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KERR-McGEE CHEMICAL LLC

HENDERSON OFF-SITE GROUNDWATER PERCHLORATE TREATMENT TECHNOLOGY REVIEW

Prepared

by

L. K. Bailey
and
E. M. Spore

Kerr-McGee Chemical LLC
8000 W. Lake Mead Dr.
Henderson, NV 89015

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OVERVIEW

Kerr-McGee Chemical LLC (Kerr-McGee) submitted a report to the Nevada Division of Environmental Protection (NDEP) on November 30,1998 describing options for removing perchlorate from groundwater at the Kerr-McGee Henderson facility.[1] This report extends that technology investigation to consider remediation of water down-gradient of the Kerr-McGee facility, near the Pittman Lateral.

A subsequent report, due to NDEP in early 1999, will include a final design assessment for remedial action.

OFF-SITE GROUNDWATER DATA

Based on groundwater samples and pumping tests conducted during the groundwater perchlorate investigation program[2], water at the Pittman Lateral contains higher levels of total dissolved solids (TDS) than site water (about 15,000 mg/L versus roughly 12,000 mg/L on-site). Perchlorate levels at the Pittman Lateral are much lower (averaging about 200 mg/L perchlorate versus approximately 1500 mg/L on-site). See Appendix I for analytical information.

Capturing the perchlorate in groundwater passing through a vertical plane along the Pittman Lateral would likely require an initial pumping rate of about 400 gallons per minute (gpm). The pumping rate would likely decline with time as a cone of depression is established. This estimate is based on available hydrologic data and is only approximate. The figure will be refined as further information becomes available.

Additional data on potential organic constituents are included in Appendix I for the off-site water since some of the samples recovered had a moderate "pesticide" smell which differentiated them from site groundwater.

TECHNOLOGY SUMMARY

The technologies evaluated previously for treating on-site groundwater are generally applicable to waters at the Pittman Lateral. Biological degradation of perchlorate appears to be the most promising technical approach at this time. Kerr-McGee is continuing to evaluate several technologies. Initial concerns regarding organic constituents in the Pittman Lateral groundwater having a negative impact on bacteria were dispelled in laboratory biological remediation tests. A second concern related to higher TDS concentrations may prove more limiting to the bacteria. TDS levels above 20,000 mg/L are not recommended.

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[1] Letter from Susan Crowley to Brenda Pohlmann, "Henderson On-Site Groundwater Perchlorate Treatment Technology Review," November 30, 1998.
[2] Phase II Groundwater Perchlorate Investigation Report, Kerr-McGee Chemical LLC, July 15, 1998.

One promising approach identified as an offshoot of the groundwater test work is the prospect of in-situ perchlorate remediation. Three In-situ concepts have been proposed separately by two firms and a university. Two of the concepts suggest that injection of nutrients and possibly inoculum could biologically destroy perchlorate without the need for pumping groundwater to the surface. One firm's proposal involves injecting the discharge from an on-site perchlorate biological treatment facility. The third in-situ approach involves injection of reducing agents into groundwater to react with perchlorate. These in-situ approaches are only conceptual and have not yet been tested. They will require significant additional work before recommendations on commercial application can be made.

Evaporation, ion exchange, reverse osmosis and other perchlorate concentrating technologies may be applicable but produce perchlorate levels in the concentrated streams which are unsuitable for landfilling. The concentrated perchlorate streams may also be unsuitable for biological or electrochemical treatment due to high TDS levels.

It should be noted that for all of the technology evaluations performed, the final effluent concentration is a key factor. Equipment sizing, process effectiveness, and capital/operating costs all depend on the final effluent target. Since toxicology work has not yet resulted in a standard for perchlorate, selection of a process option is premature.

The following technology evaluation is organized into the same three sections utilized in presenting technologies for use in treating Kerr-McGee on-site groundwater:

Evaluation of Storage Technologies
Evaluation of Separation/Concentration Technologies
Evaluation of Destruction Technologies

EVALUATION OF STORAGE TECHNOLOGIES

Recovering 400 gpm of groundwater from a series of wells along the Pittman Lateral would pose a significant storage problem. Even considering evaporation losses (2.8 gpm/acre), the large volume of water would fill the newly constructed 11-acre pond on the Kerr-McGee site (70+ million gallons) in a little over four months.

Assuming 2.8 gpm evaporation per acre of pond surface, over 140 acres of ponds would be required to evaporate the entire 400 gpm stream. Solids buildup in such a pond would total about 13,000 tons per year.

Ponding would be costly and solids disposal would be difficult. Landfill operators have suggested that concentrations above 1 percent perchlorate would preclude residue landfilling. Concentration of groundwater constituents could result in generation of a waste stream which would be more difficult to treat.

Options for below ground containment, such as slurry walls, are not considered feasible for the 400 gpm flow.

EVALUATION OF SEPARATION/CONCENTRATION TECHNOLOGIES

As reported for treatment of on-site groundwater, several technologies are available for perchlorate separation: most are costly, and there is no demonstrated approach for dealing with the concentrated perchlorate streams they produce. As with potential evaporation pond solids, landfilling concentrated streams containing perchlorate does not appear practical based on contacts with area disposal facilities. These separation technologies, therefore, would likely be paired with one of the destruction approaches discussed in the next section.

Evaporation

As noted in the storage technology section, evaporation from pond surfaces is about 2.8 gpm/acre. This can be enhanced to about 3 gpm/acre with aeration sprays if misting and carryover can be suitably controlled. At 2.8 gpm/acre, evaporating the entire 400 gpm flow from the Pittman Lateral would require a pond area of over 140 acres.

Mechanical evaporation options have been tested on on-site groundwater. While the off-site water has a somewhat higher TDS level, the evaporator technology should be effective in yielding a concentrated wet sludge. Combined capital and operating costs for an evaporator system are likely lower than corresponding costs for a 140+ acre evaporation pond.

Evaporation concentrates nearly all constituents and may produce products which exceed regulatory limits. Tests on evaporation solids generated from Pittman Lateral water will be performed to determine whether they meet the Department of Transportation criteria for oxidizers. This could significantly increase handling and disposal costs.

Other Approaches

As with on-site groundwater, Reverse Osmosis and Ion Exchange are potential approaches for treatment of off-site water. Both are typically very costly. Calgon Carbon and their subsidiary Advanced Separation Technologies (AST) recently announced results of their San Gabriel Valley, California, demonstration involving continuous ion exchange.[3] Their ISEP® technology removed perchlorate from relatively low (about 75 ppb) starting concentrations to below the detection limit of 4 ppb. The ISEP process also removed about 60 percent of the nitrate along with sulfate and other constituents. AST is now evaluating whether the technology is suitable for the higher perchlorate and TDS concentrations found in groundwater at the Pittman Lateral. Costs for the continuous ion exchange process are being determined by AST.

As with on-site groundwater, electrodialysis of off-site water was removed from consideration on the basis of cost when compared with reverse osmosis.

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[3] Company press release, Calgon Carbon, Dec. 7, 1998.

EVALUATION OF DESTRUCTION TECHNOLOGIES

Incineration

High levels of sodium in concentrated solids have a negative impact on refractory bricks used in incinerator construction. No commercial operators have been identified who are willing to take the solids.

Biochemical Destruction

As reported previously for on-site groundwater, biochemical destruction of perchlorate and chlorate is effective. Samples of groundwater from the Pittman Lateral have been tested at Applied Research Associates (ARA) and performed similarly to on-site water. The limiting factor may be the TDS concentration in the water.

ARA recommends that TDS concentrations be controlled at less than 2 percent (20,000 mg/L) in their pilot biological systems. Their bacteria survived TDS concentrations up to 3.4 percent in water samples from other sites, but that level is thought to be near the maximum tolerated by the organisms and is not recommended. Additional tests will be performed to determine the TDS limit in Pittman Lateral water.

Laboratory tests by Aerojet have also confirmed destruction of perchlorate from starting concentrations of about 150 mg/L to below 20 μg/L. The effect of TDS on their process has yet to be evaluated completely.

TDS concentrations become increasingly problematic when biochemical treatment is paired with groundwater storage. Average TDS concentrations at the Pittman Lateral are about 15,000 mg/L. Ponding of water to provide short-term storage would result in significant evaporation, and thus, higher TDS levels. To maintain TDS concentrations below the 20,000 mg/L level recommended by ARA, pond evaporation of off-site water would be limited to less than 30 volume percent.

Further concentration either by ponding or mechanical evaporation would raise the TDS limits to a point where dilution with fresh water would be required to operate the biological treatment process. This would raise costs and increase the size of the treatment plant.

In-situ Biological Remediation

Use of in-situ biological remediation (also known as bio-augmentation) at the Pittman Lateral is a potential approach, which might be possible if a biological process unit is successful on the Kerr-McGee site. ARA has proposed a study of reinjecting water from an on-site biological remediation system, plus additional nutrients, along the Pittman Lateral. The remediated stream from the on-site treatment facility would be used to inoculate in-situ Pittman Lateral groundwater without the need to bring it to the surface. Recent tests indicate the ARA bacteria are active at ambient groundwater temperatures and could

destroy perchlorate over a period of months or years. Another firm has also suggested an in-situ remediation test program involving injection of reducing agents. Details of the concept are not yet available.

Bruce Logan, of Penn State University, is reported to have successfully tested perchlorate destruction using bacteria in tubes filled with soil.[4] He reports that chlorate and perchlorate-destroying micro-organisms are already present in soils from "the Nevada Wash areas."

The in-situ concept would require extensive evaluation/test work and may also require successful completion of a commercial scale on-site bioremediation plant. Kerr-McGee will continue to evaluate the option.

Electrochemical Destruction

Electrochemical perchlorate destruction is at the same stage of development for off-site use as for on-site applications. Initial expectations that a flow-through cell design would allow treatment of up to 6 gpm of groundwater have not yet been realized. Flow rates on the order of milliliters per minute have been demonstrated. Final perchlorate concentrations from the cell system are in the low part per million range. Efforts are now concentrated on increasing the electrode surface area to improve cell throughput.

