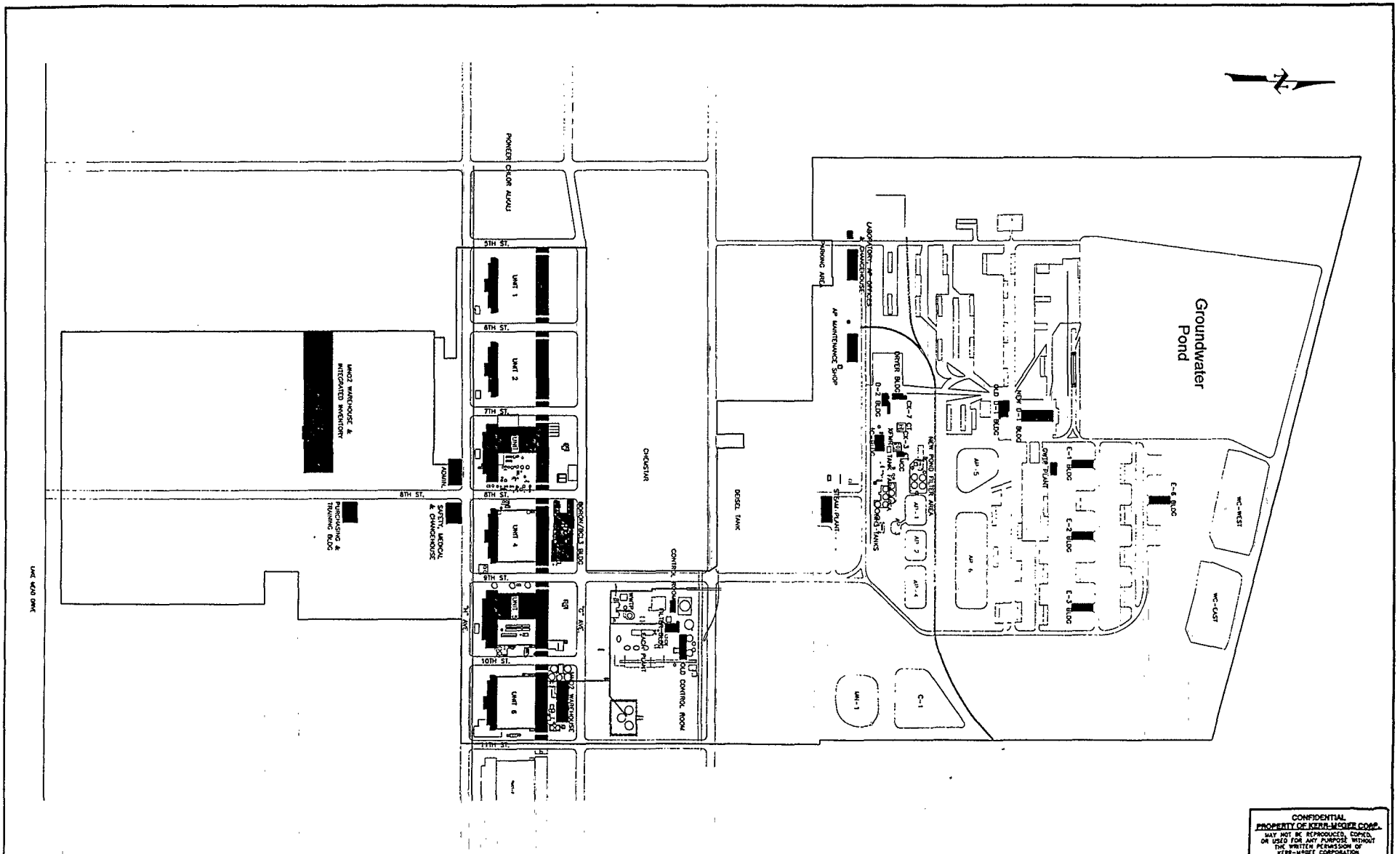
1. Kerr-McGee will continue interception of the perchlorate impacted groundwater beneath the Kerr-McGee facility utilizing the existing interception well line and temporary storage in the 11-acre basin. Lake Mead water will be injected downgradient of the interception well line as part of the interception/recharge system. The recharge of Lake Mead water not only allows Kerr-McGee to remove 1200 lbs/day of perchlorate from the alluvial groundwater system, it also stabilizes the flow characteristics, improves the quality of the aquifer, and facilitates monitoring of the clean front as it progresses northward.
2. Kerr-McGee recommends biological perchlorate reduction as the most appropriate treatment technology considering the health-based preliminary standards for perchlorate, the regional groundwater perchlorate characterization and the technology alternatives review. Upon approval of this approach, Kerr-McGee will initiate engineering and design work for a biological perchlorate reduction process for groundwater currently intercepted on-site (currently stored in the 11-acre basin). However, design work cannot be finalized without NDEP authorization of a permitted discharge (UIC or NPDES). Use of the biological perchlorate reduction is also predicated upon Kerr-McGee procuring contracts with nutrient suppliers.
3. Kerr-McGee believes that proposing perchlorate remediation at an off-site location before completing additional testing would not be productive. Therefore, to better understand hydrological systems between the Kerr-McGee facility and the Pittman

