Village of Tuluksak, Alaska WATER TREATMENT STUDY



Clear water after a successful jar test. Sludge in bottom of jars contains iron, manganese, arsenic, and removed color compounds.

Prepared by:

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TABLE OF CONTENTS

<u>SEC</u>	<u>TION</u>	<u>P</u> A	<u> GE</u>							
1.	EXE	CUTIVE SUMMARY	1							
II.	INTF	INTRODUCTION4								
III.		STING COMMUNITY WATER SOURCE, NEW WELLS AND TREATME TEM	ENT							
	A.	Existing Community Water Source and New Wells	5							
	B.	Existing Water Treatment System	5							
	C.	New Water Source	5							
IV.	REG	GULATORY REQUIREMENTS								
	A.	Surface Water Treatment Rule Requirements	8							
	B.	State of Alaska Water Quality Requirements	8							
	C.	Disinfectant and Disinfectant Byproducts Requirements	10							
	D.	Lead and Copper Rule Requirements	11							
	E.	How Water Quality Regulatory Requirements Apply to Tuluksak	11							
V.	PRC	POSED WATER TREATMENT PROCESSES	13							
	A.	Chemical Oxidation, Coagulation, and Multimedia Filtration in Pressure Vessels	14							
	B.	Chemical Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels	16							
	C.	Oxidation by Air, Coagulation, Settling, and Multimedia Filtration in Open								
	D.	Chemical Oxidation, Coagulation, Settling, and Multimedia Filtration in Open Tank	20							
VI.		ICH TESTING AND PILOT STUDIES FOR BEST TREATMENT	22							
	A.	Bench Testing Strategy	22							
	B.	Bench Testing Process	23							

SEC	TION		<u>PA</u>	\GE
	C.	Ben	nch Testing Conclusions	30
	D.	Pilo	t Studies	31
		1.	Chemical Oxidation, Coagulation, Settling, and Multimedia Filtration Open Tank	
		2.	Chemical Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels	
VII.	CON	CLU	SIONS	37
VIII.	REC	OMM	IENDATIONS	38
TAB	LES			
		Raw	<i>ı</i> Water Parameters	6
TABI	_E 2 –	EPA	National Primary Drinking Water Standards Highlights	9
TABI	_E 3 —	EPA	National Secondary Drinking Water Standards	9
TABI	_E 4 –	Wat	er Characteristics from Water Wells	23
TABI	_E 5 —	Jar [·]	Test for Optimum Dose of KMnO₄ for Water from Well W05-1	23
TABI	_E 6 –		Test for optimum dose of coagulant blend for water from Well W05-1, ng KMnO₄ as an oxidant	
TABI	_E 7 –		Test for optimum dose of coagulant blend for water from Well W05-1, ng oxidation by air injection	
TABI	_E 8 –		Test for optimum dose of coagulant blend for waters from Well W05-1	
TABI	_E 9 —		Test for optimum dose of coagulant blend for waters from Well W05-1	
TABI	_E 10		r Test for optimum dose of coagulant blend for waters from Well W05- l W05-2, using oxidation by KMnO ₄	
TABI	E 11		r Test for optimum dose of coagulant blend for waters from Well W05- I W05-2, using oxidation by KMnO ₄	
TABI	E 12		r Test for optimum dose of coagulant blend for waters from Well W05- I W05-2, using oxidation by KMnO ₄	

FIGURES

FIGURE 1 – Oxidation, Coagulation, and Multimedia Filtration in Pressure Vessels1									
FIGURE 2 – Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels1									
FIGURE 3 – Air Oxidation, Coagulation, Settlement, and Multimedia Filtration1									
FIGURE 4 – Ch	emical Oxidation, Coagulation, and Multimedia Filtration21								
FIGURE 5 – Jar	tests for optimum KMnO ₄ dose24								
	test with KMnO ₄ , followed by 80/20 blend of SternPAC and Arctic Floc								
FIGURE 7 – 300	O-gal tank and mixer for oxidation, coagulation, and settling31								
FIGURE 8 – Te	st manifold and 8-in clear PVC multimedia filter column32								
APPENDICES									
APPENDIX A	Water Quality Data for Wells W05-1 and W05-2								
APPENDIX B	Well Logs for Wells W05-1 and W05-2								
APPENDIX C	EPA Summary Sheets for Water Quality Regulations								
APPENDIX D	Jar testing and pilot study logs								
APPENDIX E Laboratory results for water quality parameters for Process I (batch process) and Process II (Pressure vessels)									
APPENDIX F	Map of Tuluksak, showing well locations for W05-1 and W05-2								

WATER TREATMENT STUDY TULUKSAK, ALASKA

I. EXECUTIVE SUMMARY

As part of the ongoing effort of bringing piped water and sewer to the Lower Kuskokwim River community of Tuluksak, Alaska (2005 population of 466), CE2 Engineers, Inc. (CE2) examined alternative treatment methods to remove iron, manganese, color, and arsenic from the ground water source of the two new wells drilled in 2005. The objective of the examination was to find a practical method to treat the water to meet current and anticipated U.S. Environmental Protection Agency (EPA) water quality standards. Findings from this analysis will be used to design a new water treatment process.

Study Approach and Procedures:

- Analyze existing water quality data from the well field;
- Collect water samples from the well field and perform basic water quality screening tests and bench-scale laboratory tests (jar tests) to identify potential water treatment processes;
- Perform an on-site water treatment pilot study to verify and optimize the treatment process indicated by the jar tests.
- Determine the potential for disinfection byproducts formation due to the addition of chlorine disinfectant.
- Size and specify the type of water treatment equipment, filter loading rates and chemical application rates for the proposed water treatment process.
- Determine how much sludge is generated in the process and what the expected concentration of arsenic would be in the sludge to determine if the sludge must be treated as hazardous waste.

Study Findings:

• Raw water quality varied slightly between wells. Wells had moderate color, high levels of iron and manganese, and moderate levels of arsenic.

- New wells drilled in 2005 appear to be true groundwater, as the aquifers were in fine sands over a hundred feet below the ground surface, though no microscopic examination was made to verify true groundwater. See the attached map located in Appendix F.
- A significant amount of the iron (7-8 ppm) was dissolved in the water, as an open container of clear well water turned reddish brown after an hour of being exposed to the air.
- Jar tests were successful in finding a process to treat the water using chemical oxidation with chlorine, adding coagulants, flocculation, and settling. Iron, manganese, arsenic, and color were removed to levels below those required by water quality regulations.
- Pilot tests indicated use of a conventional plant. A series of pressure vessels using chemical oxidation, coagulation through coarse media and filtration in multimedia arrangement was not successful. A batch process was successful, but longer residence times in the batch process indicated problems with leaching of manganese in the sludge back into the treated water.
- The recommended water treatment process for the community will sequentially utilize the following operations at 60 gpm maximum:
 - 1. Process water preheat.
 - 2. Oxidation of iron, manganese, and arsenic by injection of chlorine in a pressure vessel, with 40 minutes of reaction time.
 - 3. Injection of a coagulant blend to form floc to remove colloidal iron, manganese, arsenic, and color.
 - 4. Use of a conventional open-top treatment vessel with flocculation, clarification, and multimedia filter sections.
 - 5. pH and alkalinity adjustment downstream of the treatment vessels, if required for minimizing lead and copper leaching into the water from piping and plumbing fixtures.
- Disinfection byproducts (DBP) Trihalomethanes (THM) and Haloacetic acids (HAA) should be well below the maximum allowable limits under federal Stage Two rules (effective December 2003). No special treatment for reducing disinfection byproducts is anticipated. However, adequate floor space should be provided for additional DBP removal, if future regulations require additional reductions in contaminant levels of DBP.

 After the system has been in production for a while, finished water should be tested for corrosivity, and if required the water chemistry changed to modify the pH, achieve a neutral Langlier Index and address any lead and copper issues.

Note: Water quality data for well water is typically: Ca 36.1 mg/l as Ca⁺², Hardness 106 mg/l as CaCO3, Alkalinity as CaCO3 108 mg/l, TDS 176 mg/l, pH 7.06. This gives a calculated Langalier Index (LI) using the AWWA calculator of –0.76 at 45°F, which would be the temperature of a typical water distribution loop. This water would be slightly corrosive and could cause lead and copper issues in older building plumbing. Raising the pH to 7.7 and maintaining the same alkalinity level would produce a LI of –0.23. To do this would require addition of soda ash to raise pH, and possibly some sodium bicarbonate to restore alkalinity. The actual amounts of chemical added for pH and alkalinity adjustment would be fine-tuned after the wells have been in production for a while.

• Sludge from the process is less than 1 ppm of arsenic, so it is not considered hazardous waste.

II. INTRODUCTION

CE2 was tasked with the development of a water treatment process to cost-effectively produce safe, aesthetically pleasing drinking water for consumers in the community. Completed tasks were as follows:

- Physical characteristics of the community water source and its chemistry were examined and the existing water treatment system evaluated.
- Regulatory requirements of the EPA and the State of Alaska were researched to understand what the proposed Tuluksak water treatment system must accomplish to stay in compliance with water regulations and standards for the present and the foreseeable future.
- Various treatment technologies were evaluated, preferred processes were proposed, and the processes bench tested (commonly called "jar tests"). Pilot tests followed to verify the efficacy of the final proposed treatment processes. After the pilot tests were completed, the results were examined and the best process was recommended.
- Recommendations were made for the actual process and related equipment, including suggested chemical feed rates and treatment vessel loading rates.

The following sections discuss the above tasks in detail.

III. EXISTING COMMUNITY WATER SOURCE, NEW WELLS AND TREATMENT SYSTEM

A. Existing Community Water Source

The Village of Tuluksak draws its water for the existing water treatment plant from a 6-in cased well located just outside the water treatment/Washeteria building. The well, about 56-ft deep, has supplied the needs of residents using the Washeteria and watering point for about 20 years. Water is high in iron, moderate in manganese and color. The school uses treated water from the existing water treatment plant.

B. Existing Water Treatment System

Water treatment in the existing water treatment plant consists of the following process:

- 1. Raw water is pumped out of the old well adjacent to the water treatment plant.
- 2. The incoming raw water is preheated to 55F.
- 3. Potassium permanganate is injected into the heated raw water line.
- 4. The raw water line flows into a 10,000-gallon galvanized steel bolted-and-gasketed settling tank inside the water treatment building.
- 5. The oxidized iron in the water forms pin floc, which settles overnight at the bottom of the settling tank.
- 6. The next day, water is transferred from the settling tank, through a multimedia filter, and into a 10,000-gallon water storage tank, where a pressure pump draws water off the bottom and supplies water to the watering point, Washeteria, and the school building.

C. New Water Source

In 2005, two new 6-inch wells were drilled near the power plant approximately 1,350 linear feet southeast from the existing well and water treatment plant. The wells were through numerous layers of very dense sand. Water bearing layers were found from 135 to 159 feet in Well 05-1, and from 172 to 191 feet from the ground surface in Well 05-2. At the time they were drilled, both wells were developed and test pumped at 75 GPM for a 24-hour period with a 20-foot

drawdown from static water level. The static water surface in both wells was within 20 feet of the land surface. The community is currently applying for water rights.

The aquifer serving the two above wells consists of fine sands with some pea gravel. The aquifer lies underneath layers of silts, and fine and coarse sands (see well logs in Appendix B). The wells were drilled in September 2005, using 6-in steel casing.

CE2 has collected well water data for each new well. A full laboratory analysis is presented in Appendix A, and summarized in Table 1 below. Raw water was collected from wells on July 31, 2006, with each well running at 18 gpm after a 2 to 3-week period of pumping to stabilize water quality.

TABLE 1 – Raw Water Parameters

Water Parameter	Well W05-1	Well W05-2	MCL	
Total Organic Carbon, dissolved	44.8 mg/l	45.7 mg/l	See note at end of	
Total Organic Carbon	47.1 mg/l	48.0 mg/l	table	
UV254	0.0540 cm ⁻¹	0.0900 cm ⁻¹		
Total Dissolved Solids	176 mg/l	185 mg/l	500 mg/l	
Turbidity	0.85 NTU	1.99 NTU	0.5 NTU	
True Color	65 PCU	55 PCU	15 PCU	
Total Alkalinity as CaCO ₃	108 mg/l	108 mg/l		
OH Alkalinity	ND	ND		
Hardness as CaCO ₃	106 mg/l	104 mg/l		
рН	7.06	6.98	6.5 to 8.5	
Aluminum	ND	ND	0.05 to 0.2 mg/l	
Calcium	36.1 mg/l	29.9 mg/l	****	
Magnesium	3.85 mg/l	5.08 mg/l	***************************************	
Silver	ND	ND	0.1 mg/l	
Nitrate-N (measured as nitrogen)	ND	ND	10.0 mg/l	
Nitrite-N (measured as nitrogen)	ND	ND	1.0 mg/l	
Bromide	ND	ND	0.1 mg/l	
Antimony	ND	ND	6 μg/l	
Arsenic	36.3 μg/l	49.9 μg/l	10 μg/l	
Barium	146 μg/l	184 μg/l	2000 μg/l	
Beryllium	ND	ND	4 μg/l	
Cadmium	ND	ND	5 μg/l	
Chromium	ND	ND	100 μg/l	
Copper	ND	ND	1000 μg/l	
Cyanide	ND	ND	0.2 μg/l	

Water Parameter	Well W05-1	Well W05-2	MCL	
Fluoride	ND	ND	2 mg/l	
Mercury by Cold Vapor	ND	ND	0.2 μg/l	
Nickel	ND	ND	100 μg/l	
Selenium	ND	ND	50 μg/l	
Thallium	ND	ND	2 μg/l	
Chloride	3.09 mg/l	1.96 mg/l	250 mg/l	
Langlier Index @40F	-1.15	-1.28		
Langlier Index @140F	-0.07	-0.20		
Iron	6.99 mg/l	8.41 mg/l	0.3 mg/l	
Odor (TON)	ND	ND	3 TON	
Manganese	0.331 mg/l	0.326 mg/l	0.05 mg/l	
Sodium	2.65 mg/l	2.47 mg/l	250 mg/l	
Sulfate	2.18 mg/l	ND	250 mg/l	
Zinc	ND	ND	500 mg/l	
Total Potential Trihalomethane	69.7 μg/l	140 μg/l	80 μg/l	
Total Potential HAA5	60.1 μg/l	147 μg/l	60 μg/l	
Ammonia (as nitrogen)	0.36 mg/l	0.96 mg/l		
Dissolved oxygen	5.7 mg/l	5.8 mg/l	Tested onsite	
Hydrogen sulfide	0.04 mg/l	0.02 mg/l	l ested onsite	
Carbon dioxide	45 mg/l	60 mg/l		

Note: Organic carbon values from the laboratory for raw water were very high (over 40 mg/l), making their values suspect. Organic Carbon values for 2005, when the wells were drilled were 2.1 mg/l for TOC and 1.7 mg/l for DOC.

IV. REGULATORY REQUIREMENTS

A. Surface Water Treatment Rule Requirements

The new wells may be considered a true groundwater source, as the aquifer is located well over 100-ft below the surface, with multiple layers of fine sands that would act as a natural filter. However, with the proposed water treatment process, using conventional treatment, followed by multimedia filtration, chlorination and residence time, the necessary 3-log removal/inactivation of *giardia* cysts by multimedia filtration and chlorination, and the 4-log inactivation of viruses by chlorination will meet the SWTR anyway. Therefore, the issue of the well field being a true groundwater source, or groundwater under the influence of surface water (GWUISW) is moot.

B. State of Alaska Water Quality Requirements

The Alaska Department of Environmental Conservation (ADEC) is the primary agency in Alaska responsible for enforcement of water treatment regulations, through agreements with the United States Environmental Protection Agency. Potable water distributed to the public in Tuluksak must therefore meet all EPA and ADEC requirements. Those water quality parameters of particular concern for the system are listed in Table 2. There are many more on the EPA list of primary contaminants, however most of them are volatile organic compounds that have not shown up in any of the well water tested in Tuluksak.

TABLE 2 – EPA National Primary Drinking Water Standards Highlights

Contaminant	MCL
Antimony	0.006 mg/l
Arsenic	0.010 mg/l as of 1/23/06
Barium	2 mg/l
Beryllium	0.004 mg/l
Bromate	0.10 mg/l
Cadmium	0.005 mg/l
Chromium (total)	0.1 mg/l
Copper (action level)	1.3 mg/l
Cyanide (as free cyanide)	0.2 mg/l
Fluoride	4.0 mg/l
Haloacetic Acids	0.060 mg/l
Lead (action level)	0.015 mg/l
Mercury (inorganic)	0.002 mg/l
Nitrate (measured as nitrogen)	10.0 mg/l
Nitrite (measured as nitrogen)	1.0 mg/l
Selenium	0.05 mg/l
Total Trihalomethanes (TTHM)	0.080 mg/l
Turbidity	0.5 NTU

TABLE 3- EPA National Secondary Drinking Water Standards

Contaminant	MCL
Aluminum	0.05 to 0.2 mg/l
Chloride	250 mg/l
Color	15 PCU
Copper	1.0 mg/l
Corrosivity	Noncorrosive
Fluoride	2.0 mg/l
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 T.O.N.
pH	6.5 to 8.5
Silver	0.1 mg/l
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Zinc	5 mg/l

C. Disinfectant and Disinfectant Byproducts Requirements

Disinfection of drinking water is required to kill or inactivate organisms that have not been removed in the treatment process. Disinfectants can react with natural organic matter (NOM), however, to produce disinfection byproducts that have been associated with increased cancer risks. At Tuluksak, disinfection is presently accomplished with hypochlorite solutions such as chlorine bleach or a solution of calcium hypochlorite. Trihalomethanes (THM), consisting of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, are one category of byproduct that may be produced through disinfection using chlorine.