Pittman Lateral groundwater tested at laboratory bench scale has shown slightly faster perchlorate reduction than groundwater from the Kerr-McGee facility. These results are currently being verified. TDS concentrations may play a part in the faster perchlorate reduction.

Higher surface area cathodes have been constructed and will shortly be tested in Pittman Lateral groundwater.

Other Perchlorate Destruction Approaches

AST (the Calgon Carbon subsidiary) reportedly has a new perchlorate destruction technology being pilot tested in a program with the Jet Propulsion Laboratory in California. Very little information is available on the new process. Kerr-McGee is seeking additional details and will evaluate the process as information becomes available.

[4] Water Engineering and Management December 1998, p 7.

Appendix I

Groundwater Analyses

- Onsite
- Offsite

Table I
Henderson Groundwater Treatment Plant
Analysis of Feed and Discharge Water
Results: mg/l

Parameters	Samples			
	Feed		Discharge	
	Total	Soluble	Total	Soluble
pH	7.42	---	7.54	---
HCO_3	480	410	390	350
Cl	2100[1.]	2000[3.]	2100[1.]	2100[3.]
SO_4	1700[2.]	1700[3.]	1700[2.]	1700[3.]
ClO_3	3500[1.]	3400[3.]	3400[1.]	3200[3.]
ClO_4	1590[4.]	1520[4.]	1560[4.]	1520[4.]
ICAP Scan:				
Al	0.16	0.14	0.14	0.13
B	13.4	14.4	13.9	13.2
Ba	0.03	0.03	0.02	0.02
Ca	800	770	797	736
Co	0.01	0.01	0.01	0.01
Cr	8.88	8.88	0.06	0.009
Cu	0.009	0.006	0.007	0.006
Fe	6.19	0.007	0.40	0.008
K	33.6	37.3	39.4	36.5
Mg	426	434	445	419
Mo	0.03	0.07	0.09	0.07
Na	1800	1760	1950	1830
Ni	0.02	0.02	0.02	0.02
Sr	0.70	0.79	0.75	0.57
Sn	0.15	0.03	0.02	<0.01
Ti	0.01	0.001	0.006	<0.001
V	0.38	0.006	<0.005	<0.005
Zn	0.12	0.02	0.05	0.06
TDS	12,240	12,020	12,690	12,120
TSS	28.2	---	12.2	---
Specific Conductance (mS/cm)	16.72	16.70	18.79	14.50

1. Titration
2. Gravimetric
3. Ion Chromatography
4. Ion Selective Electrode

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Research & Development
Proprietary Information of the Company
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Primary and Secondary Drinking Water Regulations

	PARAMETER REGULATED	MCL/[SMCL] mg/L	MCLG mg/L	DATE OF PROMULGATION/ PROPOSAL	EPA METHOD[5,7]	ACCEPTANCE LIMIT
METALS	Aluminum[1]	[0.05-0.2]	—	1-30-91	202.1,2,200.7,8,9	± 30%
	Antimony[2]	0.006	0.006	7-17-92	204.2, 200.8,9, Gaseous Hydride	± 15%
	Arsenic	0.05	—	2-19-88	206.2,3,4,200.7A	
	Barium[3]	2	2	7-1-91	200.7, 208.1,2	± 15%
	Beryllium[2]	0.004	0.004	7-17-92	210.2, 200.7,8,9	± 15%
	Cadmium[3]	0.005	0.005	1-30-91	213.2, 200.7	± 20%
	Calcium	—	—	6-7-91	215.1,2, 200.7	
	Chromium[3]	0.1	0.1	1-30-91	218.2, 200.7	± 15%
	Copper[4,1]	1.3/90%ile [1.0]	1.3	6-7-91, 1-30-91	220.1,2, 200.7,8,9	± 10%
	Iron[1]	[0.3]	—	1-30-91	236.1,2, 200.7	
	Lead[4]	0.015/90%ile	zero	6-7-91	239.2, 200.8,9	± 30%
	Manganese[1]	[0.05]	—	1-30-91	243.1,2, 200.7	
	Mercury[3]	0.002	0.002	1-30-91	245.1, 245.2	± 30%
	Nickel[2]	0.1	0.1	7-17-92	249.1,2, 200.7,8,9	± 15%
	Selenium[2]	0.05	0.05	1-30-91	270.2, Gaseous Hydride	± 20%
	Silver[1]	[0.1]		1-30-91	272.1,2, 200.7,8,9	
	Sodium	20[10]	—	8-27-80, 6-7-91	273.1, 200.7	
	Thallium[2]	0.002	0.0005	7-17-92	279.2, 200.8,9	± 30%
	Zinc[1]	[5.0]		1-30-91	289.1, 200.7	
INORGANICS	Alkalinity[4]	—	—	6-7-91	310.1, Titration	
	Asbestos[3]	7MF/L >10 µm	7MF/L>10 µm	1-30-91	TEM	2 StdDev
	Chloride[1]	[250] 1400	—	1-30-91	See rule	
	Residual Disinfectant[5]	detectable	—	6-29-89	See rule	
	Color[1]	[15cu]	—	1-30-91	110.2	
	Conductivity[4]	—	—	6-7-91	120.1	
	Corrosivity[1]	[non-corrosive]	—	1-30-91	Langlier Index, Aggressive Index	
	Cyanide[2]	0.2	0.2	7-17-92	Manual distillation followed by 335.1,2,3, Electrode	± 25%
	Fluoride[1]	4.0 [2.0]	—	4-2-86 1-30-91	340.2, distillation followed by 340.1,3	± 10%
	Foaming Agents[1]	[0.5]	—	1-30-91	425.1	
	Nitrate (as N)[3]	10	10	1-30-91	353.1,2,3, 300.0A	± 10%
	Nitrite (as N)[3]	1	1	1-30-91	353.2,3, 354.1, 300.0A	± 15%
	Nitrate/Nitrite (as N)[3]	10	10	1-30-91	353.1,2,3, 300.0A	
	Odor[1]	[3ton]	—	1-30-91	140.1	
	pH[1A]	6.5-8.5 [6.5-8.5]		6-7-91 1-30-91	150.1,2	
	o-Phosphate[4]	—	—	6-7-91	365.2,3, 300.0A	
	Silica[4]	—	—	6-7-91	370.1, 200.7	
	Solids (TDS)[1]	[500] 1000	—	1-30-91	160.1	
	Sulfate[1,2]	deferred [250] 500	deferred	7-17-92 1-30-91	375.4	
	Temperature[4]	—	—	6-7-91		
MICRO-BIOLOGICALS	Turbidity[6]	Treatment 1.0	—	6-29-89	See rule	
	Coliform[8]	±5% positive samples/mo	zero	6-29-89	MF, MTF, P-A, MMO-MUG	
	E. Coli[8]	no positive repeat sample	zero	6-29-89	EC MUG, Nutrient Agar with MUG, MMO-MUG with subculture	
	Fecal Coliform[8]	no positive repeat sample	zero	6-29-89	EC test	
	Giardia Lamblia[6]	Treatment	zero	6-29-89		
	Heterotropic Bacteria or Residual Disinfectant[6]	Treatment	—	6-29-89	Pour plate, see rule	
	Legionella[6]	Treatment	zero	6-29-89		
	Viruses[6]	Treatment	zero	6-29-89		

1 — Secondary Maximum Contaminant Level — non-enforceable federal guidelines for aesthetic quality

2 — Phase V Regulations — promulgated 7-17-92

3 — Phase II Regulations — promulgated 1-30-91 and 7-1-91

4 — Lead and Copper Rule — promulgated 6-7-91; approved methods must be used for lead, copper, and water quality parameters; lead and copper levels are Action Levels

5 — Secondary contaminants must be analyzed using approved methods in laboratories approved by the states; primary contaminants must be analyzed using approved methods in laboratories certified by the states

6 — Radionuclides Proposed Rule — 7-18-91

7 — Only EPA methods have been listed here; additional methods are listed in the rules

8 — Coliform and Surface Water Treatment Rules — promulgated 6-29-89

9 — Methods 505 and 508 are used for screening and method 508A is used to quantify

10 — Recommended level

* — The acceptance limits for VOCs are ±20%/0.01(mg/L) and ±40%(mg/L)

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To Walter Ross	From Bill Lynn
Co.	Co CCHD
Dept.	Phone # [illegible]