Lateral, Kerr-McGee will conduct continuous pumping and confirmatory biological perchlorate destruction tests on groundwater in that area. Initial biological treatment tests have proven successful in destroying perchlorate, but long term testing is required to understand potential variability of water flows and potential adverse impacts of organics or other constituents in the water. Also, Kerr-McGee is seeking to maximize perchlorate recovery while minimizing the capture of other higher conductivity water in the area. Additional pumping tests will be performed on at least two wells for about one week each. Pumping rates will likely average about 50 gpm, with instantaneous rates exceeding 100 gpm. As in previous pump tests, the water will be sampled then discharged into the concrete storm water bypass leading to the lower BMI ponds. No surface discharge to the Las Vegas Wash would be allowed. Daily composite samples would be split for laboratory analysis and for shipment to Applied Research Associates (ARA). ARA would confirm the amenability of the samples for perchlorate biodegradation. Samples of treated water containing bio-mass will be analyzed. Completion of the test work and subsequent analyses would likely require about 90 days.

4. Kerr-McGee will also consider utilizing the on-site perchlorate reduction process to treat an off-site groundwater source, provided further testing confirms; a) that off-site conditions do not adversely effect the biological process, b) that hazardous constituents are not present, and c) that NDEP provides a permitted discharge authorization (UIC or NPDES) not withstanding the probable presence of TDS.

In summary, Kerr-McGee will operate the chromium recovery / treatment system and impound the impacted groundwater in the 11-acre basin. Kerr-McGee will also evaluate the effects of this cleanup on the alluvial groundwater system. Upon NDEP approval of the approach, Kerr-McGee will begin engineering and design work for a biological remediation process for the contained groundwater and will evaluate the biological remediation process amenability of an off-site source. The above four-part proposal is conditioned on the NDEP authorization of a permitted discharge (UIC or NPDES) of the treated water (water with the perchlorate removed), and on Kerr-McGee, NDEP and other potential responsible parties negotiating an acceptable consent agreement. The engineering and construction of the perchlorate treatment system is estimated to take 15 months from the time NDEP's approval of this approach is received, assuming discharge issues can be resolved.

FIGURE 1



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KERR-McGEE CHEMICAL CORP. P.O. BOX 55 HENDERSON, NEV. 89009-7000

AFE No. _____ JOB No. _____

REVISIONS			
REV	DESCRIPTION	BY	DATE

APPROVED FOR CONSTRUCTION	BY	DATE		BY	DATE
SAFETY			PROCESS ENGR.		
ENVIRONMENTAL			PROJECT ENGR.		
OPERATIONS MNGR.			ENGR. MNGR.		
PRODUCTION SUPT.			PLANT MNGR.		

DESIGN	DATE
DRAWN BY CM BUCO	10/15/96
PROJ. ENGR.	
ENGR. MNGR. EM SPORE	

KERR-MCGEE CHEMICAL LLC
PLOT PLAN

DRAWING NO. KMPLOTPLAN

SHEET 1 OF 1

REVISION