Total Trihalomethanes (TTHM) typically constitute only 15-25 percent of the total organic halide concentrations in chlorinated drinking water. Haloacetic acids (HAA) are also produced as a byproduct of disinfection through chlorination of NOM. Five of these haloacetic acids (HAA5) that have been investigated include monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.

The EPA recognized that THM and HAA5 might cause serious health problems, such as cancer, if the concentration and length of dose were above certain levels. To minimize this risk to the public, regulations limit the amounts disinfectant byproducts (DBP) in drinking water. The EPA first regulated TTHM in finished drinking water in 1979, with the maximum contaminant level set at 100 micrograms per liter based on running annual average quarterly samples. Systems serving more than 10,000 persons were required to comply with these regulations. Enforcement for systems serving fewer than 10,000 had been left to the discretion of the individual states.

TTHM and HAA5 concentrations are further regulated under the new Disinfectants/Disinfection Byproducts Rule (D/DBPR), which was promulgated in two stages. Stage One Maximum Contaminant Levels (MCL) were set TTHM to 80 micrograms per liter and HAA5 to 60 micrograms per liter (so-called "80/60" rule), as of December 2003 for systems serving fewer than 10,000 people in Alaska. Stage Two will change some of the testing requirements for DBP and introduced LRAA (Locational Running Annual Averages) to the requirements. Monitoring programs for drinking water systems not having a very small system exception will have to have

their monitoring plans in place by April 1, 2007, and be collecting samples by April 1, 2008. Water systems keeping their MCL for THHM below 40 μ g/l and HAA5 below 30 μ g/l, and are certified for same, are exempted from the additional monitoring and study requirements. EPA summary sheets for the Disinfectant Byproducts Rule are found in Appendix C.

D. Lead and Copper Rule Requirements

On June 7, 1991, the EPA adopted the National Primary Drinking Water Regulations for Lead and Copper. Lead and copper typically enter drinking water through the corrosion of copper piping, solder joints, and brass plumbing fixtures, and are monitored because of the possible detrimental health affects associated with their consumption. Studies of lead in children indicate a slowing of physical and mental development. Adults may experience kidney damage, higher blood pressure, and other adverse effects. Heath effects due to the consumption of copper are not long term; however, they may include nausea and diarrhea. The 90th percentile action level for lead is 15 ppb and for copper it is 1.3 ppm.

E. How Water Quality Regulatory Requirements Apply to Tuluksak

If the well field water source is classified as a true ground water, the EPA's SWTR should not apply here.

The D/DBPR limits the amount of disinfectant byproducts present in the treated water. Proper filtration techniques will minimize the amount of NOM and other compounds that could potentially react with chlorine to produce disinfection byproducts. The final determination of the system to stay below Stage 1 D/DBPR values of 80/60 will still have to await production and process fine-tuning, as the characteristics of the water source will change after production level pumping of 60 gpm (30 gpm from each well or 60 gpm from one well) for sustained periods. Stage 2 D/DBPR values of 40/30 will also have to await production and process fine-tuning. If, after treatment has been optimized and the chlorine residual minimized into the distribution system, the values of disinfectant byproducts could be above the MCL. Provision for a granulated activated carbon (GAC) filter vessel or other DPM removal scheme could be made to lower DBP to acceptable levels.

The Lead and Copper Rule regulates the maximum contaminant level (MCL) allowed in potable water. Prevention of lead and copper contamination involves interrupting or slowing the corrosion process in copper and brass piping and plumbing fixtures. After production treatment is in place, the water can be analyzed and its Langlier index calculated. This will be an indication if pH and/or alkalinity adjustment will be needed to prevent leaching of lead and copper in the drinking water of consumers.

V. PROPOSED WATER TREATMENT PROCESSES

The main contaminants found in the water at Tuluksak were:

- Iron
- Manganese
- Arsenic
- Color

It was found from testing that much of the iron and manganese was dissolved in the water, so removal of these contaminants would require oxidation to convert it to a form that would settle out. With the combination of the above four contaminants, treatment became complicated, and much jar and pilot testing was performed to come up with a straightforward process. Because of the significant amount of color in the water, removing iron and manganese by a catalytic process (pyrolusite) or manganese greensand was not practical. So several three-step pilot processes were proposed that involved:

- 1. Oxidation;
- 2. Coagulation;
- 3. Clarification;
- 4. Multimedia filtration.

A. Chemical Oxidation, Coagulation, and Multimedia Filtration in Pressure Vessels

This process involves the following steps (see Figure 1 on next page):

- 1. Raw water from the wells is preheated to 50°F for more effective treatment.
- 2. Potassium permanganate is injected into the process stream to oxidize the iron and manganese.
- 3. Water and oxidizer flow through a detention tank for 40 minutes to fully oxidize the iron and manganese.
- 4. A blend of inorganic coagulant and polymer is injected into the process stream after detention to form a floc of the oxidized iron and color for removal. Detention time in this step is also 30 minutes.
- 5. The floc-laden process water flows through a multimedia filter at 1 to 2 gpm per square foot of filter area, removing the contaminants.

The advantage of this process is that it is a simple flow-through system with the minimum of pumps and auxiliary equipment, with only the well pump to supply and transfer water, and a backwash pump to clean the multimedia filter.

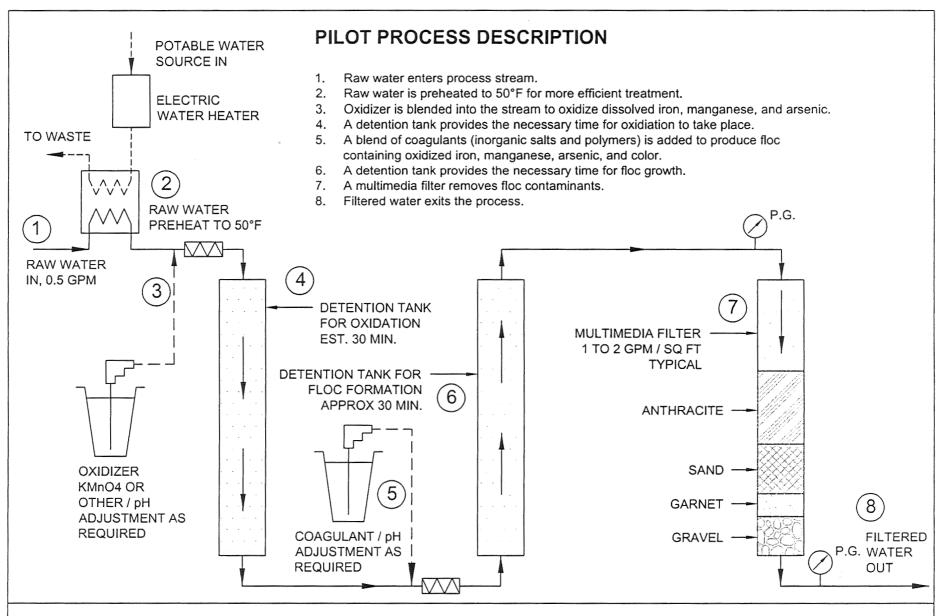


FIGURE 1 - OXIDATION, COAGULATION, AND MULTIMEDIA FILTRATION IN PRESSURE VESSELS

B. Chemical Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels

If the level of contaminants is significant, the process as shown in Figure 1 can be problematic. Contaminants could load up or blind the multimedia filter, requiring frequent backwashes. This could lower the efficiency of the process by backwash water demand increasing to 25% or more of the filtered water. The process could be modified by adding a layer of coarse anthracite in the second detention tank. This layer is designed to form floc and provide slight agitation through the detention tank. Constructed versions of this system have been found to capture 70% of the floc in this stage, extending run time in the multimedia filter significantly. A schematic of this system is shown in Figure 2 below.

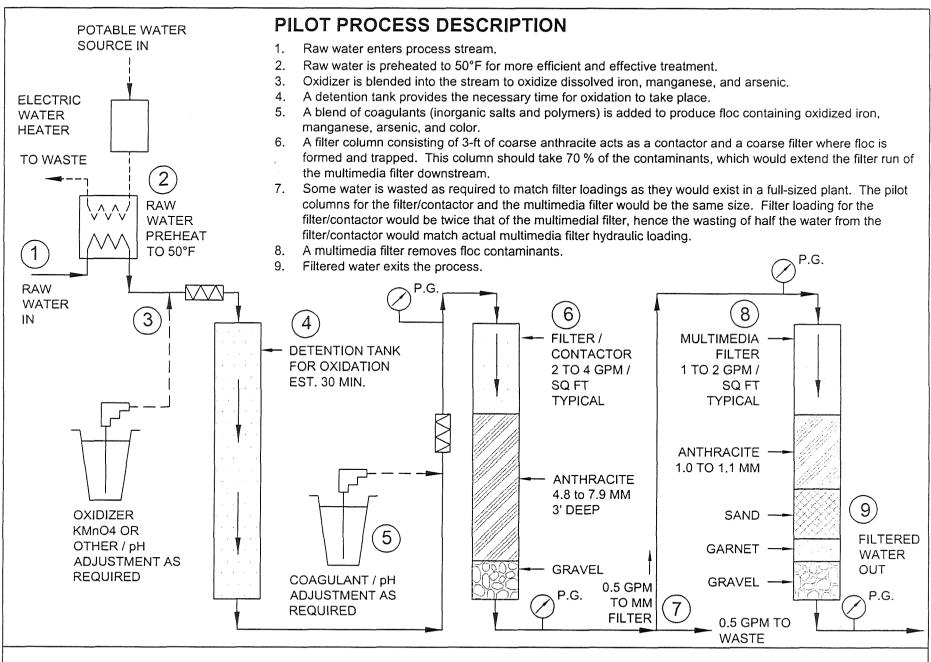
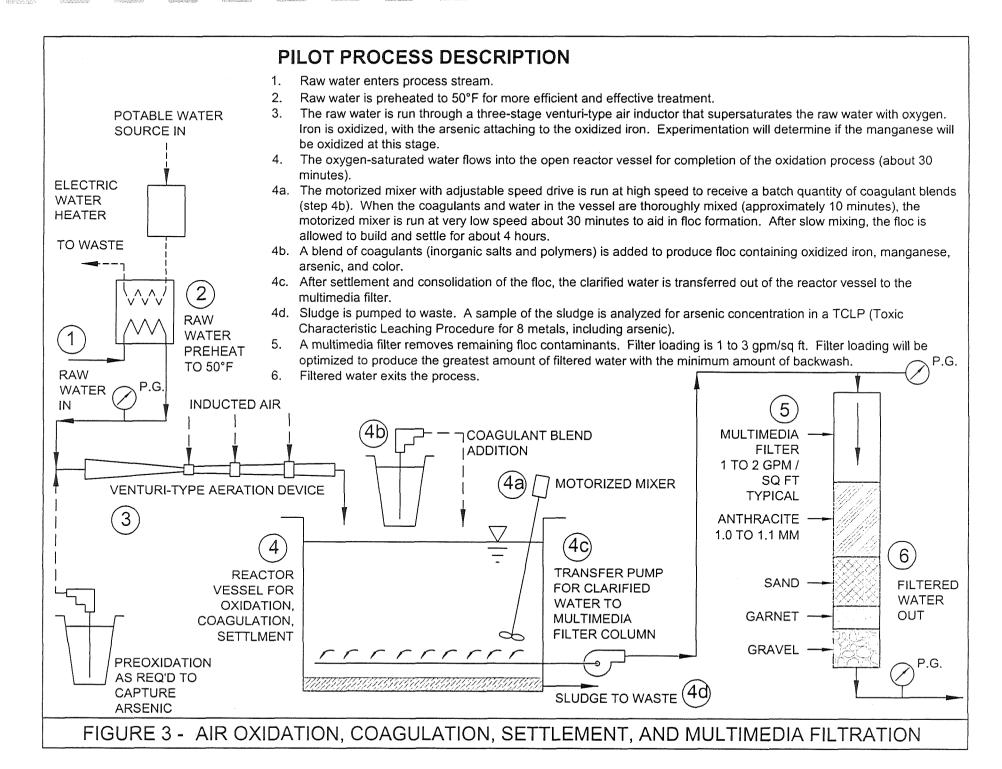


FIGURE 2 - OXIDATION, COAGULATION, COARSE FILTRATION, AND MULTIMEDIA FILTRATION IN PRESSURE VESSELS

C. Oxidation by Air, Coagulation, Settling, and Multimedia Filtration in Open Tank

This process, as seen in Figure 3 on the next page, uses inducted air to oxidize the iron in the system.

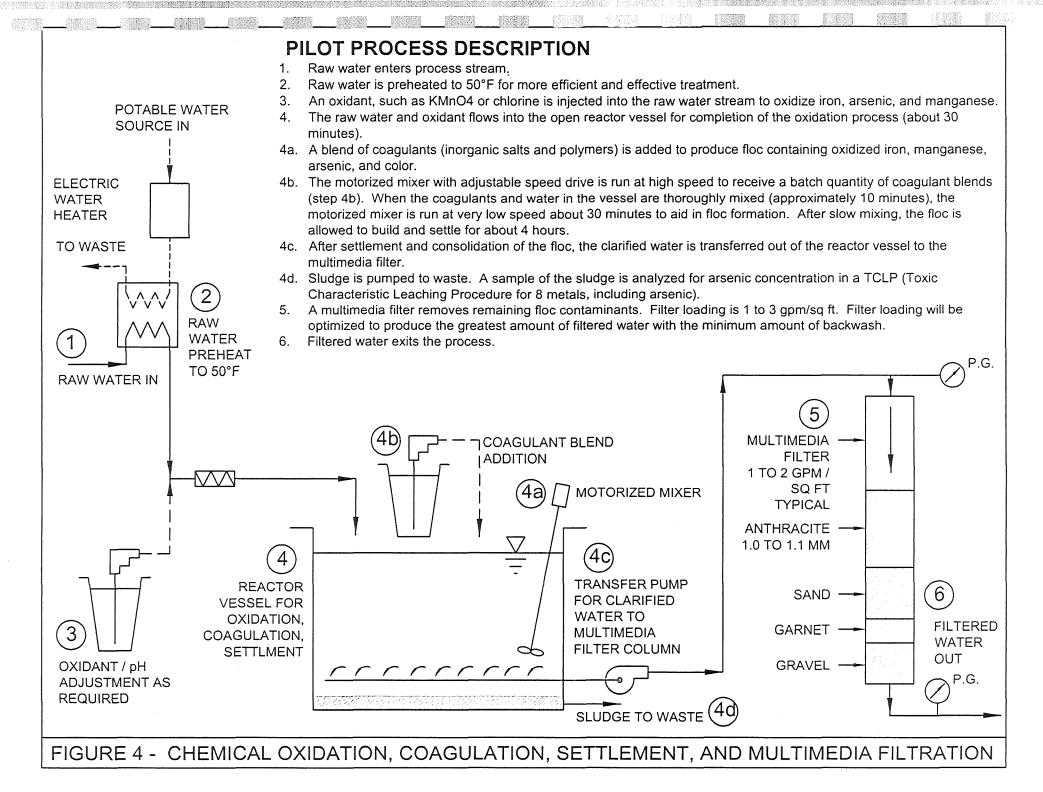
- 1. The aerated well water flows into an open top tank, where oxidation takes place for approximately 30 minutes.
- 2. After this time, a coagulant blend is added into the tank while the water is stirred at high speed for 5 minutes.
- 3. Then the water in the tank is mixed at slow speed for about 30 minutes to build floc.
- 4. After slow mixing, the coagulant is allowed to settle to the bottom for about 4 hours.
- 5. Clarified water from the open tank is pumped through a multimedia filter at 1-to 2-gpm/sq ft.
- 6. Sludge laden water is pumped to waste.



D. Chemical Oxidation, Coagulation, Settling, and Multimedia Filtration in Open Tank

This process, as seen in Figure 4 on the next page, is similar to the process used in Figure 3, but uses potassium permanganate or chlorine to oxidize the iron in the system.

- 1. The well water with potassium permanganate addition flows into an open top tank, where oxidation takes place for approximately 30 to 40 minutes.
- 2. After this time, a coagulant blend is added into the tank while the water is stirred at high speed for 5 minutes.
- 3. Then the water in the tank is mixed at slow speed for about 30 minutes to build floc.
- 4. After slow mixing, the coagulant is allowed to settle to the bottom for about 4 hours.
- 5. Clarified water from the open tank is pumped through a multimedia filter at 1-to 2-gpm/sq ft.
- 6. Sludge laden water is pumped to waste.



VI. BENCH TESTING AND PILOT STUDIES FOR BEST TREATMENT STRATEGY

A. Bench Testing Strategy

Bench testing was performed to find the best method to oxidize the iron and manganese and to find the best coagulants for flocculation and filtration. The most promising results would be used for subsequent pilot testing to find the best treatment process to remove contaminants from the well water sources.