	PARAMETER REGULATED	MCL/ [SMCL] mg/L	MCLG mg/L	DATE OF PROMULGATION/ PROPOSAL	EPA METHOD[4,7]	ACCEPTA LIMIT
VOLATILES	Trihalomethanes (Total)	0.10		11-29-79	501.1,2	± 20%
	Benzene	0.005	zero	7-8-87	502.2, 503.1, 524.1,2	•
	Carbon tetrachloride	0.005	zero	7-8-87	502.1,2, 524.1,2	•
	Chlorobenzene[3]	0.1	0.1	1-30-91	502.1,2, 503.1, 524.1,2	•
	p-Dichlorobenzene	0.075 [0.005]	0.075	7-8-87 5-89	502.1,2, 503.1, 524.1,2	•
	o-Dichlorobenzene[3]	0.6	0.6	1-30-91	502.1,2, 503.1, 524.1,2	•
	1,2-Dichloroethane	0.005	zero	7-8-87	502.1,2, 524.1,2	•
	1,1-Dichloroethylene	0.007	0.007	7-8-87	502.1,2, 524.1,2	•
	c-1,2-Dichloroethylene[3]	0.07	0.07	1-30-91	502.1,2, 524.1,2	•
	t-1,2-Dichloroethylene[3]	0.1	0.1	1-30-91	502.1,2, 524.1,2	•
	Dichloromethane[3]	0.005	zero	7-17-92	502.1,2, 524.1,2	•
	1,2-Dichloropropane[3]	0.005	zero	1-30-91	502.1,2, 524.1,2	± 40%
	Ethyl benzene[3]	0.7	0.7	1-30-91	502.2, 503.1, 524.1,2	•
	Styrene[3]	0.1	0.1	1-30-91	502.2, 503.1, 524.1,2	•
	Tetrachloroethylene[3]	0.005	zero	1-30-91	502.1,2, 503.1, 524.1,2	•
	Toluene[3]	1	1	1-30-91	502.2, 503.1, 524.1,2	•
	1,2,4-Trichlorobenzene[3]	0.07	0.07	7-17-92	502.2, 503.1, 524.2	± 40%
	1,1,1-Trichloroethane	0.2	0.2	7-8-87	502.1,2, 524.1,2	•
	1,1,2-Trichloroethane[3]	0.005	0.003	7-17-92	502.1,2, 524.1,2	± 40%
	Trichloroethylene	0.005	zero	7-8-87	502.1,2, 503.1, 524.1,2	•
	Vinyl chloride	0.002	zero	7-8-87	502.1, 2, 524.1,2	•
	Xylenes (Total)[3]	10	10	1-30-91	502.2, 503.1, 524.1,2	•
HERBICIDES & PESTICIDES	Alachlor[3]	0.002	zero	1-30-91	505, 507, 525.1	± 45%
	Aldicarb	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Aldicarb Sulfoxide[3]	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Aldicarb Sulfone[3]	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Atrazine[3]	0.003	0.003	1-30-91	505, 507, 525.1	± 45%
	Carbofuran[3]	0.04	0.04	1-30-91	531.1	± 45%
	Chlordane[3]	0.002	zero	1-30-91	505, 508, 525.1	± 45%
	2,4-D[3]	0.07	0.07	1-30-91	515.1	± 50%
	Dalapon[3]	0.2	0.2	7-17-92	515.1	2 StdDev
	Dibromochloropropane(DBCP)[3]	0.0002	zero	1-30-91	504	± 40%
	Dinoseb[3]	0.007	0.007	7-17-92	515.1	2 StdDev
	Diquat[3]	0.02	0.02	7-17-92	549	2 StdDev
	Endothall[3]	0.1	0.1	7-17-92	548	2 StdDev
	Endrin[3]	0.002	0.002	7-17-92	505, 508, 525.1	± 30%
	Ethylenedibromide(EDB)[3]	0.00005	zero	1-30-91	504	± 40%
	Glyphosate[3]	0.7	0.7	7-17-92	547	2 StdDev
	Heptachlor[3]	0.0004	zero	1-30-91	505, 508, 525.1	± 45%
	Heptachlor epoxide[3]	0.0002	zero	1-30-91	505, 508, 525.1	± 45%
	Lindane[3]	0.0002	0.0002	1-30-91	505, 508, 525.1	± 45%
	Methoxychlor[3]	0.04	0.04	1-30-91	505, 508, 525.1	± 45%
	Oxamyl[3] (vydate)	0.2	0.2	7-17-92	531.1	2 StdDev
	Pentachlorophenol[3]	0.001	zero	7-1-91	515.1, 525.1	± 50%
	Picloram[3]	0.5	0.5	7-17-92	515.1	2 StdDev
	Simazine[3]	0.004	0.004	7-17-92	505, 507, 525.1	2 StdDev
	Toxaphene[3]	0.003	zero	1-30-91	505, 508, 525.1	± 45%
	2,4,5-TP (Silvex)[3]	0.05	0.05	1-30-91	515.1	± 50%
OTHER SOCs	Hexachlorobenzene[3]	0.001	zero	7-17-92	505, 508, 525.1	2 StdDev
	Hexachlorocyclopentadiene[3]	0.05	0.05	7-17-92	505, 525.1	2 StdDev
	Benzo(a)pyrene[3]	0.0002	zero	7-17-92	550, 550.1, 525.1	2 StdDev
	PCBs[7] (as decachlorobiphenyl)	0.0005	zero	1-30-91	505, 508 508A[8]	0-200 mg/L
	2,3,7,8-TCDD(Dioxin)[3]	3x10-8	zero	7-17-92	1613	2 StdDev
	Acrylamide[3]	Treatment	zero	1-30-91		
	Epichlorohydrin[3]	Treatment	zero	1-30-91		
	Di(2-ethylhexyl)adipate[3]	0.4	0.4	7-17-92	506, 525.1	2 StdDev
	Di(2-ethylhexyl)phthalate[3]	0.006	zero	7-17-92	506, 525.1	2 StdDev
RADIONUCLIDES	Adjusted Gross Alpha[6]	15 pCi/L	zero	7-18-91	900.0	± 50%
	Beta Particle Emitters[6]	4 mrem cds per year /	zero	7-18-91	900.0	± 30%
	radioactive Cesium	— 50 pCi/L	—		901.0	± 30%
	radioactive Iodine	—	—		902.0	± 30%
	radioactive Strontium	—	—		905.0	± 30%
	tritium	—	—		906.0	± 20%
	gamma&photon emitters	—	—		901.1	
	Radium-226[6]	20 pCi/L	zero	7-18-91	903.0, 1	± 30%
	Radium-228[6]	20 pCi/L	zero	7-18-91	904.0	± 50%
	Radon-222[6]	300 pCi/L	zero	7-18-91	903.1, 913.0	± 30%
	Uranium[6]	0.02	zero	7-18-91	908.0, 1	± 30%

Primary and Secondary Drinking Water Regulations

	PARAMETER REGULATED	MCL/[SMCL] mg/L	MCLG mg/L	DATE OF PROMULGATION/ PROPOSAL	EPA METHOD[5,7]	ACCEPTANCE LIMIT
METALS	Aluminum[1]	[0.05-0.2]	—	1-30-91	202.1,.2, 200.7,.8,.9	± 30%
	Antimony[2]	0.006	0.006	7-17-92	204.2, 200.8,.9, Gaseous Hydride	± 15%
	Arsenic	0.05	—	2-19-88	206.2,.3,.4, 200.7A	
	Barium[3]	2	2	7-1-91	200.7, 208.1,.2	± 15%
	Beryllium[2]	0.004	0.004	7-17-92	210.2, 200.7,.8,.9	± 15%
	Cadmium[3]	0.005	0.005	1-30-91	213.2, 200.7	± 20%
	Calcium	—	—	6-7-91	215.1,.2, 200.7	
	Chromium[3]	0.1	0.1	1-30-91	218.2, 200.7	± 15%
	Copper[4,1]	1.3/90%ile [1.0]	1.3	6-7-91, 1-30-91	220.1,.2, 200.7,.8,.9	± 10%
	Iron[1]	[0.3]	—	1-30-91	236.1,.2, 200.7	
	Lead[4]	0.015/90%ile	zero	6-7-91	239.2, 200.8,.9	± 30%
	Manganese[1]	[0.05]	—	1-30-91	243.1,.2, 200.7	
	Mercury[3]	0.002	0.002	1-30-91	245.1, 245.2	± 30%
	Nickel[2]	0.1	0.1	7-17-92	249.1,.2, 200.7,.8,.9	± 15%
	Selenium[3]	0.05	0.05	1-30-91	270.2, Gaseous Hydride	± 20%
	Silver[1]	[0.1]		1-30-91	272.1,.2, 200.7,.8,.9	
	Sodium	20[10]	—	8-27-80, 6-7-91	273.1, 200.7	
	Thallium[2]	0.002	0.0005	7-17-92	279.2, 200.8,.9	± 30%
	Zinc[1]	[5.0]		1-30-91	289.1, 200.7	
INORGANICS	Alkalinity[4]	—	—	6-7-91	310.1, Titration	
	Asbestos[3]	7MF/L >10 µm	7MF/L>10 µm	1-30-91	TEM	2 StdDev
	Chloride[1]	[250] 1400	—	1-30-91	See rule	
	Residual Disinfectant[6]	detectable	—	6-29-89	See rule	
	Color[1]	[15cu]	—	1-30-91	110.2	
	Conductivity[4]	—	—	6-7-91	120.1	
	Corrosivity[1]	[non-corrosive]	—	1-30-91	Langlier Index, Aggressive Index	
	Cyanide[2]	0.2	0.2	7-17-92	Manual distillation followed by 335.1,.2,.3, Electrode	± 25%
	Fluoride[1]	4.0 [2.0]	—	4-2-86 1-30-91	340.2, distillation followed by 340.1,.3	± 10%
	Foaming Agents[1]	[0.5]	—	1-30-91	425.1	
	Nitrate (as N)[3]	10	10	1-30-91	353.1,.2,.3, 300.0A	± 10%
	Nitrite (as N)[3]	1	1	1-30-91	353.2,.3, 354.1, 300.0A	± 15%
	Nitrate/Nitrite (as N)[3]	10	10	1-30-91	353.1,.2,.3, 300.0A	
	Odor[1]	[3ton]	—	1-30-91	140.1	
	pH[1,4]	6.5-8.5 [6.5-8.5]		6-7-91 1-30-91	150.1,.2	
	o-Phosphate[4]	—	—	6-7-91	365.2,.3, 300.0A	
	Silica[4]	—	—	6-7-91	370.1, 200.7	
	Solids (TDS)[1]	[500] 1000	—	1-30-91	160.1	
	Sulfate[1,2]	deferred [250] 500	deferred	7-17-92 1-30-91	375.4	
	Temperature[4]	—	—	6-7-91		
MICRO-BIOLOGICALS	Turbidity[8]	Treatment 1.0	—	6-29-89	See rule	
	Coliform[8]	≤5% positive samples/mo	zero	6-29-89	MF, MTF, P-A, MMO-MUG	
	E. Coli[8]	no positive repeat sample	zero	6-29-89	EC MUG, Nutrient Agar with MUG, MMO-MUG with subculture	
	Fecal Coliform[8]	no positive repeat sample	zero	6-29-89	EC test	
	Giardia Lamblia[8]	Treatment	zero	6-29-89		
	Heterotropic Bacteria or Residual Disinfectant[8]	Treatment	—	6-29-89	Four plate, see rule	
	Legionella[8]	Treatment	zero	6-29-89		
	Viruses[8]	Treatment	zero	6-29-89		

1 — Secondary Maximum Contaminant Level — non-enforceable federal guidelines for aesthetic quality

2 — Phase V Regulations — promulgated 7-17-92

3 — Phase II Regulations — promulgated 1-30-91 and 7-1-91

4 — Lead and Copper Rule — promulgated 6-7-91; approved methods must be used for lead, copper, and water quality parameters; lead and copper levels are Action Levels