Bench testing was conducted at the Tuluksak Water and Sewer Project camp building hallway using a six-place gang mixer, six one-liter beakers, a HACH 2100P Turbidimeter, a HACH CEL/890 Advanced Portable Laboratory and syringe filtration testing equipment. An Industrial Test Systems (ISI) arsenic test kit was used to estimate arsenic levels down to 5 µg/l. Syringe filters were used to simulate multimedia filters. A Pall 32 mm dia 1.2-micron cartridge filter was stacked on top of a Pall 32 mm dia 5-micron cartridge filter. Water samples were drawn through this stack for turbidity, iron, manganese, and arsenic readings. For true color readings, an additional 0.45-micron syringe filter was added.

UV254 measurement was performed using a Real Tech Real UVT portable meter.

Mixing and flocculation of the samples included a rapid mix of 315 revolutions per minute (rpm) for about 4 minutes and flocculation at 10 RPM for 30 minutes. The mean velocity gradient G (a measure of the energy of mixing) was greater than 300 sec⁻¹ during flash mixing to simulate a static mixer and approximately 28 sec⁻¹ during flocculation to simulate gentle agitation while the floc travels through the piping and through the flocculation chambers.

Raw water was obtained for bench testing and pilot studies by hauling well water from each well. Water quality values are shown in Table 4 below.

TABLE 4- Water Characteristics from Water Wells

Contaminant	Well W05-1 Concentration (mg/l) Or Other Value	Well W05-2 Concentration (mg/l) Or Other Value		
Turbidity	0.58 NTU	1.71 NTU		
Apparent Color	41 PCU	38 PCU		
Iron	8.1 mg/l	9.24 mg/l		
Manganese	0.376 mg/l	0.343 mg/l		
Arsenic	15 μg/l	35 μg/l		
Total Dissolved Solids (TDS)	96 mg/l	84 mg/l		
рН	7.33	7.40		

B. Bench Testing Process

A water sample in a 1-liter beaker was taken and was exposed to the air for one hour. The clear water changed color to orange, but little sediment was observed at the bottom of the beaker. This experiment showed that a significant portion of the iron in the water was dissolved and existed as Fe⁺², as exposure to the air oxidized it to Fe⁺³ and formed the orange color in the beaker.

It was decided to also oxidize the iron and manganese chemically, so jar tests were set up, using potassium permanganate (KMnO₄) as an oxidant. The use of chlorine solutions was avoided to prevent the formation of disinfectant byproducts, such as THHM and HAA5. Results are shown in Table 5 below.

TABLE 5- Jar Test for Optimum Dose of KMnO₄ for water from Well W05-1

Jar No.	Dose mg/l	PH	Turbidity Filtered NTU	Color Filtered PCU	Fe mg/l	Mn mg/l	Remarks
1	2	7.33	0.08	2	0.05	O/L	Mn over limit low range test
2	4	7.33	0.08	10	0.04	0.22	Good settling
3	6	7.33	0.30	8	0.02	0.11	Good settling
4	8	7.33	0.19		0.06	0.68	Light pink (overdose)
5	10	7.33			,		Overdose
6	12	7.33					Overdose

Small pin floc was seen in Jars 2, 3, and 4 (jars are numbered from left to right). From this jar test, it was determined that the optimum dose would be between 5 and 6 mg/l of KMnO₄. Figure 5 below shows the jar testing for the optimum KMnO₄ dose.

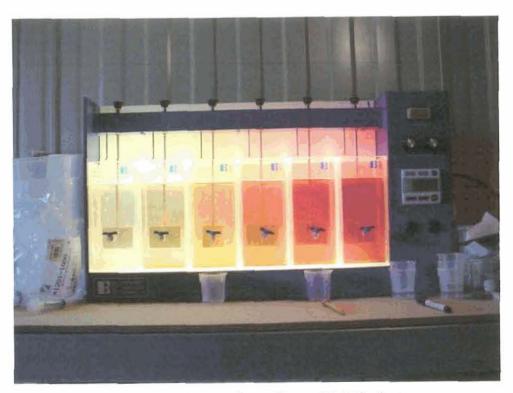


Figure 5 - Jar tests for optimum KMnO₄ dose

The next step was to perform a further jar test with the optimum dose of KMnO₄, followed by a range of doses of a coagulant blend of 80% SternPAC inorganic coagulant plus 20% Arctic Floc 12100 polymer. The procedure was as follows.

- Inject the KMnO₄ in jars with water preheated to 55°F, mix at 320 rpm for 2 minutes, and then mix at 30 rpm for 30 to 40 minutes for oxidation detention time.
- Inject the 80/20 coagulant blend in the jars, mix at 320 rpm for 2 minutes, then down to 10 rpm for coagulation, then 30 minutes with the mixer stopped for settling.

TABLE 6– Jar test for optimum dose of coagulant blend for water from Well W05-1, using KMnO₄ as an oxidant, and 80% SternPac/20% AF 12100 as a coagulant

KMnO ₄ Dose mg/l	80/20 Coagulant dose µl	PH	Turbidity Filtered NTU	Color Filtered PCU	Fe mg/l	Mn mg/l	Remarks
5	5	7.33	0.06	0	0.02	0	
5	10	7.33	0.06	0	0.01	0	Arsenic test showed no color on the strip (0µg/l)
5	15	7.33	0.07	3	0.04	0.04	
5	20	7.33	0.06	0	0.01	0.03	
5	25	7.33	0.07	0	0.07	0.05	
5	30	7.33	0.07	9	0.03	0.08	
	Dose mg/l 5 5 5 5 5 5	Dose mg/l Coagulant dose μl 5 5 5 10 5 15 5 20 5 25	Dose mg/l Coagulant dose μl 5 5 5 7.33 5 10 7.33 5 15 7.33 5 20 7.33 5 25 7.33	Dose mg/l Coagulant dose μl Filtered NTU 5 5 7.33 0.06 5 10 7.33 0.06 5 15 7.33 0.07 5 20 7.33 0.06 5 25 7.33 0.07	Dose mg/l Coagulant dose μl Filtered NTU Filtered PCU 5	Dose mg/l mg/l Coagulant dose μl Filtered NTU Filtered PCU mg/l 5 5 7.33 0.06 0 0.02 5 10 7.33 0.06 0 0.01 5 15 7.33 0.07 3 0.04 5 20 7.33 0.06 0 0.01 5 25 7.33 0.07 0 0.07	Dose mg/l Coagulant dose μl Filtered NTU Filtered PCU mg/l 5 5 7.33 0.06 0 0.02 0 5 10 7.33 0.06 0 0.01 0 5 15 7.33 0.07 3 0.04 0.04 5 20 7.33 0.06 0 0.01 0.03 5 25 7.33 0.07 0 0.07 0.05

This jar test produced excellent results with almost complete removal of all contaminants for a process using chemical oxidation, followed by coagulation and filtration. Oxidation of the iron also enabled excellent arsenic removal. Figure 6 below shows the results of the jar tests. Jars are numbered 1 through 6, left to right.



Figure 6 - Jar test with KMnO4, followed by 80/20 blend of SternPAC and Arctic Floc 12100

A similar jar test to that shown in Table 6 was performed, but air injection was substituted for chemical oxidation. Results are shown in Table 7 below.

TABLE 7 – Jar test for optimum dose of coagulant blend for water from Well W05-2, using oxidation by air injection, and 80% SternPac / 20% AF 12100 as a coagulant

Jar	80/20	PH	Turbidity	Color	Fe	Mn mg/l	Remarks
No.	Coagulant		Filtered	Filtered	mg/l		
	dose µl		NTU	PCU			
1	8	7.40	0.14	0	0.02	0.225	Medium Floc
2	11	7.40	0.06	0	0.02	0.119	Medium Floc
3	14	7.40	0.07	0	0.10	0.243	Medium Floc
4	17	7.40	0.20	12	0.02	0.174	Medium Floc
5	20	7.40	0.07	11	0.03	0.184	Small Floc
6	25	7.40	0.11	D/R	D/R	D/R	Cloudy, plugged filter

This jar test produced good iron and color removal, and filtered turbidity values were similar to the jar test in Table 6. Manganese removal, however, was poor.

A jar test, using air for oxidation, followed by an 80/20 mix of ferric sulfate and Arctic Floc 12100 was also performed on water from Well W05-1. The water turned a dark red-brown and cloudy, with no floc formation, so the jar tests were discontinued.

Another set of jar tests was performed to examine the relationship between the ratio of SternPAC and Arctic Floc 12100, using KMnO₄ as an oxidant. The SternPAC/Arctic Floc 12100 ratio was changed to 90/10. Samples were tested from both wells (W05-1 and W05-2). The results are shown in Table 8 below.

TABLE 8– Jar test for optimum dose of coagulant blend for waters from Well W05-1 and W05-2, using oxidation by KMnO₄, and 90% SternPac / 10% AF 12100 as a coagulant

Jar	KMnO ₄	90/10	PH	Turbidity	Color	Fe	Mn	UV254	Remarks
No.	Dose	Coagulant		Filtered	Filtered	mg/l	mg/l		
	mg/l	dose µl		NTU	PCU				
1	5	5	7.33	0.06	0	0.11	0.42	0.0247	Well W05-1
2	5	10	7.33	0.06	0	0.04	0	0.0173	Well W05-1
3	5	15	7.33	0.07	3	0.04	0	0.0179	Well W05-1
4	5	5	7.40	0.06	0	0.02	0.125	0.0204	Well W05-2
5	5	10	7.40	0.06	1	0.02	0.265	0.0250	Well W05-2
6	5	15	7.40	0.05	0	0.18	0.267	0.0260	Well W05-2

The UV254 value for raw water from Well W05-1 was 0.0389, indicating a TOC removal of 56%, assuming UV254 values correlated with TOC. The UV254 value for raw water from Well W05-2 was 0.0607, indicating a TOC removal of 66%. Iron removal was good for both wells, with an 80/20 coagulant blend working best for iron removal (0.01 mg/l level for 80/20 vs 0.04 mg/l for 90/10), and manganese removal was good as for the 80/20 coagulant blend.

Another set of jar tests was performed to further examine the relationship between the ratio of SternPAC and Arctic Floc 12100, using KMnO₄ as an oxidant. The SternPAC/Arctic Floc 12100 ratio was changed to 70/30. Samples were tested from both wells (W05-1 and W05-2). The results are shown in Table 9 below.

TABLE 9– Jar test for optimum dose of coagulant blend for waters from Well W05-1 and W05-2, using oxidation by $KMnO_4$, and 70% SternPac / 30% AF 12100 as a coagulant

Jar	KMnO ₄	70/30	PH	Turbidity	Color	Fe	Mn	UV254	Remarks
No.	Dose	Coagulant		Filtered	Filtered	mg/l	mg/l		
	mg/l	dose µl		NTU	PCU				
1	5	5	7.33	0.07	0	0.02	0.375	0.0060	Well W05-1
2	5	10	7.33	0.11	5	0.07	0.164	0.0072	Well W05-1
3	5	15	7.33	0.11	5	0.04	0.155	0.0054	Well W05-1
4	5	5	7.40	0.06	13	0.05	0.638	0.0089	Well W05-2
5	5	10	7.40	0.18	9	0.04	0.448	0.0085	Well W05-2
6	5	15	7.40	0.07	12	0.07	0.485	0.0066	Well W05-2

Iron removal was fairly good, but not as good as using the 80/20 blend of coagulants. Manganese removal was poor, and color removal, though satisfactory, was not nearly as good as in the use of the 80/20 coagulant blend. UV254 values of the filtered water indicated TOC removals in the order of 60% for W05-1 and 78% for W05-2.

A set of jar tests was performed to examine the relationship between the ratio of inorganic coagulant ACH (Aluminum chlorohydrate) and Arctic Floc 12100, using KMnO₄ as an oxidant. An initial ratio of 80/20 was used. Samples were tested from both wells (W05-1 and W05-2). The results are shown in Table 10 below.

TABLE 10 – Jar test for optimum dose of coagulant blend for waters from Well W05-1 and W05-2, using oxidation by KMnO₄, and 80% ACH / 20% AF 12100 as a coagulant

Jar	KMnO ₄	80/20	PH	Turbidity	Color	Fe	Mn	UV254	Remarks
No.	Dose	Coagulant		Filtered	Filtered	mg/l	mg/l		
	mg/l	dose µl		NTU	PCU_				
1	5	10	7.33	0.07	2	0.01	0	0.0142	Well W05-1
2	5	15	7.33	0.09	20	0.02	0	0.0141	Well W05-1
3	5	20	7.33	0.10	0	0.00	0	0.0122	Well W05-I
4	5	10	7.40	0.06	16	0	0	0.0099	Well W05-2
5	5	15	7.40	0.06	6	0	0	0.0142	Well W05-2
6	5	20	7.40	0.05	19	0.04	0	0.0120	Well W05-2

For well W05-1, filtered water turbidity was fair to good, with good color removal values. Iron and manganese removal were excellent. For raw water UV254 reading of 0.0235, TOC removal was estimated at 40%. Well W05-2 results were also good, though at different dosages than that of W05-1.

Another set of jar tests was performed to further examine the relationship between the ratio of ACH (Aluminum chlorohydrate) and Arctic Floc 12100, using KMnO₄ as an oxidant. A ratio of 90/10 was used. Samples were tested from well W05-1. The results are shown in Table 11 below.

TABLE 11 – Jar test for optimum dose of coagulant blend for waters from Well W05-1, using oxidation by KMnO₄, and 80% ACH / 20% AF 12100 as a coagulant

Jar	KMnO ₄	90/10	PH	Turbidity	Color	Fe	Mn	UV254	Remarks
No.	Dose	Coagulant		Filtered	Filtered	mg/l	mg/l		
	mg/l	dose µl		NTU	PCU				
1	5	5	7.57	0.07	16	0.03	0.188	0.0149	
2	5	10	7.65	0.06	0	0.01	0.073	0.0129	
3	5	15	7.65	0.07	7	0.03	0.073	0.0161	
4	5	20	7.65	0.05	0	0.04	0.085	0.0134	
5	5	25	7.61	0.05	8	0.02	0.073	0.0099	
6	5	30	7.62	0.06	0	0	0.086	0.0111	

The UV254 value for raw water from Well W05-1 was 0.0201, indicating a TOC removal of 56%. The UV254 value for raw water from Well W05-2 was 0.0607, indicating a TOC removal of 66%, assuming a direct correlation between TOC and UV254. Iron removal was good for both wells, but manganese removal was not consistent and not as good for the two wells as for the 80/20 coagulant blend.

An additional jar test using a 70-30 ratio of ACH to Arctic Floc 12100 was performed, but floc stayed suspended and settled very slowly. Performance was poor.

A jar test using a 90/10 blend of PAX XL-9 inorganic coagulant and Arctic Floc 12100 produced decent results, but the floc had a lot of floating particles, which would be detrimental to the treatment process. Other ratios produced cloudy settled particles on the bottom of the beakers. Syringe filters plugged up fairly quickly.

Another set of jar tests were performed to examine the relationship between various doses of Nalco 8185, using KMnO₄ as an oxidant. Nalco is basically a blend of 50%ACH and a polyamine (Nalco 8105, or Arctic Floc 12100). Samples were tested from well W05-2. The results are shown in Table 12 below.

TABLE 12 – Jar test for optimum dose of coagulant blend for waters from Well W05-2, using oxidation by KMnO₄, and Nalco 8185 coagulant

Jar	KMnO ₄	8185	PH	Turbidity	Color	Fe	Mn	UV254	Remarks
No.	Dose	Coagulant		Filtered	Filtered	mg/l	mg/l		
	mg/l	dose µl		NTU	PCU				
1	7	5	D/R	0.07	0	0.05	0.077	0.0356	Medium sized floc
2	7	10	D/R	0.07	0	0.06	0.070	0.0133	Medium sized floc
3	7	15	D/R	0.09	0	0.02	0.024	0.0087	Medium sized floc
4	7	20	D/R	0.10	0	0.04	0	0.0191	Medium sized floc
5	7	25	D/R	0.10	0	0.04	0	0.0057	Medium sized floc
6	7	30	D/R	0.15	0	0.09	0.054	0.0333	Medium sized floc

Note: Problems with pH meters prevented reading of pH, until a new pH probe was obtained. PH values in subsequent tests ranged from 7.2 to 7.7.

The UV254 value for raw water from Well W05-2 was 0.069, indicating a TOC removal of 87%. Iron and manganese removal were very good, with the optimum dose of Nalco 8185 about 17 mg/l. Nalco 8185 results were very good, with good turbidity and excellent color values. Iron and manganese removal was good. Overall, the 80/20 SternPac-Arctic Floc 12100 blend performed slightly better than Nalco 8185. Turbidity was slightly lower with the 80/20 blend, and iron and manganese levels were lowered to non detectable levels. UV 254 absorption levels were close to each other in the filtered water from the jars.

C. Bench Testing Conclusions

Raw water quality varied somewhat, due to the low rate of pumping out of the wells. Chemical oxidation worked well to oxidize the iron and manganese, but air oxidation did not oxidize the manganese. Blends of inorganic coagulants and polymers, such as Nalco 8185, SternPAC/Arctic Floc 12100 or ACH/Arctic Floc 12100 did well in blends in the order of an 80/20 ratio. Too much polymer in the blend formed floc that did not settle well and caused problems with filtering through a syringe filter.

In the pilot testing section of the study it was decided not to perform any pilot studies using the air oxidation technique (as shown in Figure 3), as it was not as effective as chemical oxidation using potassium permanganate.

D. Pilot Studies

Chemical Oxidation, Coagulation, Settling in Open Tank, with Pressure Multimedia Filtration

It was decided that the pilot test as shown in Figure 4 would be performed first to understand how much energy will be required in flocculation, and would expose possible problems in scaling up the process from jar tests. The process vessel was a 300-gal vertical HDPE tank with a ½-hp Neptune mixer mounted on top, with a propeller set about 4-ft below the top of the tank, as shown in Figure 7 below.

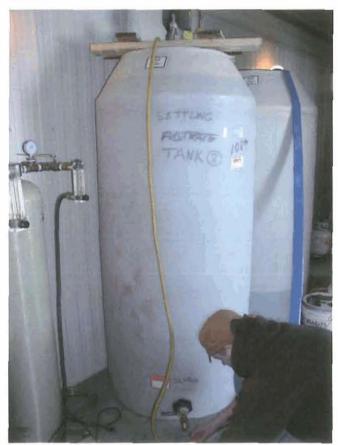


Figure 7 – 300-gal tank and mixer for oxidation, coagulation, and settling.

Multimedia filtration was accomplished by use of a manifold and a clear 8-in dia PVC multimedia pressure filter column. This apparatus is shown in Figure 8 below.



Figure 8 – Test manifold and 8-in dia clear PVC multimedia pressure filter column. Four brass pipe manifolds direct the flow of water or air any way desired. Two static mixers allow for mixing of injected chemicals. Four rotameters provide for process water, backwash water, or air scour flow measurement. A flat plate heat exchanger allows raw water preheat. All the flow connections are made with washing machine hoses in accordance with the needs of the pilot test desired.

After performing jar tests, a test run was initially made with 4.22 mg/l of potassium permanganate rapid mixed in the tank for five minutes, then slow mixed for 30 to 40 minutes for oxidation. 11 mg/l of an 80/20 blend of ACH and Arctic Floc 12100 was added to the tank, rapid mixed for 5 minutes, slow mixed for 35 minutes, then allowed to floc and settle. There were problems in the mixing system of the tank, as the floc formation performance of the system was poor, though the jar tests indicated that it should work. The mixer motor and shaft were realigned to be centered along the longitudinal axis of the tank. After considerable experimentation, an additional paddle was added to the mixer shaft and better rapid and slow mixing occurred. This was an important discovery, as it was found that the mixing energy was

critical to good floc formation. Another fresh batch of water for the pilot process was added, the process was started in late afternoon, and settlement occurred overnight. Flocculation and settling were successful, and the sludge level in the 300-gallon tank after settlement indicated about 1% sludge in the process.

After settlement, clarified liquid from the tank was pumped through the 8-in dia x 60-in high multimedia filter at 0.5 gpm to simulate a filter loading of 1.5 gpm/sq ft. The filter run duration was 8-hours. Filtrate turbidities ranged from 0.12 NTU initially to 0.06 to 0.07 for most of the run. Iron started out at 0.02 mg/l at the start of the run to 0 for the end of the run. True color varied between 0 and 3 PCU. Manganese ranged from 0.4 mg/l to 0.1 mg/l. After some examination, it was found that the tap water at the camp was still high in manganese, which affected our ability to initially clean and condition the multimedia filter. The media retained a significant amount of residual manganese for quite a few batches. The pH of the water remained relatively constant throughout the process at 7.6. UV254 measurements of raw water and filtrate indicated a 68% removal of TOC. However, because of TOC measurement problems, A UV254 correlation with TOC was not conclusively made. Arsenic readings throughout the filter run indicated 3 μg/l, well below the required MCL of 10 μg/l.

A total of six batches were made, with similar results to the above reported batch. Each batch created about 260 gallons of clear water. Total filter run time was about 48 hours. Filter loading was calculated to be: $260 \text{ gal/batch } \times 6 \text{ batches } / 0.349 \text{ sq ft} = 4470 \text{ gal/sq ft filter area.}$

Backwash of the filter took about 10 minutes and 52 gallons of water, and filter conditioning took about 10 gallons, so backwashing and conditioning used:

62 gal/4470 gal x 100 = 1.5% of filtered water.

Add about 4% waste from the settlement tank, and the whole system consumed about 5.5% of the filtered water in sludge wasting and filter backwash and conditioning.

Process efficiency: = 100% - 5.5% = 94.5%

It was noted that in the batch process, manganese would start leaching back into the clear water if the processed water stayed too long in the 300-gallon tank. This was noted by the pilot process operator, but was not recorded, due to operational problems with the system at the time.

The treatment process appeared to remove a significant amount of the total organic carbon (TOC) in the raw water. However laboratory data was suspect on the raw water TOC values. Table 13 below shows the contaminant levels during the pilot test (data from Appendix E).

TABLE 13 – Contaminant levels for raw and treated water from Water Treatment Process 1 - Chemical Oxidation, Coagulation, Settling in Open Tank, with Pressure Multimedia Filtration

Note: Raw water TOC values from the analytical laboratory are suspect, as they are so high. 2005 TOC values

TOC	UV254	Percent	Iron	Mang-	Arsenic	True	THHM	HAA5
Value	Absorption	TOC	(mg/l)	anese	(μg/l)	Color	Potential	Potential
(mg/l)	cm ⁻¹	removal		(μg/l)		(PCU)	(mg/l)	(mg/l)
48.0	0.0900		8.41	326	49.9	55	140	147
see								
note								
below								
1.94	0.0340	96%	ND	193	ND	0	55.7	37.1
		see note					(<80	(<60
		below					MCL)	MCL)
	Value (mg/l) 48.0 see note below	Value (mg/l) Absorption cm ⁻¹ 48.0 0.0900 see note below	Value (mg/l) Absorption cm ⁻¹ TOC removal 48.0 0.0900 see note below	Value (mg/l) Absorption cm ⁻¹ TOC removal (mg/l) 48.0 0.0900 8.41 see note below	Value (mg/l) Absorption cm ⁻¹ TOC removal (mg/l) anese (μg/l) 48.0 0.0900 see note 8.41 326 1.94 0.0340 96% see note ND 193 see note	Value (mg/l) Absorption cm ⁻¹ TOC removal (mg/l) anese (μg/l) (μg/l) 48.0 see note below 0.0900 8.41 326 49.9 1.94 0.0340 96% see note ND 193 ND	Value (mg/l) Absorption cm ⁻¹ TOC removal (mg/l) anese (μg/l) (μg/l) Color (PCU) 48.0 0.0900 see note 8.41 326 49.9 55 see note ND 193 ND 0	Value (mg/l) Absorption cm ⁻¹ TOC removal (mg/l) anese (μg/l) (μg/l) Color (PCU) Potential (mg/l) 48.0 see note below 0.0900 8.41 326 49.9 55 140 1.94 0.0340 96% see note ND 193 ND 0 55.7 (<80

from the wells were around 2.7 mg/l.

2. Chemical Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels

The first pilot test series with a batch type steps of oxidation, coagulation, settlement and filtration was successful, and so a second type of pilot test was run with essentially the same system, but continuously, as shown in Figure 2. The pilot testing apparatus shown in Figure 8 was replumbed to include another 8-in dia x 60-in high clear PVC vessel containing a bed of coarse anthracite. The pilot run lasted about 8 hours before the coarse anthracite and multimedia filters were loaded with contaminants. From observations in the areas of the clear filter columns above the filter media, it was noted that floc formation was small. Backwash of both filter columns was required after an 8-hour run. The efficiency of the filter run was as follows:

Filter throughput: 8 hr x 60 min/hr x 0.7 gal/min = 336 gallons in 8 hours

Backwash: 2 filters x 52 gal/filter = 104 gallons

Filter Conditioning: 10 gallons:

Water treatment process backwash water use = $(104 \text{ gal} + 10 \text{ gal}) \times 100 = 33.9\%$ 336 gal

Process efficiency: = 100% - 33.9% = 66.1%

Contaminant removal values for this process were good, except for manganese removal. However, backwash and filter conditioning required one-third of the treated water, which is excessive. Because of excessive backwash water requirements, the pilot run was discontinued.

It was apparent that successful coagulation of the oxidized iron and color into usable floc depends upon an adequate amount of energy imparted to the water during flocculation, and that natural flow through coarse anthracite will not work on this water.

Because of the poor backwash efficiency results in the above pilot test, it was decided that a pilot test involving the process as shown in Figure 1 (oxidation, coagulation, multimedia filtration in pressure vessels), that is, the same process as completed above without the coarse anthracite column, would not yield any better results.

It was noted that in the batch process, manganese would start leaching back into the clear water if the processed water stayed too long (over two hours) in the 300-gallon tank.

The treatment process removed a significant amount of the total organic carbon (TOC) in the raw water. Table 14 below shows the contaminant levels during the pilot test (data from Appendix E).

TABLE 14 – Contaminant levels for raw and treated water from Water Treatment Process 2 - Chemical Oxidation, Coagulation, Coarse Filtration, and Multimedia Filtration in Pressure Vessels

Water	TOC	UV254	Percent	Iron	Man-	Arsenic	True	THHM	HAA5
Sample	Value	Absorption	TOC	(mg/l)	ganese	(µg/l)	Color	Potential	Potential
Location	(mg/l)	cm ⁻¹	removal		(μg/l)		(PCU)	(mg/l)	(mg/l)
Raw Water	48.0	0.0900		8.41	326	49.9	55	140	147
Effluent from Multimedia Filter	1.82	0.0260	96%	ND	252	ND	0	53.4 (<80 MCL)	40.4 (<60 MCL)

VII. CONCLUSIONS

- A. Raw water quality from the two wells varied throughout the pilot runs, and were slightly different from each other. However, they were similar enough to each other to enable the same type of water treatment process. The wells had high levels of iron and manganese, low turbidity, moderate arsenic, and moderate to high color. Samples of water, when exposed to air, turned reddish brown, indicating that a significant portion of the iron in the water was Fe⁺² that oxidized to Fe⁺³.
- B. The iron and manganese appeared to be readily oxidized by potassium permanganate (KMnO₄) without a pH change.
- C. Color and colloidal iron and manganese were readily removed by the use of a blend of inorganic and polymer coagulants. The ratio of inorganic and polymer coagulant components could be optimized for best overall performance in removal of turbidity, iron, manganese, arsenic, and true color. Filtered water UV254 values indicated lower TOC removal than actually occurred during the process. UV254 values did not correlate in a linear fashion with actual TOC values, though their directional trend did agree with decreases in TOC. However, raw water quality changed during the testing, indicating that sustained pumping during production would have to be done to stabilize the raw water parameters.
- D. Arsenic was readily removed down to levels well below 10 μg/l (new level under the Arsenic Rule). Arsenic in all successful jar and pilot tests removed arsenic down to non-detectable levels.
- E. Flocculation and settlement were easily accomplished in the jars, but took some work in the pilot process (1000:1 scaling up) to accomplish the same result. Reconfiguring the mixer geometry and paddle shape resulted in successful flocculation in the pilot process. This indicated that the energy of flocculation was critical to the success of the process.

- F. Sludge production was in the order of 1 to 1.5 percent of the water used in the process. Arsenic in the sludge was below 1 ppm, so that the sludge would not be considered hazardous material, and could be disposed of without special precautions.
- G. The floc would settle out at a rate of 4 ft/hr or 0.07 ft/minute.
- H. Sludge remaining in the clarified water too long (about 2-hours) would result in manganese leaching into the clarified water, which would raise manganese values in the finished water.
- I. Multimedia filtration of the clarified water was excellent, resulting in turbidities of less than 0.1 NTU consistently, color between 0 and 5 PCU, and filter runs of up to 48 hours.
- J. Final determination of the level of disinfectant byproducts (DPB, specifically THHM and HAA5) due to finished water being disinfected by chlorine will have to await production, as the level of TOC in raw water will change (and probably go down) as the wells are pumped at production level rates. However, with present well water quality, the process will have THHM and HAA5 well below present Stage 1 levels of 80 μg/l and 60 μg/l, respectively. Under the Standard Methods for the Examination of Water and Wastewater Method No. 5710, DPB potential is found by adding chlorine disinfectant five to ten times the amount that process water disinfection uses. In normal practice at a future treatment plant in Tuluksak, chlorine disinfectant would be added in the order of 1 mg/l. Even with rechlorination of the water storage tank one time, the DPB levels should be well below the MCL.
- K. The same situation as in I above applies to the finished water's effect on lead and copper. Once the treatment system runs on a production basis, and the wells are pumped at 50 to 60 gpm continuously, a slight change in pH and/or alkalinity may have to be made to keep the water from being corrosive to lead and copper.

Note: Water quality data for well water is typically: Ca 36.1 mg/l as Ca⁺², Hardness 106 mg/l as CaCO3, Alkalinity as CaCO3 108 mg/l, TDS 176 mg/l, pH 7.06. This gives a

calculated Langalier Index (LI) using the AWWA calculator of -0.76 at 45°F, which would be the temperature of a typical water distribution loop. This water would be slightly corrosive and could cause lead and copper issues in older building plumbing. Raising the pH to 7.7 and maintaining the same alkalinity level would produce a LI of -0.23. To do this would require addition of soda ash to raise pH, and possibly some sodium bicarbonate to restore alkalinity. The actual amounts of chemical added for pH and alkalinity adjustment would be fine-tuned after the wells have been in production for a while.

VIII. RECOMMENDATIONS

- A. The water is readily treatable using a conventional process. This process would consist of the following steps:
 - 1. Preheat incoming well water to 50°F for more effective treatment.
 - 2. Inject a potassium permanganate or chlorine solution into the process stream at about 5 mg/l. For economic and operational considerations, oxidation with ozone was not considered, but should remain a possibility down the line.
 - 3. The process stream would enter a pressure vessel with near plug flow characteristics for 40 minutes of detention time. For Tuluksak, this would be about 2,500-gallons at 60 gpm maximum process flow rate. Having oxidation take place inside the pressure vessel would prevent the water from being in contact with air, which would oxidize some of the iron in the water, and possibly cause a potassium permanganate or chlorine overdose. To have control over this step in the treatment process, a closed vessel would be the best choice.
 - 4. The process stream would enter into the flocculation chamber of the conventional plant. Residence time in the flocculation chamber would be 30 to 40 minutes at rated flow. Flocculation should occur in two stages, and flocculator paddle rotational speed controls should have adequate dynamic range. In normal practice in flocculation, velocity gradients (G) will vary from 20 to 75 sec⁻¹ (ft/sec/ft). It is recommended that each of the two flocculator paddles and drives be configured to vary G from 15 to 100 sec⁻¹.
 - 5. The clarifier (floc settling section) should have inclined tubes with a steep bottom hopper to collect sludge. Sludge should be wasted in short pumping cycles every 15 to 20 minutes to remove accumulated sludge and prevent leaching of manganese back into the water. The clarifier should be sized conservatively to prevent floc from being drawn into the filter section of the plant.
 - 6. Water flowing out of the clarifier would enter a multimedia filter section. This section should be sized for a filter loading of 2.0 gpm/sq ft maximum for long filter

runs. The multimedia filter should be equipped with an air scour system capable of 2-cfm/sq ft.

- B. A blend of 80% SternPAC inorganic coagulant and 20% Arctic Floc 12100 polymer is recommended for flocculation. These chemicals are readily available, and when used with the oxidized iron, manganese, and color, forms medium floc with good settling characteristics, and no floaters. Starting dose would be 10 mg/l. Other blends, such as Nalco 8185, or ACH / Nalco 8156 or Arctic Floc 12100 could also be used. After the wells have been pumped at a 30-60 gpm production rate for some weeks, a few jar tests will verify the blend, and it can be adjusted as required.
- C. Based upon pilot testing, disinfectant byproducts (DPB) levels for THHM and HAA5 will be well below Stage 1 MCLs (80 µg/l and 60 µg/l, respectively), and no additional treatment will be needed for DBP removal. If, in the future, additional DBP reduction is required, provision should be made for the addition of a granulated activated carbon (GAC) pressure vessel or other process for further removal of disinfectant byproducts if the treatment train itself cannot meet future D/DBP standards for THHM and HAA5. However, a GAC removal step could be expensive to operate, with the additional cost burden of periodically replacing GAC media or having to regenerate it.
- D. Chlorination for disinfection should be kept at the minimum level (0.2 0.35 mg/L), in order to minimize disinfectant byproducts.
- E. After water production is established and run for a while, filtered water should be analyzed and a Langlier Index (LI) calculated for 40°F and for 140°F. If the Langlier Index is less than -0.5, the pH, calcium hardness, and/or alkalinity can be adjusted using soda ash and sodium bicarbonate, as required, to make the water non-corrosive. The 140°F value of the LI should also be examined, so the water does not form deposits in or corrode water heaters.
- F. Because of issues with the pilot testing system as it related to flocculation and sludge removal, manganese levels were higher in the pilot test, even though the jar tests

indicated excellent manganese reduction with several coagulant blends. To minimize uncertainties about the recommended process, the following is recommended:

- 1. Pump the wells at 30-60 gpm for two weeks (depending upon whether both or one well is used as a water source, which is a conservative rate, based upon test pumping at 75 gpm, when the wells were drilled.
- 2. Construct a conventional treatment system pilot apparatus, approximately 2-ft wide x 2-ft high x 6-ft long from available materials to test the conventional treatment process. This apparatus could test different configurations of the clarifier to determine the optimum setting to minimize leaching of manganese back into the water from process sludge.
- 3. Try using a hypochlorite solution for an oxidizer to compare the efficacy of the treatment process with that of potassium permanganate for manganese and DPM precursor removal.
- 4. Utilize the VSW on-site TOC analyzer to accurately determine process TOC removal without the problems related to sample logistics, laboratory schedules and limited sample hold times.