5 — Secondary contaminants must be analyzed using approved methods in laboratories approved by the states; primary contaminants must be analyzed using approved methods in laboratories certified by the states

6 — Radionuclides Proposed Rule — 7-18-91

7 — Only EPA methods have been listed here; additional methods are listed in the rules

8 — Coliform and Surface Water Treatment Rules — promulgated 6-29-89

9 — Methods 505 and 508 are used for screening and method 508A is used to quantify

10 — Recommended level

* — The acceptance limits for VOCs are ±20%/0.010mg/L and ±40%/0.005mg/L

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To Walter Ross	From Bill Lyman
Co.	Co. CCHD
Dept.	Phone # 242-1711

	PARAMETER REGULATED	MCL/ (SMCL) mg/L	MCLG mg/L	DATE OF PROMULGATION/ PROPOSAL	EPA METHOD[5,7]	ACCEPTA LIMIT
VOLATILES	Trihalomethanes (Total)	0.10		11-29-79	501.1,2	± 20%
	Benzene	0.005	zero	7-8-87	502.2, 503.1, 524.1, 2	•
	Carbon tetrachloride	0.005	zero	7-8-87	502.1, 2, 524.1, 2	•
	Chlorobenzene[3]	0.1	0.1	1-30-91	502.1, 2, 503.1, 524.1, 2	•
	p-Dichlorobenzene	0.075 (0.005)	0.075	7-8-87 5-89	502.1, 2, 503.1, 524.1, 2	•
	o-Dichlorobenzene[3]	0.6	0.6	1-30-91	502.1, 2, 503.1, 524.1, 2	•
	1,2-Dichloroethane	0.005	zero	7-8-87	502.1, 2, 524.1, 2	•
	1,1-Dichloroethylene	0.007	0.007	7-8-87	502.1, 2, 524.1, 2	•
	c-1,2-Dichloroethylene[3]	0.07	0.07	1-30-91	502.1, 2, 524.1, 2	•
	t-1,2-Dichloroethylene[3]	0.1	0.1	1-30-91	502.1, 2, 524.1, 2	•
	Dichloromethane[2]	0.005	zero	7-17-92	502.1, 2, 524.1, 2	•
	1,2-Dichloropropane[3]	0.005	zero	1-30-91	502.1, 2, 524.1, 2	•
	Ethyl benzene[3]	0.7	0.7	1-30-91	502.2, 503.1, 524.1, 2	± 40%
	Styrene[3]	0.1	0.1	1-30-91	502.2, 503.1, 524.1, 2	•
	Tetrachloroethylene[3]	0.005	zero	1-30-91	502.1, 2, 503.1, 524.1, 2	•
	Toluene[3]	1	1	1-30-91	502.2, 503.1, 524.1, 2	•
	1,2,4-Trichlorobenzene[3]	0.07	0.07	7-17-92	502.2, 503.1, 524.2	± 40%
	1,1,1-Trichloroethane	0.2	0.2	7-8-87	502.1, 2, 524.1, 2	•
	1,1,2-Trichloroethane[3]	0.005	0.003	7-17-92	502.1, 2, 524.1, 2	± 40%
	Trichloroethylene	0.005	zero	7-8-87	502.1, 2, 503.1, 524.1, 2	•
	Vinyl chloride	0.002	zero	7-8-87	502.1, 2, 524.1, 2	•
	Xylenes (Total)[3]	10	10	1-30-91	502.2, 503.1, 524.1, 2	•
HERBICIDES & PESTICIDES	Alachlor[3]	0.002	zero	1-30-91	505, 507, 525.1	± 45%
	Aldicarb[3]	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Aldicarb Sulfoxide[3]	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Aldicarb Sulfone[3]	Postponed	Postponed	5-27-92	531.1	2 StdDev
	Atrazine[3]	0.003	0.003	1-30-91	505, 507, 525.1	± 45%
	Carbofuran[3]	0.04	0.04	1-30-91	531.1	± 45%
	Chlordane[3]	0.002	zero	1-30-91	505, 508, 525.1	± 45%
	2,4-D[3]	0.07	0.07	1-30-91	515.1	± 50%
	Dalapon[3]	0.2	0.2	7-17-92	515.1	2 StdDev
	Dibromochloropropane (DBCP)[3]	0.0002	zero	1-30-91	504	± 40%
	Dinoseb[3]	0.007	0.007	7-17-92	515.1	2 StdDev
	Diquat[2]	0.02	0.02	7-17-92	549	2 StdDev
	Endothall[2]	0.1	0.1	7-17-92	548	2 StdDev
	Endrin[3]	0.002	0.002	7-17-92	505, 508, 525.1	± 30%
	Ethylenedibromide (EDB)[3]	0.00005	zero	1-30-91	504	± 40%
	Glyphosate[2]	0.7	0.7	7-17-92	547	2 StdDev
	Heptachlor[3]	0.0004	zero	1-30-91	505, 508, 525.1	± 45%
	Heptachlor epoxide[3]	0.0002	zero	1-30-91	505, 508, 525.1	± 45%
	Lindane[3]	0.0002	0.0002	1-30-91	505, 508, 525.1	± 45%
	Methoxychlor[3]	0.04	0.04	1-30-91	505, 508, 525.1	± 45%
	Oxamyl[2] (vydate)	0.2	0.2	7-17-92	531.1	2 StdDev
	Pentachlorophenol[3]	0.001	zero	7-1-91	515.1, 525.1	± 50%
	Picloram[3]	0.5	0.5	7-17-92	515.1	2 StdDev
	Simazine[3]	0.004	0.004	7-17-92	505, 507, 525.1	2 StdDev
	Toxaphene[3]	0.003	zero	1-30-91	505, 508, 525.1	± 45%
	2,4,5-TP (Silvex)[3]	0.05	0.05	1-30-91	515.1	± 45%
OTHER SOCs	Hexachlorobenzene[2]	0.001	zero	7-17-92	505, 508, 525.1	2 StdDev
	Hexachlorocyclopentadiene[2]	0.05	0.05	7-17-92	505, 525.1	2 StdDev
	Benzo(a)pyrene[2]	0.0002	zero	7-17-92	550, 550.1, 525.1	2 StdDev
	PCBs[7] (as decachlorobiphenyl)	0.0005	zero	1-30-91	505, 508 508A[9]	0-200 mg/L
	2,3,7,8-TCDD (Dioxin)[2]	9x10-8	zero	7-17-92	1613	2 StdDev
	Acrylamide[3]	Treatment	zero	1-30-91		
	Epichlorohydrin[3]	Treatment	zero	1-30-91		
	Di(2-ethylhexyl)adipate[2]	0.4	0.4	7-17-92	506, 525.1	[illegible]
	Di(2-ethylhexyl)phthalate[2]	0.006	zero	7-17-92	506, 525.1	2 StdDev
RADIONUCLIDES	Adjusted Gross Alpha[4]	15 pCi/L	zero	7-18-91	900.0	± 50%
	Beta Particle Emitters[4]	4 mrem cde per year /	zero	7-18-91	900.0	± 30%
	radioactive Cesium	— 50 pCi/L	—		901.0	± 30%
	radioactive Iodine	—	—		902.0	± 30%
	radioactive Strontium	—	—		905.0	± 30%
	tritium	—	—		906.0	± 20%
	gamma&photon emitters	—	—		901.1	
	Radium-226[4]	20 pCi/L	zero	7-18-91	903.0, 1	± 30%
	Radium-228[4]	20 pCi/L	zero	7-18-91	904.0	± 50%
	Radon-222[4]	300 pCi/L	zero	7-18-91	903.1, 913.0	± 30%
	Uranium[4]	0.02	zero	7-18-91	908.0, .1	± 30%

NEL LABORATORIES
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Las Vegas Division
4208 Arcata Way, Suite A • Las Vegas, NV 89030
(702) 657-1010 • Fax. (702) 657-1577
1-888-368-3282

CLIENT: Nevada Department of Environmental Protection
555 E. Washington, Suite 4300
Las Vegas, NV 89101-1049
ATTN: Brenda Pohlmann

PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

NEL ORDER ID: L9811207

Attached are the analytical results for samples in support of the above referenced project.

Samples were received by NEL in good condition, under chain of custody on 11/20/98.

Samples were analyzed as received.

Should you have any questions or comments, please feel free to contact our Client Services department at (702) 657-1010.

Stan Van Wagenen
Laboratory Manager

11/30/98
Date

CERTIFICATIONS:

	Reno	Las Vegas	S. California
Arizona	AZ0520	AZ0518	AZ0583
California	1707	2002	2264
US Army Corps of Engineers	Certified	Certified	Certified

	Reno	Las Vegas	S. California
Idaho	Certified	Certified	
Montana	Certified	Certified	
Nevada	NV033	NV052	CA084

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protection
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 637
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-01

TEST: **RCRA-8 GROUP**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Arsenic	0.10	.1mg/L	1	EPA 6010	11/24/98	11/24/98
Barium	0.038	.005mg/L	1	EPA 6010	11/24/98	11/24/98
Cadmium	ND	.01mg/L	1	EPA 6010	11/24/98	11/24/98
Chromium	ND	.01mg/L	1	EPA 6010	11/24/98	11/24/98
Lead	ND	.05mg/L	1	EPA 6010	11/24/98	11/24/98
Manganese	1.4	.005mg/L	1	EPA 6010	11/24/98	11/24/98
Mercury	ND	.0002mg/L	1	EPA 7470A	11/24/98	11/24/98
Selenium	ND	.1mg/L	1	EPA 6010	11/24/98	11/24/98
Silver	ND	.02mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protection
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 639
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-02

TEST: **RCRA-8 GROUP**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Arsenic	0.13	.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Barium	0.054	.005 mg/L	1	EPA 6010	11/24/98	11/24/98
Cadmium	ND	.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Chromium	ND	.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Lead	ND	.05 mg/L	1	EPA 6010	11/24/98	11/24/98
Manganese	0.94	.005 mg/L	1	EPA 6010	11/24/98	11/24/98
Mercury	ND	.0002 mg/L	1	EPA 7470A	11/24/98	11/24/98
Selenium	ND	.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Silver	ND	.02 mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protection
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 641
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-03