Appendix A



Laboratory Analysis Report

200 W. Potter Drive Anchorage, AK 99518-1605 Tel: (907) 562-2343 Fax: (907) 561-5301 Web: http://www.us.sgs.com

Paul Weisner Chuck Eggener Consulting Engr. P.O. Box 232946 Anchorage, AK 99523

Work Order:

1063346

Tuluksak VSW W-05-1

Chuck Eggener Consulting Engr.

Report Date:

Client:

July 31, 2006

Released by:

Forest Taylor 2006.07.31 17:09:02 -

08'00'

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by SGS. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request.

The laboratory certification numbers are AK971-05 (DW), UST-005 (CS) and AK00971 (Micro) for ADEC and 001543 for NELAP.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS OAP. the National Environmental Laboratory Accreditation Program and, when applicable, other regulatory authorities.

If you have any questions regarding this report or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343.

December 1 Commission I feets (according limits)

The following descriptors may be found on your report which will serve to further qualify the data.

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
В	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is above the calibrated range.

Note: Soil samples are reported on a dry weight basis unless otherwise specified.

SGS Ref.# Client Name Project Name/#

Matrix

1063346001

Chuck Eggener Consulting Engr.

Tuluksak VSW W-05-1

Client Sample ID W-05-1RW Drinking Water All Dates/Times are Alaska Standard Time

Printed Date/Time

07/31/2006 13:48

Collected Date/Time Received Date/Time

06/20/2006 16:15 06/22/2006 13:06

Stephen C. Ede Technical Director

Sample Remarks:

SM 5910 - %T = 88.0

HAA Formation Potential was analyzed by Montgomery Watson Harza of Monrovia, CA.

TTHM Formation Potential was analyzed by Montgomery Watson Harza of Monrovia, CA.

Parameter	Results		PQL	Units	Method (Container ID	Allowable Limits	Prep Date	Analysis Date	lnit
Calcium	36.1		0.100	mg/L	SM20 2340B	Κ		06/28/06	07/12/06	ΤK
Hardness as CaCO3	106		5.00	mg/L	SM20 2340B	K		06/28/06	07/12/06	TK
Magnesium	3.84		0.100	mg/L	SM20 2340B	K		06/28/06	07/12/06	TK
Metals by ICP/MS										
Aluminum	ND		20.0	ug/L	EP200.8	K		06/28/06	06/30/06	МН
Calcium	32400		500	ug/L	EP200.8	K		06/28/06	06/30/06	МН
Magnesium	3850		50.0	ug/L	EP200.8	K		06/28/06	06/30/06	МН
Silver	ND		1.00	ug/L	EP200.8	K		06/28/06	06/30/06	МН
Waters Department										
Nitrite-N	ND		0.100	mg/L	EPA 353.2	Α			06/22/06	ALR
Nitrate-N	ND		0.100	mg/L	EPA 353.2	Α			06/22/06	ALR
Bromide	ND		0.100	mg/L	EPA 300.0	Α		06/26/06	06/26/06	DSH
Total Organic Carbon	47.1		0.500	mg/L	EPA 415.1	Н			06/29/06	TSN
Total Organic Carbon, Dissolved	44.8		0.500	mg/L	EPA 415.1	1			06/30/06	TSN
UV-254	0.0540		0.0200	cm-l	SM20 5910B	С			06/22/06	CAW
Inorganic Contaminants										
Antimony	ND		1.00	ug/L	EP200.8	K	(<6)	06/28/06	06/30/06	МН
Arsenic	36.3	*	5.00	ug/L	EP200.8	K	(<10)	06/28/06	06/30/06	МН
Barium	146		3.00	ug/L	EP200.8	K	(<2000)	06/28/06	06/30/06	МН
Beryllium	ND		0.400	ug/L	EP200.8	K	(<4)	06/28/06	06/30/06	МН
Cadmium	ND		0.500	ug/L	EP200.8	K	(<5)	06/28/06	06/30/06	МН
Chromium	ND		1.00	ug/L	EP200.8	K	(<100)	06/28/06	06/30/06	МН
Cyanide	ND		0.0050	mg/L	SM20 4500-CN C	C,E J	(<0.2)	06/26/06	06/27/06	KP

SGS Ref.# Client Name Project Name/# Client Sample ID

Matrix

1063346001 Chuck Eggener Consulting Engr. Tuluksak VSW W-05-1

D W-05-1RW Drinking Water All Dates/Times are Alaska Standard Time

Printed Date/Time Collected Date/Time Received Date/Time 07/31/2006 13:48 06/20/2006 16:15 06/22/2006 13:06

Technical Director Stephen C. Ede

Parameter	Results		PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants										
Fluoride	ND		0.100	mg/L	EPA 300.0	Α	(<2)	06/26/06	06/26/06	DSH
Mercury by Cold Vapor	ND		0.200	ug/L	EP245.1	K	(<0.2)	07/03/06	07/05/06	HKG
Nickel	ND		2.00	ug/L	EP200.8	K	(<100)	06/28/06	06/30/06	МН
Selenium	ND		5.00	ug/L	EP200.8	K	(<50)	06/28/06	06/30/06	МН
Thallium	ND		1.00	ug/L	EP200.8	K	(<2)	06/28/06	06/30/06	МН
Secondary Contaminants										
Calcium	36.1		2.00	mg/L	EP200.7	κ		06/28/06	07/12/06	TK
Chloride	3.09		0.100	mg/L	EPA 300.0	Α	(<250)	06/26/06	06/26/06	DSH
Color	65.0	*	5.00	PCU	SM20 2120B	D	(<15)		06/22/06	CRY
Copper	ND		1.00	ug/L	EP200.8	K	(<1000)	06/28/06	06/30/06	МН
Fluoride	ND		0.100	mg/L	EPA 300.0	Α	(<2)	06/26/06	06/26/06	DSH
Langlier Index @ 40 degree F	-1.15				SM2330B	Α			07/13/06	PLW
Alkalinity	108		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
Langlier Index @ 140 degree F	-0.07				SM2330B	Α			07/13/06	PLW
CO3 Alkalinity	ND		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
Iron	6.99	*	0.0400	mg/L	EP200.7	K	(<0.3)	06/28/06	07/12/06	TK
HCO3 Alkalinity	108		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
OH Alkalinity	ND		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
Manganese	331	*	1.00	ug/L	EP200.8	K	(<50)	06/28/06	06/30/06	МН
Odor (TON)	ND		1.00	T.O.N.	SM20 2150B	E	(<3)		06/22/06	CRY
рН	7.06		0.100	pH units	EPA 150.1	D	(6.5-8.5)		06/22/06	CRY
Magnesium	3.84		0.200	mg/L	EP200.7	K		06/28/06	07/12/06	TK
Sodium	2.65		2.00	mg/L	EP200.7	K	(<250)	06/28/06	07/12/06	TK
Sulfate	2.18		0.100	mg/L	EPA 300.0	Α	(<250)	06/26/06	06/26/06	DSH
Total Dissolved Solids	176		10.0	mg/L	SM20 2540C	D	(<500)		06/27/06	KР
Zinc	ND		5.00	ug/L	EP200.8	К	(<5000)	06/28/06	06/30/06	МН



750 Royal Oaks Ortve, Suite 100 Montove, Casisomia 91016-3829 Tel 626 386 1100 Fax 626 386 1101 1 800 566 LABS (1 800 566 5227)

Laboratory Report

for

SGS Environmental Services Inc. 200 W. Potter Drive

Anchorage , AK 99518

Attention: Forest Taylor Fax: (907) 561-5301

DATE OF ISSUE

JUL 2 7 2006 WH LABORATORIES

YOM Yolanda Martin Project Manager inelac 1

Report#: 177353 DRINKING

Laboratory certifies that the test results meet all NELAC requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report,QC Summary,Data Report,Hits Report, totaling 5 page[s].



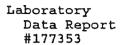
Laboratory
Hits Report
#177353

750 Royal Oaks Drive, Suite 100 Monrova, California 91016-3629 Tel: 626 386 1100 Fax: 626 386 1101 1 800 566 LABS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518

Samples Received 24-jun-2006 09:18:43

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2606240164	W-05-1 RW 10633	346001			
07/19/06 07/19/06 07/07/06 07/14/06 07/19/06 07/19/06 07/19/06 07/08/06 07/03/06 07/08/06 07/08/06 07/08/06	Bromodichlore Chlorine Dose Chlorine Ress D/DBP Haloace Dichloroacet Trichloroacet Bromodichlore Chlorine Dose Chlorine Ress Chloroform Dibromochlore	pacetic acid idual etic Acids (HAA5) ic acid cic acid omethane e	2.97 4.24 10 2.2 60.1 27.5 32.6 5.03 10 2.1 64.0 0.637	60	ug/l ug/l mg/l ug/l ug/l ug/l ug/l ug/l mg/l ug/l ug/l	1.0 1.0 0.1 1.0 1.0 1.0 0.5 1.0 0.1





750 Royal Oeka Drive, Suite 100 Monroves, Celifornia, 91016-3629 Tel: 626 386 1100 Fax: 626 386 1101 1 800 566 LASS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518 Samples Received 06/24/06

Prepared	Analyzed	QC Ref#	Method	Analyte		Result	Units	MRL	Dilution
W-05-1	. RW 1063:	346001	(26062401	.64)	Sampled on	06/20/06 1	.6:15		
			Tot Pot T	rihalom	ethanes 5710	В			
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Bromoform	ı	ND	ug/1	0.5	1
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Chlorofor	m	64.0	ug/l	0.5	1
07/07/06	06/26/06 00:00	324842	(SM2350) Chlorine	Dose	10	mg/1	1.0	1
07/07/06	07/03/06 00:00	324842	(ML/S 4500CL-C) Chlorine	Residual	2.1	mg/l	0.1	ı
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Dibromoch	loromethane	0.637	ug/1	0.5	1
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Bromodich	loromethane	5.03	ug/1	0.5	1
07/01/06	07/08/06 00:00	324842	(ML/EPA 551.1) Total Pot	ential Trihalomethan	e 69.7	ug/l	0.5	1
			(ML/SM 5710) 1,2-Dibro	mopropane (70-130)	100	* Rec		
			Total Pot	ential	Haloacetic				
07/18/06	07/07/06 00:00	326271	(ML/SM 5710B) Chlorine	Dose	10	mg/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Bromochlo	roacetic acid	2.97	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Bromodich	loroacetic acid	4.24	ug/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Chlorodib	romomacetic acid	ממ	ug/l	2.0	1
07/18/06	07/14/06 00:00	326271	(ML/SM 5710B) Chlorine	Residual	2.2	mg/1	0.1	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Dibromoac	etic acid	ND	ug/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Dichloroa	cetic acid	27.5	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Monobromo	acetic acid	ND	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Monochlor	oacetic acid	כוע	ug/l	2.0	1
07/18/06	07/19/06 00:00	326271	(ML/SH 6251B) Tribromoa	cetic acid	NA	ug/l	4.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Trichloro	acetic acid	32.6	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/S6251B) D/DBP Hal	oacetic Acids (HAA5)	60.1	ug/l	1.0	1
			(SM5710 6251B) 1,2,3-TCP	(80-120)	104	* Rec		
		>	(SM5710 6251B) 2,3-Dibro	m Acid(70-130)	94	* Rec		

CHAIN OF CUSTODY RECORD SGS Environmental Services Inc.

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Relinquished By: (4) Date Time	Received By:																			
9/23/ 130																				

1063346 SAMPLE RECEIPT FORM SGS WO#:

Yes	No	NA	SIMILED RECEIL IT OF CHILD	
			Are samples RUSH, priority, or w/n 72 hrs. of hold time	
	called)		If yes have you done e-mail notification?	Received Date: 6-22-6
			Are samples within 24 hrs. of hold time or due date?	Received Time: 1306
			If yes, have you spoken with Supervisor?	Is date/time conversion necessary?
			Archiving bottles – if req., are they properly marked?	# of hours to AK Local Time:
K-			Are there any problems? PM Notified?	Thermometer ID: 7D
			Were samples preserved correctly and pH verified?	Cooler ID Temp Blank Cooler Temp
		<u></u>	(Bubles in WAS ORAS) Con	
		Ŋ	Constant Control Control	°C °C
フ			If this is for PWS, provide PWSID.	
			Will courier charges apply?	
	_		Method of payment?	"Temperature readings include thermometer correction fact Delivery method (circle all that apply): Client /
			Motos:	Alert Couried/ UPS / FedEx / USPS /
		•	Notes: Is this a DoD project? (USACE, Navy, AFCEE)	AA Goldstreak/ NAC / ERA / PenAir / Carlile
<u>· </u>			is this a DOD project? (DOAGE, Navy, AFGEE)	
			i an i a a a a a a a a a a a a a a a a a	
			must be filled out for DoD projects (USACE, Navy, AFCEE)	Airbill # //38 /462
Yes	N	0	Is received temperature 4 ± 2°C?	Additional Sample Remarks: (\(\sigma\) if applicable)
l			Exceptions: Samples/Analyses Affected:	Extra Sample Volume?
İ			Exceptions. Samples/Analyses Affected.	Limited Sample Volume? Field preserved for volatiles?
				Field-filtered for dissolved?
				Lab-filtered for dissolved?
			Rad Screen performed? Result:	
		_	Was there an airbill? (Note # above in the right hand column)	Ref Lab required? MSA STTUM HAAS
			Was cooler sealed with custody seals?	Poleigii Soil?
	***************************************		#/where:	This section must be filled if problems are found.
			Were seal(s) intact upon arrival?	Yes No
		_	Was there a COC with cooler?	Was client notified of problems?
			Was COC sealed in plastic bag & taped inside lid of cooler?	
			Was the COC filled out properly?	Individual sontacted: LLOYO.
			Did the COC indicate COE / AFCEE / Navy project?	Via: Phone Fax Email (circle one)
			Did the COC and samples correspond?	Date/Time: 6/72/66 1325
			Were all sample packed to prevent breakage?	Reason for contact: TC 1CHIONINEE DEMAN
			Packing material:	ARE PAST HT. MGAS IS CLOSE ARUN
	***************************************		Were all samples unbroken and clearly labeled?	WILL BE 24 COST. CYELL 5415
		_	Were all samples sealed in separate plastic bags?	CAMCEL MBASTE, & CHURINE
		_	Were all VOCs free of headspace and/or MeOH preserved?	DEMAND, CANCEL VOC.
 		_	Were correct container / sample sizes submitted?	
	***************************************		Is sample-condition good?	Change Order Required? No
		-	Was copy of CoC, SRF, and custody seals given to PM to fax?	SGS Contact: FMT
L				
Notes	: <u>CA</u>	MCE	L TC, CHLORINE DEMAND, & MBAS	
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	CA	LE	L VUE DILE TO PAIR BLURBLES	
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SAMPLE RECEIPT FORM (page 2)

1063346

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Completed by:

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6-22-06

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Form # F004r14: 05/17/04

1063346

SGS	.Environmental
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CUSTODY SEAL

Signature:	Dany H Bouling	CEZ KNOLUANES	Date/Times 6/20/06	5\$20m
			bate/fine: 19/00/00	

SGS Environmental

CUSTODY SEAL

Signature: Johns H fault ElZ Date/Time: 6/20/06 5:20pm

Alert Expeditors Inc. DBA/Petroleum Courier Service Citywide Delivery 272-0349 • 440-3351 8421 Flamingo Drive • Anchorage, Alaska 99502 Date From Prepay C Account C Account C PO#
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Laboratory Analysis Report

200 W. Potter Drive Anchorage, AK 99518-1605 Tel: (907) 562-2343 Fax: (907) 561-5301 Web: http://www.us.sgs.com

Paul Weisner Chuck Eggener Consulting Engr. P.O. Box 232946 Anchorage, AK 99523

Work Order:

1063345

Tuluksak VSW W-05-2

Client:

Chuck Eggener Consulting Engr.

Report Date:

August 02, 2006

Released by:

Forest Taylor 2006.08.03

13:44:40 -

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by SGS. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request.

The laboratory certification numbers are AK971-05 (DW), UST-005 (CS) and AK00971 (Micro) for ADEC and 001543 for NELAP.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP, the National Environmental Laboratory Accreditation Program and, when applicable, other regulatory authorities.

If you have any questions regarding this report or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates value that is greater than or equal to the MDL.
J , ·	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
В	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
Е	The analyte result is above the calibrated range.

Note: Soil samples are reported on a dry weight basis unless otherwise specified.

SGS Ref.#

1063345001

Client Name

Chuck Eggener Consulting Engr.

Project Name/# Client Sample ID Tuluksak VSW W-05-2

Matrix

W-05-2RW Drinking Water All Dates/Times are Alaska Standard Time Printed Date/Time

Collected Date/Time

08/02/2006 8:40

Received Date/Time

06/20/2006 16:05 06/22/2006 13:06

Technical Director

Stephen C. Ede

PWSID

0

Sample Remarks:

SM 5910 - %T = 81.2

HAA Formation Potential was analyzed by Montgomery Watson Harza of Monrovia, CA.

TTHM Formation Potential was analyzed by Montgomery Watson Harza of Monrovia, CA.

Parameter	Results		PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Calcium	34.3		0.100	mg/L	SM20 2340B	K		06/27/06	07/07/06	TK
Hardness as CaCO3	104		5.00	mg/L	SM20 2340B	κ		06/27/06	07/07/06	TK
Magnesium	4.54		0.100	mg/L	SM20 2340B	K		06/27/06	07/07/06	TK
Metals by ICP/MS										
Aluminum	ND		20.0	ug/L	EP200.8	K		06/27/06	06/30/06	МН
Calcium	29900		500	ug/L	EP200.8	K		06/27/06	06/30/06	МН
Magnesium	5080		50.0	ug/L	EP200.8	Κ		06/27/06	06/30/06	МН
Silver	ND		1.00	ug/L	EP200.8	K		06/27/06	06/30/06	МН
Waters Department										
Nitrite-N	ND		0.100	mg/L	EPA 353.2	Α			06/22/06	ALR
Nitrate-N	ND		0.100	mg/L	EPA 353.2	Α			06/22/06	ALR
Bromide	ND		0.100	mg/L	EPA 300.0	Α		06/23/06	06/23/06	DSH
Total Organic Carbon	48.0		0.500	mg/L	EPA 415.1	Н			06/29/06	TSN
Total Organic Carbon, Dissolved.	45.7		0.500	mg/L	EPA 415.1	I			06/29/06	TSN
UV-254	0.0900		0.0200	cm-1	SM20 5910B	С			06/22/06	CAW
Inorganic Contaminants										
Antimony	ND		1.00	ug/L	EP200.8	K	(<6)	06/27/06	06/30/06	МН
Arsenic	49.9	*	5.00	ug/L	EP200.8	K	(<10)	06/27/06	06/30/06	МН
Barium	184		3.00	ug/L	EP200.8	K	(<2000)	06/27/06	06/30/06	МН
Beryllium	ND		0.400	ug/L	EP200.8	K	(<4)	06/27/06	06/30/06	МН
Cadmium	ND		0.500	ug/L	EP200.8	K	(<5)	06/27/06	06/30/06	МН
Chromium	ND		1.00	ug/L	EP200.8	K	(<100)	06/27/06	06/30/06	МН
Cyanide	ND		0.0050	mg/L	SM20 4500-CN (C,E J	(<0.2)	06/26/06	06/27/06	KР

SGS Ref.#

1063345001

Client Name

Chuck Eggener Consulting Engr.

Project Name/# Tuluksak VSW W-05-2

Client Sample ID Matrix

W-05-2RW Drinking Water

PWSID

0

All Dates/Times are Alaska Standard Time

Printed Date/Time

08/02/2006 8:40

Collected Date/Time

06/20/2006 16:05 06/22/2006 13:06

Received Date/Time

hnical Director	Stephen C. Ede
inical Director	Stephen C. Ede

Parameter	Results		PQL_	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants										
Fluoride	ND		0.100	mg/L	EPA 300.0	Α	(<2)	06/23/06	06/23/06	DSH
Mercury by Cold Vapor	ND		0.200	ug/L	EP245.1	K	(<0.2)	07/03/06	07/05/06	HKG
Nickel	ND		2.00	ug/L	EP200.8	K	(<100)	06/27/06	06/30/06	МН
Selenium	ND		5.00	ug/L	EP200.8	K	(<50)	06/27/06	06/30/06	МН
Thallium	ND		1.00	ug/L	EP200.8	K	(<2)	06/27/06	06/30/06	МН
Secondary Contaminants										
Calcium	34.3		0.200	mg/L	EP200.7	K		06/27/06	07/07/06	тк
Chloride	1.96		0.100	mg/L	EPA 300.0	A	(<250)	06/23/06	06/23/06	DSH
Color	55.0	*	5.00	PCU	SM20 2120B	D	(<15)		06/22/06	CRY
Copper	ND		1.00	ug/L	EP200.8	K	(<1000)	06/27/06	06/30/06	МН
Fluoride	ND		0.100	mg/L	EPA 300.0	Α	(<2)	06/23/06	06/23/06	DSH
Langlier Index @ 40 degree F	-1.2797				SM2330B	Α			07/10/06	PLW
Alkalinity	108		40.0	mg′L	SM20 2320B	D			06/27/06	PLW
Langlier Index @ 140 degree F	-0.1997				SM2330B	A			07/10/06	PLW
CO3 Alkalinity	ND		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
Iron	8.41	*	0.0400	mg/L	EP200.7	K	(<0.3)	06/27/06	07/07/06	TK
HCO3 Alkalinity	108		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
OH Alkalinity	ND		40.0	mg/L	SM20 2320B	D			06/27/06	PLW
Manganese	326	*	1.00	ug/L	EP200.8	K	(<50)	06/27/06	06/30/06	МН
Odor (TON)	2.00		1.00	T.O.N.	SM20 2150B	E	(<3)		06/22/06	CRY
pH	6.98		0.100	pH units	EPA 150.1	D	(6.5-8.5)		06/22/06	CRY
Magnesium	4.54		0.200	mg/L	EP200.7	K		06/27/06	07/07/06	TK
Sodium	2.47		2.00	mg/L	EP200.7	K	(<250)	06/27/06	07/07/06	TK
Sulfate	ND		0.100	mg/L	EPA 300.0	Α	(<250)	06/23/06	06/23/06	DSH
Total Dissolved Solids	185		10.0	mg/L	SM20 2540C	D	(<500)		06/27/06	KP
Zinc	ND		5.00	ug/L	EP200.8	K	(<5000)	06/27/06	06/30/06	МН



750 Royal Oaks Orive. Suita 100 Monrovia, Calnornia 91016-0629 Tef. 626 386 1100 Fax 626 386 1101 1 800 566 LABS (1 800 566 5227)

Laboratory Report

for



SGS Environmental Services Inc. 200 W. Potter Drive

Anchorage , AK 99518

Attention: Forest Taylor Fax: (907) 561-5301

D/DBP Haloacetic acids (HAAS) changed from ND to 147 ug/L

DATE OF ISSUE

WH LABORATORIES

YCM Yolanda Martin Project Manager nelac 1

Report#: 177352 DRINKING

Laboratory certifies that the test results meet all NELAC requirements unless noted in the Comments section or the Case Narrative. Following the cover page are QC Report, QC Summary, Data Report, Hits Report, totaling 5 page[s].

Laboratory
Hits Report
#177352

750 Royal Oaks Drive, Suite 100 Monrovia, California 91016-3629 Tel: 626 365 1100 Fax: 625 365 1101 1 800 566 LABS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518

Samples Received 24-jun-2006 09:16:05

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2606240163	W-05-2 RW 10633	345001			
07/19/06 07/19/06 07/07/06 07/14/06 07/19/06 07/19/06 07/19/06 07/19/06 07/19/06 07/08/06 07/03/06 07/10/06 07/10/06	Chlorine Dose Chlorodibromo D/DBP Haloace Dichloroaceti Tribromoaceti Trichloroacet Bromodichloro Chlorine Dose Chlorine Resi Chloroform	pacetic acid dual macetic acid etic Acids (HAA5) c acid c acid cic acid methane	3.55 5.19 20 4.6 2.13 147 65.3 147 82.1 4.57 20 5.0 135 140	60	ug/l ug/l mg/l ug/l ug/l ug/l ug/l ug/l ug/l ug/l u	1.0 1.0 0.1 2.0 1.0 5.0 4.0 5.0 0.5 1.0

Laboratory
Data Report
#177352



750 Royat Oaks Drive, Suite 100 Murrova, Calicrina 91016-3629 Tel. 826 386 1100 Fax: 826 385 1101 1 800 566 LABS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518 Samples Received 06/24/06

Prepared	Analyzed	QC Ref#	Method	Analyte .		Result	Units	MRL	Dilution
W-05-	2 RW 10633	345001	(26062401	63) Sa	mpled on	06/20/06 1	6:05		
			Tot Pot T	rihalometh	anes 5710E	3			
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Bromoform		ND	ug/l	0.5	1
07/07/06	07/10/06 00:00	324842	(ML/EPA 551.1) Chloroform		135	2g/1	2.5	5
07/07/06	06/26/06 00:00	324642	(SM2350) Chlorine Dose		20	mg/l	1.0	1
07/07/06	07/03/06 00:00	324842	(ML/S 4500CL-G) Chlorine Resid	iual	5.0	mg/l	0.1	1
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Dibromochlorom	methane	СИ	ug/1	0.5	ı
07/07/06	07/08/06 00:00	324842	(ML/EPA 551.1) Bromodichloron	rethane	4.57	ug/1	0.5	1
07/07/06	07/10/06 00:00	324842	(ML/EPA 551.1) Total Potentia	al Trihalomethane	140	ug/l	0.5	1
			(ML/SM 5710) 1,2-Dibromopro	pane (70-130)	96	1 Rec		
			Total Pot	ential Hal	oacetic				
07/18/06	07/07/06 00:00	326271	(ML/SM 5710B) Chlorine Dose		20	mg/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SH 6251B) Bromochloroace	tic acid	3.55	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Fromodichloroa	cetic acid	5.19	ug/l	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Chlorodibromom	wcetic acid	2.13	ug/l	2.0	1
07/18/06	07/14/06 00:00	326271	(ML/SM 5710B) Chlorine Resid	lual	4.6	mg/l	0.1	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Dibromoacetic	acid	ир	ug/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Dichloroacetic	acid	65.3	ug/l	5.0	5
07/18/06	07/19/06 00:00	326271	{ ML/SM 6251B) Monobromoaceti	c acid	ND	ug/1	1.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Monochloroacet	ic acid	אם	ug/l	2.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Tribromoacetic	acid	147	ug/l	4.0	1
07/18/06	07/19/06 00:00	326271	(ML/SM 6251B) Trichloroaceti	c acid	82.1	ug/1	5.0	5
07/18/06	07/19/06 00:00	326271	(ML/S6251B) D/DBP Haloacet	ic Acids (HAAS)	147	ug/1	1.0	1
			(SM5710 62518) 1,2,3-TCP(80-1	20)	107	* Rec		
			(SM5710 6251B) 2,3-Dibrom Aci	d(70·130)	99	1 Rec		



CHAIN OF CUSTODY RECORD SGS Environmental Services Inc.



ryland th Carolina 051099

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_	Relinquished E	By: (A)																					
	r remiquisited E	(3. (4)	Date 6/22/	Time 1306	Received B	y:																	
			106	1706		Sa		-·															

1063345



,	•		SAMPLE RECEIPT FORM	SGS WO#:	
Yes	No	NA	- -		
			Are samples RUSH, priority, or w/n 72 hrs. of hold time?	Due Date:	7-7-06
	calle		If yes have you done e-mail notification?	Received Date	e: 6.22-06
			Are samples within 24 hrs. of hold time or due date?		e: 1306
			If yes, have you spoken with Supervisor?		nversion necessary?
***************************************	<u>-</u>		Archiving bottles – if req., are they properly marked?		K Local Time:
*			Are there any problems? PM Notified?	Thermometer	
N			Were samples preserved correctly and pH verified?		Temp Blank Cooler Temp
		X	Bubbles in VOAs (1) R=6mm 5> 1cm		2.5℃ 3.3℃
		n			°C °C
2					°C°C
·-			If this is for PWS, provide PWSID.		°C°C
			Will courier charges apply?		°C°C
			Method of payment?	·	re readings include thermometer correction fact
			Data package required? (Level: 1 / 2 / 3 / 4)		d (circle all that apply): Client /
	_		Notes: Is this a DoD project? (USACE, Navy, AFCEE)		UPS / FedEx / USPS /
•			Is this a DoD project? (USACE, Navy, AFCEE)	AA Goldstre	NAC / ERA / PenAir / Carlile
<u></u>				Lynden / SGS	
			must be filled out for DoD projects (USACE, Navy, AFCEE)		1138 1462
Yes	N	Vо	T 1 1 0000		e Remarks: (√if applicable)
			Is received temperature 4 ± 2°C? Exceptions: Samples/Analyses Affected:		Sample Volume?
			Exceptions: Samples/Analyses Affected:		ed Sample Volume? preserved for volatiles?
į					filtered for dissolved?
					Itered for dissolved?
			Rad Screen performed? Result:		ab required? MsA5 chluse
			Was there an airbill? (Note # above in the right hand column)		In Soil? THM HAAS FO
			Was cooler sealed with custody seals?		Po
			# / where:		ust be filled if problems are found.
		·	Were seal(s) intact upon arrival?	Yes No	1'
	_		Was there a COC with cooler? Was COC sealed in plastic bag & taped inside lid of cooler?	- w	as client notified of problems?
			Was the COC filled out properly?	Individual cont	tacted: •
			Did the COC indicate COE / AFCEE / Navy project?		Fax / Email (circle one)
			Did the COC and samples correspond?		e/22/01e 1325
	_		Were all sample packed to prevent breakage?	Reason for con	tact: MBAS 15
			Packing material: Were all samples unbroken and clearly labeled?	SKORT K	OLD AMB CLIENT WELL
					MY 2x PRICE. CHAKEL
			Were all samples sealed in separate plastic bags?		TE ALLO CHURIME
			Were all VOCs free of headspace and/or MeOH preserved?	nemenan	ME PAST HIT. CHIKER
			Were correct container / sample sizes submitted? Is sample-condition good?	Chance On Inc.	D' 10 A
	_		Was copy of CoC, SRF, and custody seals given to PM to fax?		Required? No
			was copy of coc, bid, and custody souls given to the tolak:	303 Contact.	1 171
				<u></u>	
Note	s. C.	۸. ۱۰	5 TC CHARLES DOWNER & MARS FOR	160/	
Note	s. <u> </u>	Mr-cc	EL TC, CHLORINE DEMAND, & MBAS. FAT	प्ल ८८/०७	7.554-0004-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1
	C #	m r E	L NOC DUE TO BUBBLES.		
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Com	pleted	by (si	ign): (print): 0	amer!)	o hason
Logir	proof	f (ched	ck one): waived \(\square\) required \(\square\) performed by:	/.	

SGS

SAMPLE RECEIPT FORM (page 2)

1063345

SGS WO#.

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#		9	Test				.,1			1				Other								Other	 	1	T			ativ	T	Other
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Bottle Totals 7

Completed by:

_ Date: _ G-22-06

Form # F004r14: 05/17/04

1063345

SGS Environmental

CUSTODY SEAL

ignature: Janes A Lawly CRZ

Date/Time:

5:00 gm

Date/Time: 0/20/06 5,20 gm

23) Amel H lend

Signature:

CUSTODY SEAL

Environmental.

SDS

Gold'Streak Marka Aldiner	;	www.ALASKACARGO.com 1-800-225-2752	P.O. Box 68900 Seattle, WA 98168	O27- Ber		YBILL Number 8 1.46	
From Shipper:	Aviation	上去的議論	Total Pieces	Total Weight	MULTIPLE PIECES Please / If Li	سنن فيستنكث	
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City: Pathel	State	Zip Code: 전체 기계	PAS Account Num	184751	1-15	5	
I certify that this shipment does not co		estructive devices or hazardous materials.	☐ Credit Card Num	per a la l	<u></u> 16-50	16	<u>//</u> -
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Address:	Hills be	Phone: 349-1040	_ 74	MAP	(Offline only) Pickup NON AS COURIER	· •[-] (
City: ANCH	State: 1:1	Zip.Code:	1063	345	Delivery (NON AS COURIER)		
Bished No.	Raymon and Till Name	Time - A (a m	+		Special Service	ce .	

Gold Streak Alaska Aldines

1138 1462

This is a non-negotiable AIR WAYBILL subject to the terms and conditions set forth

027-

Remarks

Insurance

TOTAL

Appendix B

1665

CE2 ENGINEERS, INC. DRILLING LOG

Well Owner Communit	Wor Tuhuksak, Alaska Uso of Well Public Water
Location (address of: To	waship, Range, Section, if known)
GPS Coordinates	
Size of casing	Depth of Hole 159 feet Cased to 135 feet
Static water level 129	_ft. (above) (below) land surface.
Finish of well (check or	e): Open End () Screen (🗡) Perforated()
Describe screen or perfor	ation 15' . DIO 3 A. T 10' . OIF SLOT TOT 27'
of drawdown from static	
Date of completion	9-18: PRILETIN
	WELL LOG (MY LAST AM 83)
Depth in feet from ground surface	Give details of formations penetrated, size of material, color and hardness.
<u>0 70/9</u>	FINE SAND
19 TO 41	FINE AWCKY SAND TWATER
41 70 66	GRAY SAND I WATER GG PEA CRAVEL
66 TO 72	COR'S SAND TWATER SOME PEACRAVEL
72 TO 135	PACK BAND VERY LITTHE WATER
135 TO 158	LITTEE STRIPS OF WATER IN THE
IO.	PACKAAN SOM PEA GRAVEL MOSLEY
TO	FINE SAND
159 10/61	HARP PACK SAND NOWATER
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PUMPING TEST RECORD ODNIK-Division of Water Water Resources Section

Paga No	
---------	--

I WELL OWNER TULUKSAK . Aggress. Township . County. _ ODNR Log#_ _ Other Wall ID _ DRILLING Company Conducting Test -_ Individual Making Messurements_ Type of Test ______ . Distance From Pumping Well .. Menaving Equipment Used DEPTK MEATOR Measuring Point Tol CASING 31 Elevation Above Ground _ SINC WELDE LOVA! (So).