TEST: RCRA-8 GROUP
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Arsenic	0.23	.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Barium	0.051	.005 mg/L	1	EPA 6010	11/24/98	11/24/98
Cadmium	ND	.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Chromium	ND	.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Lead	ND	.05 mg/L	1	EPA 6010	11/24/98	11/24/98
Manganese	0.45	.005 mg/L	1	EPA 6010	11/24/98	11/24/98
Mercury	ND	.0002 mg/L	1	EPA 7470A	11/24/98	11/24/98
Selenium	ND	.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Silver	ND	.02 mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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CLIENT: Nevada Department of Environmental Protection
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 645
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-04

TEST: RCRA-8 GROUP
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Arsenic	0.11	.1mg/L	1	EPA 6010	11/24/98	11/24/98
Barium	0.046	.005mg/L	1	EPA 6010	11/24/98	11/24/98
Cadmium	ND	.01mg/L	1	EPA 6010	11/24/98	11/24/98
Chromium	ND	.01mg/L	1	EPA 6010	11/24/98	11/24/98
Lead	ND	.05mg/L	1	EPA 6010	11/24/98	11/24/98
Manganese	0.44	.005mg/L	1	EPA 6010	11/24/98	11/24/98
Mercury	ND	.0002mg/L	1	EPA 7470A	11/24/98	11/24/98
Selenium	ND	.1mg/L	1	EPA 6010	11/24/98	11/24/98
Silver	ND	.02mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: Method Blank
DATE SAMPLED: NA
NEL SAMPLE ID: L111207i-BLK

TEST: RCRA-8 GROUP

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Arsenic	ND	0.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Barium	ND	0.005 mg/L	1	EPA 6010	11/24/98	11/24/98
Cadmium	ND	0.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Chromium	ND	0.01 mg/L	1	EPA 6010	11/24/98	11/24/98
Lead	ND	0.05 mg/L	1	EPA 6010	11/24/98	11/24/98
Selenium	ND	0.1 mg/L	1	EPA 6010	11/24/98	11/24/98
Silver	ND	0.02 mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: **Method Blank**
DATE SAMPLED: NA
NEL SAMPLE ID: L11181Hg-BLK

TEST: **RCRA-8 GROUP**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.0002mg/L	1	EPA 7470A	11/24/98	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: **Method Blank**
DATE SAMPLED: NA
NEL SAMPLE ID: L11207-Mn-BLK

TEST: **RCRA-8 GROUP**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Manganese	ND	0.005mg/L	1	EPA 6010	11/24/98	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

IENT: Nevada Department of Environmental Protecti
OJECT ID: November Lateral Sampling/ReFBMI 81-1
OJECT #: ReFBMI 81-1
ST: Metals
TRIX: Aqueous

RAMETER	NEL Sample ID	Spike Amount	Spike Result	Percent Recovery	Acceptable Range	RPD
enic	L111207i-LCS	0.5	0.467	93	85 - 115	
enic	L9811207-01-MS	0.5	0.621	104	75 - 125	
enic	L9811207-01-MSD	0.5	0.633	107	75 - 125	2.3
um	L111207i-LCS	1	1.02	102	85 - 115	
ium	L9811207-01-MS	1	1.05	101	75 - 125	
um	L9811207-01-MSD	1	1.04	100	75 - 125	1.
mium	L111207i-LCS	0.2	0.219	110	85 - 115	
mium	L9811207-01-MS	0.2	0.218	109	75 - 125	
mium	L9811207-01-MSD	0.2	0.22	110	75 - 125	0.9
mium	L111207i-LCS	0.5	0.551	110	85 - 115	
mium	L9811207-01-MS	0.5	0.525	105	75 - 125	
mium	L9811207-01-MSD	0.5	0.522	104	75 - 125	0.6
l	L111207i-LCS	1	1.15	115	85 - 115	
l	L9811207-01-MS	1	1.07	107	75 - 125	
l	L9811207-01-MSD	1	1.07	107	75 - 125	0.
ganese	L11207-Mn-LCS	0.5	0.547	109	85 - 115	
ganese	L9811207-01-MS	0.5	1.9	100	75 - 125	
ganese	L9811207-01-MSD	0.5	1.93	106	75 - 125	5.8
cury	L11181Hg-LCS	0.005	0.00525	105	85 - 115	
cury	L9811181-01-MS	0.005	0.00606	121	75 - 125	
cury	L9811181-01-MSD	0.005	0.00594	119	75 - 125	2.
ium	L111207i-LCS	0.5	0.518	104	85 - 115	
ium	L9811207-01-MS	0.5	0.549	110	75 - 125	
ium	L9811207-01-MSD	0.5	0.557	111	75 - 125	1.4
r	L111207i-LCS	0.5	0.57	114	85 - 115	
r	L9811207-01-MS	0.5	0.578	116	75 - 125	
r	L9811207-01-MSD	0.5	0.569	114	75 - 125	1.6

Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protect
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 637
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-01

TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous
EXTRACTED: 12/25/98
DILUTION: 1
ANALYZED: 12/1/98
ANALYST: JRW

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	3.2 µg/L	0.1 µg/L
beta-BHC	4.8 µg/L	0.1 µg/L
delta-BHC	6.0 E µg/L	0.1 µg/L
gamma-BHC (Lindane)	ND	0.1 µg/L
Alpha-chlordane	ND	0.1 µg/L
Chlordane	ND	1. ug/L
Gamma-chlordane	ND	0.1 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Endrin ketone	ND Jc	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Methoxychlor	ND J	1. µg/L
Toxaphene	ND	3. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	92	70 - 130
Tetrachloro-m-xylene	69	70 - 130

ND - Not Detected

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PRILIMINARY

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protect
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 639
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-02

TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous
EXTRACTED: 12/25/98
DILUTION: 1
ANALYZED: 12/1/98
ANALYST: JRW

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	2.7 µg/L	0.1 µg/L
beta-BHC	0.7 µg/L	0.1 µg/L
delta-BHC	6.4 E µg/L	0.1 µg/L
gamma-BHC (Lindane)	0.3 µg/L	0.1 µg/L
Chlordane	ND	1. ug/L
Alpha-chlordane	ND	0.1 µg/L
Gamma-chlordane	ND	0.1 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Endrin ketone	ND Jc	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Methoxychlor	ND J	1. µg/L
Toxaphene	ND	3. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	78	70 - 130
Tetrachloro-m-xylene	84	70 - 130

ND - Not Detected

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PRILIMINARY

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protect
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 641
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-03

TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous
EXTRACTED: 12/25/98
DILUTION: 1
ANALYZED: 12/1/98
ANALYST: JRW

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	3.2 µg/L	0.1 µg/L
beta-BHC	0.8 µg/L	0.1 µg/L
delta-BHC	6.5 E µg/L	0.1 µg/L
gamma-BHC (Lindane)	0.4 µg/L	0.1 µg/L
Chlordane	ND	1. ug/L
Alpha-chlordane	ND	0.1 µg/L
Gamma-chlordane	ND	0.1 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Endrin ketone	ND Jc	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Methoxychlor	ND J	1. µg/L
Toxaphene	ND	3. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	85	70 - 130
Tetrachloro-m-xylene	61	70 - 130

ND - Not Detected

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PRELIMINARY

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protect
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 645
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-04

TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous
DILUTION: 1
EXTRACTED: 12/25/98
ANALYZED: 12/1/98
ANALYST: JRW

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	4.3 µg/L	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	5.6 E µg/L	0.1 µg/L
gamma-BHC (Lindane)	ND	0.1 µg/L
Chlordane	ND	1. ug/L
Alpha-chlordane	ND	0.1 µg/L
Gamma-chlordane	ND	0.1 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Endrin ketone	ND Jc	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Methoxychlor	ND J	1. µg/L
Toxaphene	ND	3. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	74	70 - 130
Tetrachloro-m-xylene	53	70 - 130

ND - Not Detected

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PRILIMINARY

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: Method Blank
DATE SAMPLED: NA
NEL SAMPLE ID: 981125PSTS-BK

TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous

EXTRACTED: 12/25/98
ANALYZED: 12/1/98
ANALYST: JRW

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
gamma-BHC (Lindane)	ND	0.1 µg/L
Alpha-chlordane	ND	0.1 µg/L
Chlordane	ND	0.1 µg/L
Gamma-chlordane	ND	0.1 µg/L
4,4'-DDD	ND	1 ug/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Endrin ketone	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Methoxychlor	ND	0.1 µg/L
Toxaphene	ND	1 µg/L
	ND	3 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	83	70 - 130
Tetrachloro-m-xylene	55	70 - 130

ND - Not Detected

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PRILIMINARY

NEL LABORATORIES

:LIENT: Nevada Department of Environmental Protecti
'ROJECT ID: November Lateral Sampling/ReFBMI 81-1
'ROJECT #: ReFBMI 81-1
'EST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
IATRIX: Aqueous

ARAMETER	NEL Sample ID	Spike Amount	Spike Result	Percent Recovery	Acceptable Range	RPD
ldrin	981125PSTS-LCS	1	1.01	101	70 - 130	
ldrin	981125PSTS-LCSD	1	0.95	95	70 - 130	6.1
ha-BHC	981125PSTS-LCS	1	0.87	87	70 - 130	
ha-BHC	981125PSTS-LCSD	1	0.86	86	70 - 130	1.2
ta-BHC	981125PSTS-LCS	1	1.09	109	70 - 130	
a-BHC	981125PSTS-LCSD	1	1.04	104	70 - 130	4.7
ta-BHC	981125PSTS-LCS	1	1.07	107	70 - 130	
ta-BHC	981125PSTS-LCSD	1	1.04	104	70 - 130	2.8
nma-BHC (Lindane)	981125PSTS-LCS	1	0.9	90	70 - 130	
ma-BHC (Lindane)	981125PSTS-LCSD	1	0.84	84	70 - 130	6.9
ha-chlordane	981125PSTS-LCS	1	0.84	84	70 - 130	
ha-chlordane	981125PSTS-LCSD	1	0.82	82	70 - 130	2.4
nma-chlordane	981125PSTS-LCS	1	0.98	98	70 - 130	
-DDD	981125PSTS-LCS	1	0.97	97	70 - 130	
-DDD	981125PSTS-LCSD	1	0.92	92	70 - 130	5.3
-DDE	981125PSTS-LCS	1	0.92	92	70 - 130	
DDE	981125PSTS-LCSD	1	0.87	87	70 - 130	5.6
-DDT	981125PSTS-LCS	1	0.96	96	70 - 130	
-DDT	981125PSTS-LCSD	1	0.94	94	70 - 130	2.1
drin	981125PSTS-LCS	1	0.99	99	70 - 130	
drin	981125PSTS-LCSD	1	0.95	95	70 - 130	4.1
sulfan I	981125PSTS-LCS	1	1.03	103	70 - 130	
sulfan I	981125PSTS-LCSD	1	0.98	98	70 - 130	5.
sulfan II	981125PSTS-LCS	1	1.01	101	70 - 130	
sulfan II	981125PSTS-LCSD	1	0.98	98	70 - 130	3.
sulfan sulfate	981125PSTS-LCS	1	1.17	117	70 - 130	
sulfan sulfate	981125PSTS-LCSD	1	1.1	110	70 - 130	6.2
n	981125PSTS-LCS	1	1.07	107	70 - 130	
n	981125PSTS-LCSD	1	1.04	104	70 - 130	2.8
n aldehyde	981125PSTS-LCS	1	1.48	148	70 - 130	
n aldehyde	981125PSTS-LCSD	1	1.4	140	70 - 130	5.6
n ketone	981125PSTS-LCS	1	1.1	110 Jc	70 - 130	
n ketone	981125PSTS-LCSD	1	1.04	104 Jc	70 - 130	5.6
chlor	981125PSTS-LCS	1	0.99	99	70 - 130	
chlor	981125PSTS-LCSD	1	0.93	93	70 - 130	6.3
chlor epoxide	981125PSTS-LCS	1	1.01	101	70 - 130	
chlor epoxide	981125PSTS-LCSD	1	0.95	95	70 - 130	6.1
oxychlor	981125PSTS-LCS	1	0.57	57 J	70 - 130	

Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protecti
PROJECT ID: November Lateral Sampling/ReFBMI 81-1
PROJECT #: ReFBMI 81-1
TEST: **Organochlorine Pesticides by EPA 8081A, Dec. 1996**
MATRIX: Aqueous

PARAMETER	NEL Sample ID	Spike Amount	Spike Result	Percent Recovery	Acceptable Range	RPD
Methoxychlor	981125PSTS-LCSD	1	0.54	54 J	70 - 130	5.4

ND - Not Detected

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Phoenix • So. California

Las Vegas Division • 4208 Arcata Way, Ste. A • Las Vegas, NV 89030
(702) 657-1010 • FAX: (702) 657-1577 • 1-888-368-3282

CHAIN OF CUSTODY

Project Name: NOVEMBER LATERAL SAMPLING
Project No.: ReFBMI 81-1
P.O. No.: DEP 98030
Sampled By: NDEP/TJC

Company: NEVADA DEP
Attn.: BRENDA POHLMANN
Address: 555 E. WASHINGTON AVE., SUITE 4300 LAS VEGAS NV 89101-1049
Phone No.: 702/486-2857
Fax No.: 702/486-2863
Billing Address:
Expected Due Date: 12/1/98

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	5260 + MTBE	8081 (PESTICIDES)	CONDUCTIVITY	RCRA 8 METALS + Mn						pH (for lab use only)	Remarks
11/20/98 3:30pm	L 637	L9811207-01	7		A/B		✓	✓	✓	✓							PRESERVATIVES PROVIDED BY LAB
11/20/98 3:45	L 639	-02	7		A/B		✓	✓	✓	✓							"
11/20/98 4:00	L 641	-03	7		A/B		✓	✓	✓	✓							"
11/20/98 4:15	L 645	-04	7		A/B		✓	✓	✓	✓							"

NOTE: FOR METALS SAMPLES, NO PRESERVATIVE WAS USED

Custody Seal intact? Y N None Temp. 20°C
Condition when received good

Box #1: DW - Drinking Water, WW - Waste Water, RW - RCRA Water, OL - Oil, SG - Sludge, SO - Soil, SD - Solid, AQ - Aqueous, A - Air

Box #2: A. HCl, B. HNO, C. H_2SO_4, D. NaOH, E. Ice Only, F. Other, G. Not Preserved
VOC BOTTLES
METALS BOTTLE

Box #3: H - High, M - Medium, L - Low, U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
Todd J. Croft	[signature]	11/20/98 1712	T. Sandoval	[signature]	11-20-98/1712

report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further ...ution of the report or its contents.

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Phoenix • Irvine

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4208 Arcata Way, Suite A, Las Vegas, NV 89030
(702) [illegible] Fax: (702) 657-1577
1-888-388-3282

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TO: Todd

COMPANY:

PHONE:

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FROM: Vanessa

DATE: 11/30

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metals and Pesticides to follow tomorrow.

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Las Vegas Division
4208 Arcata Way, Suite A • Las Vegas, NV 89030
(702) 657-1010 • Fax: (702) 657-1577
1-888-368-3282

CLIENT: Nevada Department of Environmental Protection
555 E. Washington, Suite 4300
Las Vegas, NV 89101-1049
ATTN: Brenda Pohlmann

PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

NEL ORDER ID: L9811207

Attached are the analytical results for samples in support of the above referenced project.

Samples were received by NEL in good condition, under chain of custody on 11/20/98.

Samples were analyzed as received.

Should you have any questions or comments, please feel free to contact our Client Services department at (702) 657-1010.

Stan Van Wagenen
Laboratory Manager

11/30/98
Date

CERTIFICATIONS:

	Reno	Las Vegas	S. California		Reno	Las Vegas	S. California
Arizona	AZ0520	AZ0518	AZ0583	Idaho	Certified	Certified	
California	1707	2002	2264	Montana	Certified	Certified	
US Army Corps of Engineers	Certified	Certified	Certified	Nevada	NV033	NV052	CA084

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 637
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-01

TEST: **Volatile Organic Compounds by EPA SW846 Method 8260B, Dec. 1996**
METHOD: EPA 8260B
MATRIX: Aqueous
DILUTION: 1

EXTRACTED: 11/25/98
ANALYZED: 11/25/98
ANALYST: SEJ

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acetone	ND	25.µg/L	1,1-Dichloropropene	ND	5.µg/L
Benzene	ND	5.µg/L	cis-1,3-Dichloropropene	ND	5.µg/L
Bromobenzene	ND	5.µg/L	trans-1,3-Dichloropropene	ND	5.µg/L
Bromochloromethane	ND	5.µg/L	Ethylbenzene	ND	5.µg/L
Bromodichloromethane	ND	5.µg/L	Hexachlorobutadiene	ND	5.µg/L
Bromoform	ND	5.µg/L	2-Hexanone	ND	25.µg/L
Bromomethane	ND	5.µg/L	Iodomethane	ND	5.µg/L
2-Butanone	ND	25.µg/L	Isopropylbenzene	ND	5.µg/L
n-Butylbenzene	ND	5.µg/L	p-Isopropyltoluene	ND	5.µg/L
sec-Butylbenzene	ND	5.µg/L	Methylene chloride (Dichloromethane)	ND	5.µg/L
tert-Butylbenzene	ND	5.µg/L	4-Methyl-2-pentanone	ND	25.µg/L
Carbon disulfide	ND	5.µg/L	MTBE	ND	5.µg/L
Carbon tetrachloride	ND	5.µg/L	Naphthalene	ND	5.µg/L
Chlorobenzene	79	5.µg/L	n-Propylbenzene	ND	5.µg/L
Chloroethane	ND	5.µg/L	Styrene	ND	5.µg/L
Chloroform	ND	5.µg/L	1,1,1,2-Tetrachloroethane	ND	5.µg/L
Chloromethane	ND	5.µg/L	1,1,2,2-Tetrachloroethane	ND	5.µg/L
2-Chlorotoluene	ND	5.µg/L	Tetrachloroethene (PCE)	ND	5.µg/L
4-Chlorotoluene	ND	5.µg/L	Toluene	ND	5.µg/L
Dibromochloromethane	ND	5.µg/L	1,2,3-Trichlorobenzene	ND	5.µg/L
1,2-Dibromo-3-chloropropane (DBCP)	ND	5.µg/L	1,2,4-Trichlorobenzene	47	5.µg/L
1,2-Dibromoethane (EDB)	ND	5.µg/L	1,1,1-Trichloroethane (1,1,1-TCA)	ND	5.µg/L
Dibromomethane	ND	5.µg/L	1,1,2-Trichloroethane (1,1,2-TCA)	ND	5.µg/L
1,2-Dichlorobenzene (o-DCB)	26	5.µg/L	Trichloroethene (TCE)	ND	5.µg/L
1,3-Dichlorobenzene (m-DCB)	8	5.µg/L	Trichlorofluoromethane (Freon 11)	ND	5.µg/L
1,4-Dichlorobenzene (p-DCB)	40	5.µg/L	1,2,3-Trichloropropane	ND	5.µg/L
Dichlorodifluoromethane (Freon 12)	ND	5.µg/L	1,2,4-Trimethylbenzene	ND	5.µg/L
1,1-Dichloroethane (1,1-DCA)	14	5.µg/L	1,3,5-Trimethylbenzene	ND	5.µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5.µg/L	Vinyl chloride	ND	5.µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5.µg/L	o-Xylene	ND	5.µg/L
cis-1,2-Dichloroethene	ND	5.µg/L	m,p-Xylene	ND	5.µg/L
trans-1,2-Dichloroethene	ND	5.µg/L			
1,2-Dichloropropane	ND	5.µg/L			
1,3-Dichloropropane	ND	5.µg/L			
2,2-Dichloropropane	ND	5.µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	92	86 - 115
Dibromofluoromethane	99	86 - 118
Toluene-d8	99	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 639
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-02