Date	Clock Thee (Use Millery Time)	Tires Since Pumping Started (in Meause)	Depth to Wester (S)	Change in Water Level (S • S ₄)	Discharge Reta (GPM)	Commercia (Include Weather Consistions)
9-17-05	8:10	0	12'8"		76	
	8:15	15	32'3"			
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All and the second seco	8:55	7 10	32 12-			
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	22:40	1060	3 7 1.6		77	
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	14,40	150 60	33_3_			April Commission of State
		180 (3hr)	-			and the second s
		240 (4hr)	W	-		

PUMPING TEST RECORD

(WELL Observation Wells
ODNR-Division of Water
Water Resources Section
Address DNA 7811,93 Owner TULUKSAK Location of well on property County 9-19-05
Date 9-19-05
Test Stated " Charletol" ODNR Logs_ Dihet Well ID_ Company Conducting Tast R. L. D. RINLING
Type of Tast D. ROW DOWN Notes _ Individual Maldry Mazaurements Distance From Pumping Well ... Messering Equipment Used PAPTH ME STER Static Water Laval (\$0) 12 - Massuring Point TOP CASING Elevation Above Ground 3/

	Pumping Water Le	vel (TL) 33			Depth of Pump (A.)	<u> </u>
Peu	Olook Time (Use Milhary Time)	Time Sinse Pumping Startes (in Minutes)	Depth to . Watek (8)	Change in Water Level (6 - 8 ₀)	Discharge Rate (GPM)	Consments (Include Westher Conditions)
9-18.0	1140	60	33 3/	•	75	
	2140	60	335			
, 	3:40	60	33 -			
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	5:40	60	33.3			
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4	Commence in Commen	الم سيسسم رحم			,	Management and the second of the second seco

#### CE2 ENGINEERS, INC. DRILLING LOG

Well Owner Community of Tuluktak Alaska # 2 WELL Use of Well Public Water Supply
Location (address of: Township, Range, Section, if known)
GPS Coordinates
Size of casing 6" Depth of Hole 171 feet Cased to 172 feet
Static water level 13 17. (above) (below) land surface.
Finish of well (check one): Open End ( ) Scream ( > ) Perforated( )
Describe screen or perforation 2/12" 10/AL: .010010016030
Well pumping test at 75 gallons per (Hour) (Minute) for 24 hours with 2010 to of thewdown from static level.
Date of completion 9-7-05
WELLLOG Ry Longhather Ju DRILLER Ry Longhather Ju
Dapth in feet from
ground surface Give details of formations penetrated, size of material, color and hardness.
0 TO 4 10P 301h
A TO 10 BROWN SAND
10 TO:16 FROZEN SILT,
16 TO 24 FINE BAND
24 TO SO FINE BAND TWATER
50 TO 515 CORSE BAND PER GRAVEL
512 TOELE FINE BAND TWATER
FIL TO 82 PACK SAND NO WATER
82 TO 83 FINE SAND & WATER
83 TO 107 PACK SAND
107 TO: 108 SAND PEAGRAVEL DWATER WATER TESTED ?
104 TO 125 PACK SAND
125 TO 169 PACK SAND & LITTLE STREAMS OF WATER.
167 TO: 191 CORSE GAND PER GRAVEL WATER. 1445
STREAKS OF PACK SAND IN BETWEEN LAYERS OF SAND & WATER.

たたて アンイング・ナナー

DNA 7811.63

AR13421012

#### PUMPING TEST RECORD Observation Wells ODNR-Division of Water

PARE NO.

Owner	WAVE IMPOU	Address	
Location of well on property			
County		_ Townside	
Deta 9-7-05		DDNR Log#	Other Well ID
Company Conducting last	(boban saer )		g Housesmania Konchotaam
Type of Test			
Measuring Equipment Used	214"		The state of the s
- •	Measuring Poin		Elevation Above Ground 3
Pumning West I shall (5)		Floorith of Discuss 18	11 4 7

	Pumping Week!				Depth of Pump (A.) _	
Date	Olook Time (Use Milbiry Time)		Depth to Weter (S)	Change in Water Level (8 - \$0)	Discharge Rete (GPM)	Comments (Include Weather Conditions)
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/	16:05	60		33 10.6		
	7:05	60		33 8.5		
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	3:05	60	***************************************	34 15		
2	4105	60				
-8-05	1105	60		34 5		
	1:05	60		34 4		
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Osy Lython to

#### **PUMPING TEST RECORD**

DNA 7811.93

Owner -

Observation Wells
ODNR-Division of Water
Water Resources Section
Add:63

Page No. ______

		budbalth			t.	
	Carry 9-C/	- 0 b		TOWNS	ър	AIL. 111. # 10
	Date 7-7	tarted	/ Tout E	ndnd)	DANK FOO4	Other Well ID
	Company Conduc	ting Test	LUKIL	elb G	Individual Maxing Me	asuramenta APA O-100/11/4/11
	Type of Test _P	ROWDOW	<u> </u>	. Distance From Pi	ımping Well	The state of the s
	Measuring Equipme	ra Used <u>D.S.I</u>	P. P. IN	LEATAR.		
	Static Weter Lev	al (So) 13"	Hand Mark	uring Point 75	P CASINET	vation Abova Ground _3'
	Pumping Water Le	vel (1.)			epth of Pump (ft.)	40
Data	Clock Time (Use Military Time)	Time Since	Depth to Veter (B)	Change in Water Level (\$ - \$ ₀ )	Discharge Rate (GPM)	Comments (Include Weather Conditions)
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	6105	40		346		
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## Appendix C



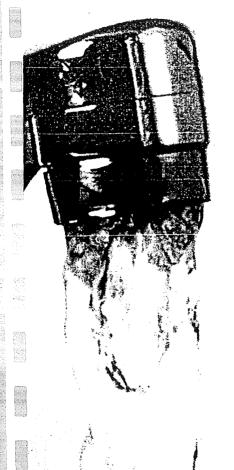


# Stage 1 Disinfectants and Disinfection Byproducts Rule: A Quick Reference Guide

Overvie	w of the Rule.
	Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) 63 FR 69390 - 69476, December 16, 1998, Vol. 63, No. 241
Title	Revisions to the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR), and Revisions to State Primxy Requirements to Implement the Safe Drinking Water Act (SDWA) Amendments 66 FR 3770, January 16, 2001, Vol 66, No. 29
Purpose	Improve public health protection by reducing exposure to disinfection byproducts. Some disinfectants and disinfection byproducts (DBPs) have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans.
General Description	The Stage 1 DBPR is the first of a staged set of rules that will reduce the allowable levels of DBPs in drinking water. The new rule establishes seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce DBP exposure. The rule is designed to limit capital investments and avoid major shifts in disinfection technologies until additional information is available on the occurrence and health effects of DBPs.
Utilities Covered	The Stage 1 DBPR applies to all sizes of community water systems and nontransient noncommunity water systems that add a disinfectant to the drinking water during any part of the treatment process and transient noncommunity water systems that use chlorine dioxide.

#### **Public Health Benefits** Implementation of the As many as 140 million people receiving increased protection from DBPs. Stage 1 DBPR will result in . . . 24 percent average reduction nationally in trihalomethane levels. Reduction in exposure to the major DBPs from use of ozone (DBP = bromate) and chlorine dioxide (DBP = chlorite). Estimated impacts of National capital costs: \$2.3 billion the Stage 1 DBPR National total annualized costs to utilities: \$684 million include . . . 95 percent of households will incur an increase of less than \$1 per month. 4 percent of households will incur an increase of \$1-10 per month. <1 percent of households will incur an increase of \$10-33 per month.

#### Critical Deadlines and Requirements For Drinking Water Systems January 1, 2002 Surface water systems and ground water systems under the direct influence of surface water serving ≥ 10,000 people must comply with the Stage 1 DBPR requirements. January 1, 2004 Surface water systems and ground water systems under the direct influence of surface water serving < 10,000, and all ground water systems must comply with the Stage 1 DBPR requirements. For States December 16, 2000 States submit Stage 1 DBPR primacy revision applications to EPA (triggers interim primacy). December 16, 2002 Primacy extension deadline - all states with an extension must submit primacy revision applications to EPA.



For additional information on the Stage 1 DBPR

call the Safe Drinking Water Hotline at 1-800-426-4791; isit the EPA web site at ww.epa.gov/safewater; or contact your State drinking water representative.

Additional material is available at www.epa.gov/safewater/
adbp/implement.html.

Regulated Contami	nants/[	Disinfec	tants		
Regulated Contaminants	MCL (mg/L)	MCLG (mg/L)	Regulated Disinfectants	MRDL*	MRD[6* (mg/l)
Total Trihalomethanes (TTHM)	0.080	·			
Chloroform Bromodichloromethane Dibromochloromethane Bromoform		zero 0.06 zero	Chlorine	4.0 a S Cl ₂	4
Five Haloacetic Acids (HAA5)	0.060		Chloramines	4.0 as CI ₂	4
Monochloroacetic acid Dichloroacetic acid Trichloroacetic acid Bromoacetic acid Dibromoacetic acid		- zero 0.3 -	Chlorine dioxide	0.8	0.8
Bromate (plants that use ozone)	0.010	zero	*Stage 1 DBPR inclu disinfectant levels (	MRDLs) and ma:	ximum
Chlorite (plants that use chlorine dioxide)	1.0	0.8	residual disinfectant which are similar to disinfectants.		

#### Treatment Technique

Enhanced coagulation/enhanced softening to Improve removal of DBP precursors (See Step 1 TOC Table) for systems using conventional filtration treatment.

Source Water	Source Water Alkalinity, mg/L as CaCO ₃						
TOC (mg/L)	0-60	> 60-120	> 120				
> 2.0 to 4.0	35.0%	25.0%	15.0%				
> 4.0 to 8.0	45.0%	35.0%	25.0%				
> 8.0	50.0%	40.0%	30.0%				

Systems meeting at least one of the alternative compliance criteria in the rule are not required to meet the removals in this table.

¹ Systems practicing softening must meet the TOC removal requirements in the last column to the right

	Coverage	Monitoring Frequency	Compliance
TTHM/HAA5	Surface and ground water under the direct influence of surface water serving ≥ 10,000	4/plant/quarter	Running annual average
	Surface and ground water under the direct influence of surface water serving 500 - 9,999	1/plant/quarter	Running annual average
	Surface and ground water under the direct influence of surface water serving < 500	1/plant/year in month of warmest water temperature**	Running annual average of increased monitoring
	Ground water serving ≥ 10,000	1/plant/quarter	Running annual average
	Ground water serving < 10,000	1/plant/year in month of warmest water temperature**	Running annual average of increased monitoring
Bromate	Ozone plants	Monthly	Running annual average
Chlorite	Chlorine dioxide plants	Daily at entrance to distribution system; monthly in distribution system	Daily/follow-up monitoring
Chlorine dioxide	Chlorine dioxide plants	Daily at entrance to distribution system	Daily/follow-up monitoring
Chlorine/Chloramines	All systems	Same location and frequency as TCR sampling	Running annual average
DBP precursors	Conventional filtration	Monthly for total organic carbon and alkalinity	Running annual average

^{**} System must increase monitoring to 1 sample per plant per quarter if an MCL is exceeded.





#### Stage 2 Disinfectants and Disinfection Byproducts Rule: A Quick Reference Guide For Schedule 2 Systems

Overv	iew of the Rule
Title	Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) 71 FR 388, January 4, 2006, Vol. 71, No. 2
Purpose	To increase public health protection by reducing the potential risk of adverse health effects associated with disinfection byproducts (DBPs) throughout the distribution system. Builds on the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) by focusing on monitoring for and reducing concentrations of two classes of DBPs - TTHM and HAA5 - in drinking water.
General Description	Stage 2 DBPR requires systems to complete an Initial Distribution System Evaluation (IDSE) to characterize DBP levels in their distribution systems and identify locations to monitor DBPs for Stage 2 DBPR compliance. The Stage 2 DBPR bases TTHM and HAA5 compliance on a locational running annual average (LRAA) calculated at each monitoring location.
Utilities Covered	All community water systems (CWSs) and nontransient noncommunity water systems (NTNCWSs) that either add a primary or residual disinfectant other than ultraviolet light, or deliver water that has been treated with a primary or residual disinfectant other than ultraviolet light.
	Schedule 2 includes CWSs and NTNCWSs serving 50,000 to 99,999 people OR CWSs and NTNCWSs that are part of a combined distribution system in which the largest system serves 50,000 to 99,999 people.

Stage 2 DBPR Regula	nts		
Regulated Contaminants	MCLG (mg/L)	MCL (mg/L)	
Total Trihalomethanes (TTHM)		0.080 LRAA	
Chloroform Bromodichloromethane Dibromochloromethane Bromoform	0.07 zero 0.06 zero		
Five Haloacetic Acids (HAA5)		0.060 LRAA	
Monochloroacetic acid Dichloroacetic acid Trichloroacetic acid Bromoacetic acid Dibromoacetic acid	0.07 zero 0.02 - -		

IDSE Option	Description
Standard Monitoring	Standard monitoring Is one year of increased monitoring for TTHM and HAA5 in addition to the data being collected under Stage 1 DBPR. These data will be used with Stage 1 DBPR data to select Stage 2 DBPR monitoring locations for DBP compliance monitoring. Any system may conduct standard monitoring to meet the IDSE requirements of the Stage 2 DBPR.
System Specific Study (SSS)	Systems that have extensive DBP data (including Stage 1 DBPR compliance data) or technica expertise to prepare a hydraulic model may choose to conduct a system specific study to select Stage 2 DBPR compliance monitoring locations.
40/30 Certification †	The term "40/30" refers to a system that during a specific time period has all individual Stage 1 DBPR compliance samples less than or equal to 0.040 mg/L for TTHM and 0.030 mg/L for HAA5 and has no monitoring violations during the same time period. These systems have no IDSE monitoring requirements, but will still need to conduct Stage 2 DBPR compliance monitoring.
Very Small System (VSS) Waiver †	Systems that serve fewer than 500 people and have DBP data can qualify for a VSS Waiver and would not be required to conduct IDSE monitoring. These systems have no IDSE monitoring requirements, but will still need to conduct Stage 2 DBPR compliance monitoring.

EPA has developed several tools to assist systems with complying with the Stage 2 DBPR IDSE requirements. These materials can be downloaded at www.epa.gov/safewater/disinfection/stage2.

For additional information on the Stage 2 DBPR

Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at www.epa.gov/safewater; or contact your State drinking water representative.

Additional material is available at www.epa.gov/safewater/disinfection/stage2.

NTNCWS serving < 10,000 people do not need to complete any of the IDSE options.</li>

[†] Unless notified by EPA or the state that they must complete standard monitoring or system specific study.

Complian	ce with Stage 2	DBPR MC4s (	Routine Monitoring)
Source Water Type	Population Size Category	Monitoring Frequency ¹	Total Distribution System Monitoring Locations Per Monitoring Period ²
	<500	per year	2
	500-3,300	per quarter	2
	3,301-9,999		2
	10,000-49,999		4
Subpart H	50,000-249,999	per quarter	8
	250,000-999,999		12
	1,000,000-4,999,999		16
	≥5,000,000		20
	<500		2
	500-9,999	per year	2
Ground Water	10,000-99,999		4
	100,000-499,999	per quarter	6
	≥500,000		8
Operational E	valuation		

Systems must begin complying with rule requirements to determine compliance with the operational evaluation levels for TTHMs and HAA5s.

Critical Deadlines and Requirement

² Systems on quarterly monitoring must take dual sample sets every 90 days at each monitoring location, except for subpart H systems serving 500-3,300. Systems on annual monitoring and subpart H systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. If monitoring annually, only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location, and month.

Calmara	2 eauther and Neyuriement 2.
For Drinking	Water Systems (Schedule 2)
January 4, 2006	Systems serving fewer than 500 people that have TTHM and HAA5 compliance data qualify for a VSS Waiver from conducting an IDSE, unless informed otherwise by U.S. EPA or state primacy agency.
April 1, 2007	Systems that do not receive a VSS Waiver must submit to the U.S EPA or state primacy agency either a:  Standard monitoring plan,  System specific study plan, or  40/30 certification.
April 1, 2008	Systems conducting standard monitoring or SSS begin collecting samples in accordance with their approved plan.
March 31, 2009	No later than this date, systems conducting standard monitoring or a SSS complete their monitoring or study.
July 1, 2009	No later than this date, systems conducting standard monitoring or a SSS must submit their IDSE report.
April 1, 2009	Consecutive systems must begin monitoring for chlorine or chloramines as specified under the Stage 1 DBPR.
October 1, 2012	No later than this date, systems must:  Complete their Stage 2 DBPR Compliance Monitoring Plan (Systems serving more than 3,300 people must submit their Monitoring Plan to the state.)*  Begin complying with monitoring requirements of the Stage 2 DBPR.*
July 2013	Systems must begin complying with rule requirements to determine compliance with the operational evaluation levels for TTHMs and HAA5s.
For States	
January - June 2006	States are encouraged to inform systems serving fewer than 500 people and do not qualify for a VSS Waiver from the IDSE requirements should begin complying with standard monitoring requirements.
March 31, 2008	States must approve the system's standard monitoring plan, 40/30 certification, or system specific study plan or notify the system that the state has not completed its review.
October 4, 2007	States are encouraged to submit final primacy applications or extension requests to EPA.
January 4, 2008	Final primacy applications must be submitted to EPA, unless granted an extension.