TEST: **Volatile Organic Compounds by EPA SW846 Method 8260B, Dec. 1996**
METHOD: EPA 8260B
MATRIX: Aqueous
DILUTION: 1

EXTRACTED: 11/25/98
ANALYZED: 11/25/98
ANALYST: SEJ

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acetone	ND	25.µg/L	1,1-Dichloropropene	ND	5.µg/L
Benzene	ND	5.µg/L	cis-1,3-Dichloropropene	ND	5.µg/L
Bromobenzene	ND	5.µg/L	trans-1,3-Dichloropropene	ND	5.µg/L
Bromochloromethane	ND	5.µg/L	Ethylbenzene	ND	5.µg/L
Bromodichloromethane	ND	5.µg/L	Hexachlorobutadiene	ND	5.µg/L
Bromoform	ND	5.µg/L	2-Hexanone	ND	25.µg/L
Bromomethane	ND	5.µg/L	Iodomethane	ND	5.µg/L
2-Butanone	ND	25.µg/L	Isopropylbenzene	ND	5.µg/L
n-Butylbenzene	ND	5.µg/L	p-Isopropyltoluene	ND	5.µg/L
sec-Butylbenzene	ND	5.µg/L	Methylene chloride (Dichloromethane)	ND	5.µg/L
tert-Butylbenzene	ND	5.µg/L	4-Methyl-2-pentanone	ND	25.µg/L
Carbon disulfide	ND	5.µg/L	MTBE	ND	5.µg/L
Carbon tetrachloride	ND	5.µg/L	Naphthalene	ND	5.µg/L
Chlorobenzene	180	5.µg/L	n-Propylbenzene	ND	5.µg/L
Chloroethane	ND	5.µg/L	Styrene	ND	5.µg/L
Chloroform	ND	5.µg/L	1,1,1,2-Tetrachloroethane	ND	5.µg/L
Chloromethane	ND	5.µg/L	1,1,2,2-Tetrachloroethane	ND	5.µg/L
2-Chlorotoluene	ND	5.µg/L	Tetrachloroethene (PCE)	ND	5.µg/L
4-Chlorotoluene	ND	5.µg/L	Toluene	ND	5.µg/L
Dibromochloromethane	ND	5.µg/L	1,2,3-Trichlorobenzene	6	5.µg/L
1,2-Dibromo-3-chloropropane (DBCP)	ND	5.µg/L	1,2,4-Trichlorobenzene	55	5.µg/L
1,2-Dibromoethane (EDB)	ND	5.µg/L	1,1,1-Trichloroethane (1,1,1-TCA)	ND	5.µg/L
Dibromomethane	ND	5.µg/L	1,1,2-Trichloroethane (1,1,2-TCA)	ND	5.µg/L
1,2-Dichlorobenzene (o-DCB)	38	5.µg/L	Trichloroethene (TCE)	ND	5.µg/L
1,3-Dichlorobenzene (m-DCB)	10	5.µg/L	Trichlorofluoromethane (Freon 11)	ND	5.µg/L
1,4-Dichlorobenzene (p-DCB)	63	5.µg/L	1,2,3-Trichloropropane	ND	5.µg/L
Dichlorodifluoromethane (Freon 12)	ND	5.µg/L	1,2,4-Trimethylbenzene	ND	5.µg/L
1,1-Dichloroethane (1,1-DCA)	11	5.µg/L	1,3,5-Trimethylbenzene	ND	5.µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5.µg/L	Vinyl chloride	ND	5.µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5.µg/L	o-Xylene	ND	5.µg/L
cis-1,2-Dichloroethene	ND	5.µg/L	m,p-Xylene	ND	5.µg/L
trans-1,2-Dichloroethene	ND	5.µg/L			
1,2-Dichloropropane	ND	5.µg/L			
1,3-Dichloropropane	ND	5.µg/L			
2,2-Dichloropropane	ND	5.µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	93	86 - 115
Dibromofluoromethane	100	86 - 118
Toluene-d8	99	88 - 110

ND - Not Detected

This report shall not be reproduced except in full, without the written approval of the laboratory.

NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 641
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-03

TEST: **Volatile Organic Compounds by EPA SW846 Method 8260B, Dec. 1996**
METHOD: EPA 8260B
MATRIX: Aqueous
DILUTION: 1

EXTRACTED: 11/25/98
ANALYZED: 11/25/98
ANALYST: SEJ

PARAMETER	Result µg/L	Reporting Limit
Acetone	34	25.µg/L
Benzene	ND	5.µg/L
Bromobenzene	ND	5.µg/L
Bromochloromethane	ND	5.µg/L
Bromodichloromethane	ND	5.µg/L
Bromoform	ND	5.µg/L
Bromomethane	ND	5.µg/L
2-Butanone	ND	25.µg/L
n-Butylbenzene	ND	5.µg/L
sec-Butylbenzene	ND	5.µg/L
tert-Butylbenzene	ND	5.µg/L
Carbon disulfide	ND	5.µg/L
Carbon tetrachloride	ND	5.µg/L
Chlorobenzene	150	5.µg/L
Chloroethane	ND	5.µg/L
Chloroform	ND	5.µg/L
Chloromethane	ND	5.µg/L
2-Chlorotoluene	ND	5.µg/L
4-Chlorotoluene	ND	5.µg/L
Dibromochloromethane	ND	5.µg/L
1,2-Dibromo-3-chloropropane (DBCP)	ND	5.µg/L
1,2-Dibromoethane (EDB)	ND	5.µg/L
Dibromomethane	ND	5.µg/L
1,2-Dichlorobenzene (o-DCB)	26	5.µg/L
1,3-Dichlorobenzene (m-DCB)	6	5.µg/L
1,4-Dichlorobenzene (p-DCB)	43	5.µg/L
Dichlorodifluoromethane (Freon 12)	ND	5.µg/L
1,1-Dichloroethane (1,1-DCA)	11	5.µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5.µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5.µg/L
cis-1,2-Dichloroethene	ND	5.µg/L
trans-1,2-Dichloroethene	ND	5.µg/L
1,2-Dichloropropane	ND	5.µg/L
1,3-Dichloropropane	ND	5.µg/L
2,2-Dichloropropane	ND	5.µg/L

PARAMETER	Result µg/L	Reporting Limit
1,1-Dichloropropene	ND	5.µg/L
cis-1,3-Dichloropropene	ND	5.µg/L
trans-1,3-Dichloropropene	ND	5.µg/L
Ethylbenzene	ND	5.µg/L
Hexachlorobutadiene	ND	5.µg/L
2-Hexanone	ND	25.µg/L
Iodomethane	ND	5.µg/L
Isopropylbenzene	ND	5.µg/L
p-Isopropyltoluene	ND	5.µg/L
Methylene chloride (Dichloromethane)	ND	5.µg/L
4-Methyl-2-pentanone	ND	25.µg/L
MTBE	ND	5.µg/L
Naphthalene	ND	5.µg/L
n-Propylbenzene	ND	5.µg/L
Styrene	ND	5.µg/L
1,1,1,2-Tetrachloroethane	ND	5.µg/L
1,1,2,2-Tetrachloroethane	ND	5.µg/L
Tetrachloroethene (PCE)	ND	5.µg/L
Toluene	ND	5.µg/L
1,2,3-Trichlorobenzene	8	5 µg/L
1,2,4-Trichlorobenzene	32	5.µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5.µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5.µg/L
Trichloroethene (TCE)	ND	5.µg/L
Trichlorofluoromethane (Freon 11)	ND	5.µg/L
1,2,3-Trichloropropane	ND	5.µg/L
1,2,4-Trimethylbenzene	ND	5.µg/L
1,3,5-Trimethylbenzene	ND	5.µg/L
Vinyl chloride	ND	5.µg/L
o-Xylene	ND	5.µg/L
m,p-Xylene	ND	5.µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	94	86 - 115
Dibromofluoromethane	100	86 - 118
Toluene-d8	99	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: L 645
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-04

TEST: **Volatile Organic Compounds by EPA SW846 Method 8260B, Dec. 1996**
METHOD: EPA 8260B
MATRIX: Aqueous
DILUTION: 1

EXTRACTED: 11/25/98
ANALYZED: 11/25/98
ANALYST: SEJ

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acetone	ND	25.µg/L	1,1-Dichloropropene	ND	5.µg/L
Benzene	ND	5.µg/L	cis-1,3-Dichloropropene	ND	5.µg/L
Bromobenzene	ND	5.µg/L	trans-1,3-Dichloropropene	ND	5.µg/L
Bromochloromethane	ND	5.µg/L	Ethylbenzene	ND	5.µg/L
Bromodichloromethane	ND	5.µg/L	Hexachlorobutadiene	ND	5.µg/L
Bromoform	ND	5.µg/L	2-Hexanone	ND	25.µg/L
Bromomethane	ND	5.µg/L	Iodomethane	ND	5.µg/L
2-Butanone	ND	25.µg/L	Isopropylbenzene	ND	5.µg/L
n-Butylbenzene	ND	5.µg/L	p-Isopropyltoluene	ND	5.µg/L
sec-Butylbenzene	ND	5.µg/L	Methylene chloride (Dichloromethane)	ND	5.µg/L
tert-Butylbenzene	ND	5.µg/L	4-Methyl-2-pentanone	ND	25.µg/L
Carbon disulfide	ND	5.µg/L	MTBE	ND	5.µg/L
Carbon tetrachloride	ND	5.µg/L	Naphthalene	ND	5.µg/L
Chlorobenzene	340	5.µg/L	n-Propylbenzene	ND	5.µg/L
Chloroethane	ND	5.µg/L	Styrene	ND	5.µg/L
Chloroform	ND	5.µg/L	1,1,1,2-Tetrachloroethane	ND	5.µg/L
Chloromethane	ND	5.µg/L	1,1,2,2-Tetrachloroethane	ND	5.µg/L
2-Chlorotoluene	ND	5.µg/L	Tetrachloroethene (PCE)	ND	5.µg/L
4-Chlorotoluene	ND	5.µg/L	Toluene	ND	5.µg/L
Dibromochloromethane	ND	5.µg/L	1,2,3-Trichlorobenzene	7	5.µg/L
1,2-Dibromo-3-chloropropane (DBCP)	ND	5.µg/L	1,2,4-Trichlorobenzene	24	5.µg/L
1,2-Dibromoethane (EDB)	ND	5.µg/L	1,1,1-Trichloroethane (1,1,1-TCA)	ND	5.µg/L
Dibromomethane	ND	5.µg/L	1,1,2-Trichloroethane (1,1,2-TCA)	ND	5.µg/L
1,2-Dichlorobenzene (o-DCB)	50	5.µg/L	Trichloroethene (TCE)	ND	5.µg/L
1,3-Dichlorobenzene (m-DCB)	5	5.µg/L	Trichlorofluoromethane (Freon 11)	ND	5.µg/L
1,4-Dichlorobenzene (p-DCB)	80	5.µg/L	1,2,3-Trichloropropane	ND	5.µg/L
Dichlorodifluoromethane (Freon 12)	ND	5.µg/L	1,2,4-Trimethylbenzene	ND	5.µg/L
1,1-Dichloroethane (1,1-DCA)	15	5.µg/L	1,3,5-Trimethylbenzene	ND	5.µg/L
1,2-Dichloroethane (1,2-DCA)	7	5.µg/L	Vinyl chloride	ND	5.µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5.µg/L	o-Xylene	ND	5.µg/L
cis-1,2-Dichloroethene	ND	5.µg/L	m,p-Xylene	ND	5.µg/L
trans-1,2-Dichloroethene	ND	5.µg/L			
1,2-Dichloropropane	ND	5.µg/L			
1,3-Dichloropropane	ND	5.µg/L			
2,2-Dichloropropane	ND	5.µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	93	86 - 115
Dibromofluoromethane	101	86 - 118
Toluene-d8	100	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protectio
PROJECT NAME: November Lateral Sampling
PROJECT NUMBER: ReFBMI 81-1

CLIENT ID: **Method Blank**
DATE SAMPLED: NA
NEL SAMPLE ID: 9811251W60-BLK

TEST: **Volatile Organic Compounds by EPA SW846 Method 8260B, Dec. 1996**
MATRIX: Aqueous

EXTRACTED: 11/25/98
ANALYZED: 11/25/98

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acetone	ND	25µg/L	1,1-Dichloropropene	ND	5µg/L
Benzene	ND	5µg/L	cis-1,3-Dichloropropene	ND	5µg/L
Bromobenzene	ND	5µg/L	trans-1,3-Dichloropropene	ND	5µg/L
Bromochloromethane	ND	5µg/L	Ethylbenzene	ND	5µg/L
Bromodichloromethane	ND	5µg/L	Hexachlorobutadiene	ND	5µg/L
Bromoform	ND	5µg/L	2-Hexanone	ND	25µg/L
Bromomethane	ND	5µg/L	Iodomethane	ND	5µg/L
2-Butanone	ND	25µg/L	Isopropylbenzene	ND	5µg/L
n-Butylbenzene	ND	5µg/L	p-Isopropyltoluene	ND	5µg/L
sec-Butylbenzene	ND	5µg/L	Methylene chloride (Dichloromethane)	ND	5µg/L
tert-Butylbenzene	ND	5µg/L	4-Methyl-2-pentanone	ND	25µg/L
Carbon disulfide	ND	5µg/L	MTBE	ND	5µg/L
Carbon tetrachloride	ND	5µg/L	Naphthalene	ND	5µg/L
Chlorobenzene	ND	5µg/L	n-Propylbenzene	ND	5µg/L
Chloroethane	ND	5µg/L	Styrene	ND	5µg/L
Chloroform	ND	5µg/L	1,1,1,2-Tetrachloroethane	ND	5µg/L
Chloromethane	ND	5µg/L	1,1,2,2-Tetrachloroethane	ND	5µg/L
2-Chlorotoluene	ND	5µg/L	Tetrachloroethene (PCE)	ND	5µg/L
4-Chlorotoluene	ND	5µg/L	Toluene	ND	5µg/L
Dibromochloromethane	ND	5µg/L	1,2,3-Trichlorobenzene	ND	5µg/L
1,2-Dibromo-3-chloropropane (DBCP)	ND	5µg/L	1,2,4-Trichlorobenzene	ND	5µg/L
1,2-Dibromoethane (EDB)	ND	5µg/L	1,1,1-Trichloroethane (1,1,1-TCA)	ND	5µg/L
Dibromomethane	ND	5µg/L	1,1,2-Trichloroethane (1,1,2-TCA)	ND	5µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5µg/L	Trichloroethene (TCE)	ND	5µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5µg/L	Trichlorofluoromethane (Freon 11)	ND	5µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5µg/L	1,2,3-Trichloropropane	ND	5µg/L
Dichlorodifluoromethane (Freon 12)	ND	5µg/L	1,2,4-Trimethylbenzene	ND	5µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5µg/L	1,3,5-Trimethylbenzene	ND	5µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5µg/L	Vinyl chloride	ND	5µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5µg/L	o-Xylene	ND	5µg/L
cis-1,2-Dichloroethene	ND	5µg/L	m,p-Xylene	ND	5µg/L
trans-1,2-Dichloroethene	ND	5µg/L			
1,2-Dichloropropane	ND	5µg/L			
1,3-Dichloropropane	ND	5µg/L			
2,2-Dichloropropane	ND	5µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	88	86 - 115
Dibromofluoromethane	94	86 - 118
Toluene-d8	100	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Nevada Department of Environmental Protecti	CLIENT ID:	L 637
PROJECT ID:	November Lateral Sampling/ReFBMI 81-1	DATE SAMPLED:	11/20/98
PROJECT #:	ReFBMI 81-1	NEL SAMPLE ID:	L9811207-01

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Specific Conductance	18700	1.	1	SM 2510 B	µS/cm	11/24/98

D.F. - Dilution Factor
ND - Not Detected

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NEL LABORATORIES

CLIENT:	Nevada Department of Environmental Protecti	CLIENT ID:	L 639
PROJECT ID:	November Lateral Sampling/ReFBMI 81-1	DATE SAMPLED:	11/20/98
PROJECT #:	ReFBMI 81-1	NEL SAMPLE ID:	L9811207-02
TEST:	Inorganic Non-Metals		
MATRIX:	Aqueous		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Specific Conductance	19700	1.	1	SM 2510 B	µS/cm	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Nevada Department of Environmental Protecti
PROJECT ID: November Lateral Sampling/ReFBMI 81-1
PROJECT #: ReFBMI 81-1

CLIENT ID: L 641
DATE SAMPLED: 11/20/98
NEL SAMPLE ID: L9811207-03

TEST: Inorganic Non-Metals
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Specific Conductance	17200	1.	1	SM 2510 B	µS/cm	11/24/98

D.F. - Dilution Factor
ND - Not Detected

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NEL LABORATORIES

CLIENT:	Nevada Department of Environmental Protecti	CLIENT ID:	L 645
PROJECT ID:	November Lateral Sampling/ReFBMI 81-1	DATE SAMPLED:	11/20/98
PROJECT #:	ReFBMI 81-1	NEL SAMPLE ID:	L9811207-04
TEST:	Inorganic Non-Metals		
MATRIX:	Aqueous		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Specific Conductance	16200	1.	1	SM 2510 B	µS/cm	11/24/98

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

Reno • Las Vegas
Phoenix • So. California

Las Vegas Division • 4208 Arcata Way, Ste. A • Las Vegas, NV 89030
(702) 657-1010 • FAX: (702) 657-1577 • 1-888-368-3282

CHAIN OF CUSTODY

Project Name: NOVEMBER LATERAL SAMPLING
Project No.: ReFBMI 81-1
P.O. No.: DEP 98 030
Sampled By: NDEP / TJC

Company: NEVADA DEP
Attn.: BRENDA POHLMANN
Address: 555 E. WASHINGTON AVE., SUITE 4300 LAS VEGAS NV 89101-1049
Phone No.: 702/486-2857
Fax No.: 702/486-2863
Billing Address:
Expected Due Date: 12/1/98

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	8260 + MTBE	8081 PESTICIDES	CONDUCTIVITY	RCRA 8 METALS + Mn					pH (for lab use only)	Remarks
11/20/98 3:30 pm	L 637	L981207-01	7		A/B		✓	✓	✓	✓						PRESERVATIVES PROVIDED BY LAB
11/20/98 3:45	L 639	-02	7		A/B		✓	✓	✓	✓						"
11/20/98 4:00	L 641	-03	7		A/B		✓	✓	✓	✓						"
11/20/98 4:15	L 645	-04	7		A/B		✓	✓	✓	✓						"
NOTE:	FOR METALS SAMPLES, NO PRESERVATIVE WAS USED															

Custody Seal intact? Y N None Temp. 20°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; ~~B. HNO3~~; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other; G. Not Preserved
VOC BOTTLES ~~METALS BOTTLE~~

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Todd J. Croft		11/20/98 1712	T. Sandoval		11-20-98/1712
2					
3					
4					

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client. Distribution of the report or its contents

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

December 31, 1998

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

Dear Ms. Pohlmann:

Subject: Henderson Off-Site Groundwater Perchlorate Treatment Technology Review

Please find enclosed two copies of the Henderson Off-Site Groundwater Perchlorate Treatment Technology Review.

Kerr-McGee Chemical (KMC) will forward copies to Doug Zimmerman (Nevada Division Environmental Protection), Southern Nevada Water Authority, US EPA Region IX, Metropolitan Water District, and the City of Henderson.

Please feel free to call me at (702) 651-2234 or Keith Bailey at (405) 270-3651 if you have any questions regarding this information. KMC believes a meeting to review this information would be helpful. Please contact me at your earliest convenience to set a time. Thank you.

Sincerely,

Susan M. Crowley
Staff Environmental Specialist

Enclosures

cc: Jeanne-Marie Bruno
Barry Conaty
Patrick S. Corbett
Alan Dooley
Kevin Mayer
Pat Mulroy
Tom Reed
Doug Zimmerman

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