A monitoring plan is not required if the IDSE report includes all information required in the monitoring plan.

September 30, 2009

January 4, 2010

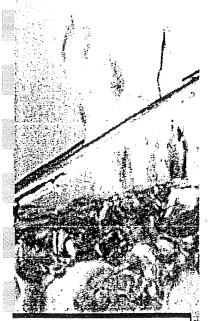
States must approve the system's IDSE report or notify the system that the state has not completed its review of the IDSE report.

Final primacy revision applications from states with approved 2-year extensions agreements must be submitted to EPA.

¹ All systems must monitor during month of highest DBP concentrations.

[†] States may allow up to an additional 24 months for compliance with MCLs for systems requiring capital improvements.

# United States Environmental Protection Agency



The June 1991 LCR was revised with the following Technical Amendments: 56 FR 32112, July 15, 1991; 57 FR 28785, June 29, 1992; 59 FR 33860, June 30, 1994; and the LCR Minor Revisions 65 FR 1950, January 12, 2000.



#### Lead and Copper Rule: A Quick Reference Guide

Overvi	ew of the Rule
Title	Lead and Copper Rule (LCR)¹,56 FR 26460 - 26564, June 7, 1991
Purpose	Protect public health by minimizing lead (Pb) and copper (Cu) leve is in drinking water, primarily by reducing water corrosivity. Pb and Cu enter drinking water mainly from corrosion of Pb and Cu containing plumbing materials.
General Description	Establishes action level (AL) of 0.015 mg/L for Pb and 1.3 mg/L for Cu based on 90th percentile level of tap water samples. An AL exceedance is not a violation but can trigger other requirements that include water quality parameter (WQP) monitoring, corrosion control treatment (CCT), source water monitoring/treatment public education, and lead service line replacement (LSLR).
Utilities Covered	All community water systems (CWSs) and non-transient, non-community water systems (NTNCWSs) are subject to the LCR requirements.

#### Public Health Benefits

Implementation of the LCR has resulted in . . .

- Reduction in risk of exposure to Pb that can cause damage to brain, red blood cells, and kidneys, especially for young children and pregnant women.
- Reduction in risk of exposure to Cu that can cause stomach and intestinal distress, liver or kidney damage, and complications of Wilson's disease in genetically predisposed people.

#### Lead and Copper Tap Sampling Requirements

- First draw samples must be collected by all CWSs & NTNCWSs at cold water taps in homes/buildings that are at high risk of Pb/Cu contamination as identified in 40 CFR 141.86(a).
- ▶ Number of sample sites is based on system size (see Table 1).
- Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring (see Table 2).

Size		Number of Pb/Cu	Tap Sample Sites	Number of WQP Ta	p Sampling Sies
Category	System Size	Standard	Reduced	Standard ***	Reduced
Lorgo	> 100K	100	50	25	10
Large	50,001-100K	60	30	10	7
Medium	10,001 - 50K	60	30	10	7
Wedium	3,301 - 10K	40	20	3	3
	501 - 3,300	20	10	2	2
Small	101 - 500	10	5	1	1
	≤ 100	5	5	1	1

Can Monitor	If the System
	1. Serves ≤ 50,000 and is ≤ both ALs for 2 consecutive 6-month monitoring periods; or
Annually	2. Meets Optimal Water Quality Parameter (OWQP) specifications for 2 consecutive 6-month monitoring periods.
	1. Serves ≤ 50,000 and is ≤ both ALs for 3 consecutive years of monitoring; or
	2. Meets OWQP specifications for 3 consecutive years of monitoring; or
Triennially	3. Has 90 th percentile Pb levels ≤ 0.005 mg/L & 90 th percentile Cu level ≤ 0.65 mg/L for 2 consecutive 6-month periods (i.e, accelerated reduced Pb/Cu tap monitoring), or
	4. Meets the 40 CFR 141.81(b)(3) criteria.
Once every 9 years	Serves ≤ 3,300 and meets monitoring waiver criteria found at 40 CFR 141.86(g).
A O	

Samples are collected at reduced number of sites (see Table 1 above).

#### Treatment Technique and Sampling Requirements

CORROSION CONTROL TREATMENT INSTALLATION: All large systems (except systems that meet the requirements of 40 CFR 141.81(b)(2) or (3)) must install CCT. Medium and small systems that exceed either AL must install CCT.

WATER QUALITY PARAMETER MONITORING: All large systems are required to do WQP monitoring. Medium and small systems that exceed either AL are required to do WQP monitoring.

For additional information on the LCR, call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at www.epa.gov/safewater/lcrmr/ implement.html; or contact your State drinking water representative.



### Treatment Technique and Sampling Requirements the AL is Exceeded

#### Water Quality Parameter (WQP) Monitoring

- ▶ All systems serving > 50,000 people, and those systems serving ≤ 50,000 people if 90th percentile to level > either AL, must take WQP samples during the same monitoring periods as Pb/Cu tap sample
- ▶ Used to determine water corrosivity, and if needed, to help identify type of CCT to be installed and how CCT should be operated (i.e., establishes OWQP levels).
- WQPs include: pH, alkalinity, calcium, conductivity (initial WQP monitoring only), orthophosphate (if phosphate-based inhibitor is used); silica (if silicate-based inhibitor is used), and temperature (initial WQP monitoring only).
- ▶ Samples are collected within distribution system (i.e., WQP tap samples), with number of sites based on system size (see Table 1), and at each entry point to distribution system (EPTDS).
- ▶ Systems installing CCT, must conduct follow-up monitoring for 2 consecutive 6-month periods WQP tap monitoring is conducted semi-annually; EPTDS monitoring increases to every two weeks.
- ▶ After follow-up monitoring, State sets ranges of values for the OWQPs.
- Reduced WQP tap monitoring is available for systems in compliance with OWQPs; Reduced monitoring does not apply to EPTDS monitoring.
- For systems ≤ 50,000, WQP monitoring is not required whenever 90th percentile tap levels are ≤ bot ALs.

#### Public Education (PE)

- ▶ Only required if Pb AL is exceeded (no public education is required if only Cu AL exceeded).
- Informs Public Water System's (PWS) customers about health effects, sources, and what can be done to reduce exposure.
- Includes billing inserts sent directly to customers, pamphlets or brochures distributed to hospitals & other locations that provide services to pregnant woman & children, and for some CWSs, newspaper notices and public service announcements (PSAs) submitted to TV/radio stations.
- ▶ System must begin delivering materials within 60 days of Pb AL exceedance and continue every 6 months for PSAs and annually for all other forms of delivery for as long as it exceeds Pb AL.
- ▶ Different delivery methods and mandatory language for CWSs & NTNCWSs.
- ▶ Can discontinue delivery whenever ≤ Pb AL; but must recommence if Pb AL subsequently exceeded.
- ▶ PE requirements are in addition to the Public Notification required in 40 CFR Subpart Q.

#### Source Water Monitoring and Treatment

- All systems that exceed Pb or Cu AL must collect source water samples to determine contribution from source water to total tap water Pb/Cu levels and make a source water treatment (SOWT) recommendation within 6 months of the exceedance.
- ▶ One set of samples at each EPTDS is due within 6 months of first AL exceedance.
- ▶ If State requires SOWT; system has 24 months to install SOWT.
- ▶ After follow-up Pb/Cu tap and EPTDS monitoring, State sets maximum permissible levels for Pb & Cu in source.

#### O Corrosion Control Treatment

- ▶ Required for all large systems (except systems that meet the requirements of 40 CFR 141.81(b)(2) or (b)(3)) and medium/small systems that exceed either AL. The system shall recommend optimal CCI within 6 months.
- Corrosion control study required for large systems.
- If State requires study for medium or small systems, it must be completed within 18 months.
- Once State determines type of CCT to be installed, PWS has 24 months to install CCT.
- Systems installing CCT must conduct 2 consecutive 6-months of follow-up monitoring.
- ▶ After follow-up Pb/Cu tap & WQP monitoring, State sets OWQPs.
- Small & medium systems can stop CCT steps if s both ALs for 2 consecutive 6-month monitoring periods.

#### If the system continues to exceed the AL after installing CCT and/or SOWT...

#### **⊙** Lead Service Line (LSL) Monitoring

- Two types of sampling associated with LSL replacement (LSLR):
  - Optional Monitoring from LSL to determine need to replace line. If all Pb samples from line s 0.015 mg/L then LSL does not need to be replaced and counts as replaced line.
  - Required Monitoring if entire LSL is **not** replaced to determine impact from "partial" LSLR. Sample is collected that is representative of water in service line that is partially replaced.
- Monitoring only applies to system subject to LSLR.

#### O Lead Service Line Replacement

- ▶ System must replace LSLs that contribute more than 0.015 mg/L to tap water levels.
- ▶ Must replace 7% of LSL per year; State can require accelerated schedule.
- If only a portion of a LSL is replaced, PWS must:
  - Notify customers at least 45 days prior to replacement about the potential for increased Pb levels;
  - Collect sample within 72 hours of replacement and mail/post results within 3 days of receipt of results.
- Systems can discontinue LSLR whenever & Pb AL in tap water for 2 consecutive monitoring periods.



## Arsenic and Clarifications to Compliance and New Source Monitoring Rule: A Quick Reference Guide



Overvi	ew of the Rule
Title	Arsenic and Clarifications to Compliance and New Source Monitoring Rule 66 FR 6976 (January 22, 2001)
Purpose	To improve public health by reducing exposure to arsenic in drinking water.
General Description	Changes the arsenic MCL from 50 µg/L to 10 µg/L; Sets arsenic MCLG at 0; Requires new systems and new drinking water sources to demonstrate compliance as specified by the State; Clarifies the procedures for determining compliance with the MCLs for IOCs, SOCs, and VOCs.
Utilities Covered	All community water systems (CWSs) and nontransient, noncommunity water systems (NTNCWSs) must comply with the arsenic requirements. EPA estimates that 3,024 CWSs and 1,080 NTNCWSs will have to install treatment to comply with the revised MCL.

#### **Public Health Benefits**

Implementation of the
Arsenic Rule will
result in

- · Avoidance of 16 to 26 non-fatal bladder and lung cancers per year.
- · Avoidance of 21 to 30 fatal bladder and lung cancers per year.
- · Reduction in the frequency of non-carcinogenic diseases.

Critical	Deadlines & Requirements
Consume	r Confidence Report Requirements
Report Due	Report Requirements
July 1, 2002 and beyond	For reports covering calendar years 2001 and beyond, systems that detect arsenic between 5 μg/L and 10 μg/L must include an educational statement in the CCRs.
July 1, 2002 - July 1, 2006	For reports covering calendar years 2001 to 2005, systems that detect arsenic between 10 µg/L and 50 µg/L must include a health effects statement in their CCRs.
July 1, 2007 and beyond	For reports covering calendar year 2006 and beyond, systems that are in violation of the arsenic MLC (10 $\mu$ g/L) must include a health effects statement in their CCRs.
For Drink	ing Water systems
Jan. 22, 2004	All NEW systems/sources must collect initial monitoring samples for all IOCs, SOCs, and VOCs within a period and frequency determined by the State.
Jan. 1, 2005	When allowed by the State, systems may grandfather data collected after this date.
Jan. 23, 2006	The new arsenic MCL of 10 µg/L becomes effective. All systems must begin monitoring or when allowed by the State, submit data that meets grandfathering requirements.
Dec. 31, 2006	Surface water systems must complete initial monitoring or have a State approved waiver.
Dec. 31, 2007	Ground water systems must complete initial monitoring or have a State approved waiver.
For States	
Spring 2002	EPA meets and works with States to explain new rule and requirements and to support adoption and implementation activities.
Jan. 22, 2003	State primacy revision applications due.
Jan. 22, 2005	State primacy revision applications due from States that received 2-year extensions.

^{*} For required educational and health effect statements, please see 40 CFR 141.154.

#### Compliance Determination (IOCs, VOCs, and SOCs)

- 1. Calculate compliance based on a running annual average at each sampling point.
- 2. Systems will not be in violation until 1 year of quarterly samples have been collected (unless fewer samples would cause the running annual average to be exceeded.)
- If a system does not collect all required samples, compliance will be based on the running annual average of the samples collected.

#### Monitoring Requirements for Total Arsenic(1)

#### Monitoring .

One sample after the effective date of the MCL (January 23, 2006). Surface water systems must take annual samples. Ground water systems must take one sample during the 2005-2007 compliance period. If the monitoring result is less than the MCL ground water systems must collect one sample every 3 years and surface water systems must continue to collect annual samples.

#### Increased Monitoring

A system with a sampling point result above the MCL must collect quarterly samples at that sampling point, until the system is reliably and consistently below the MCL.

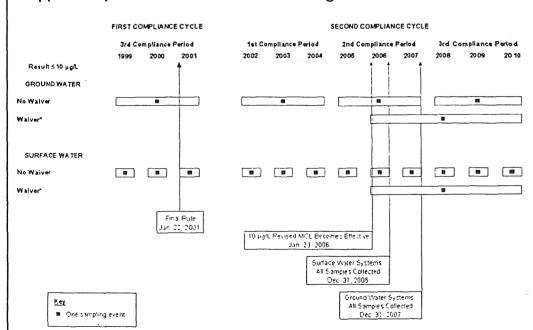
(1) All samples must be collected at each entry point to the distribution system, unless otherwise specified by the State.

For additional information on the Arsenic Rule

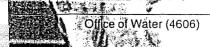
Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA Web site at www.epa.gov/safewater; or contact your State drinking water representative.

EPA will provide arsenic training over the next year.

#### Applicability of Standardized Monitoring Framework to Arsenic



'States may issue 9 year monitoring waivers under the January 22, 2001 final arsenic rule. Waivers are not permitted under the current arsenic requirements. To be eligible for a waiver, surface water systems must have monitored annually for at least 3 years. Ground water systems must conduct a minimum of 3 rounds of monitoring with detections limits below 10 µg/L.







# Interim Enhanced Surface Water Treatment Rule: A Quick Reference Guide

Overvier	w of the Rule
	Interim Enhanced Surface Water Treatment Rule (IESWTR) 63 FR 69478 - 69521, December 16, 1998, Vol. 63, No. 241
Title	Revisions to the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR), and Revisions to State Primacy Requirements to Implement the Safe Drinking Water Act (SDWA) Amendments 66 FR 3770, January 16, 2001, Vol 66, No. 29
Purpose	Improve public health control of microbial contaminants, particularly <i>Cryptosporidium</i> .  Prevent significant increases in microbial risk that might otherwise occur when systems implement the Stage 1 Disinfectants and Disinfection Byproducts Rule.
General Description	Builds upon treatment technique approach and requirements of the 1989 Surface Water Treatment Rule. Relies on existing technologies currently in use at water treatment plants.
Utilities Covered	Sanitary survey requirements apply to all public water systems using surface water or ground water under the direct influence of surface water, regardless of size. All remaining requirements apply to public water systems that use surface water or ground water under the direct influence of surface water and serve 10,000 or more people.

Cryptosporidium	<ul> <li>Maximum contaminant level goal (MCLG) of zero.</li> <li>99 percent (2-log) physical removal for systems that filter.</li> <li>Include in watershed control program for unfiltered systems.</li> </ul>
Turbidity Performance Standards	Conventional and direct filtration combined filter effluent:  → ≤ 0.3 nephelometric turbidity units (NTU) in at least 95 percent of measurements taken each month.  → Maximum level of 1 NTU.
Turbidity Monito	oring Requirements Direct Filtration)
Combined Filter Effluent	<ul> <li>Performed every 4 hours to ensure compliance with turbidity performance standards.</li> </ul>
Individual Filter Effluent	Performed continuously (every 15 minutes) to assist treatment plant

Disinfection profiling and benchmarking.

and every 5 years for noncommunity water systems).

Construction of new uncovered finished water storage facilities prohibited.

Sanitary surveys, conducted by the state, for all surface water and ground water under the

direct influence of surface water systems regardless of size (every 3 years for community water systems

#### **Profiling and Benchmarking**

Public water systems must evaluate impacts on microbial risk before changing disinfection practices to ensure adequate protection is maintained. The three major steps are:

- Determine if a public water system needs to profile based on TTHM and HAA5 levels (applicability monitoring)
- Develop a disinfection profile that reflects daily Giardia lamblia inactivation for at least a year (systems using ozone or chloramines must also calculate inactivation of viruses)
- Calculate a disinfection benchmark (lowest monthly inactivation) based on the profile and consult with the state prior to making a significant change to disinfection practices

## or additional information

on the IESWTR

Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at www.epa.gov/safewater; or contact your State drinking water representative.

Additional material is available at www.epa.gov/safewater/mdbp/implement.html.

#### Critical Deadlines and Requiremen For Drinking Water Systems February 16, 1999 Construction of uncovered finished water reservoirs is prohibited. March 1999 Public water systems lacking ICR or other occurrence data begin 4 quarters of applicability monitoring for TTHM and HAA5 to determine if disinfection profiling is necessary. Systems that have 4 consecutive quarters of HAA5 occurrence data that meet April 16, 1999 the TTHM monitoring requirements must submit data to the state to determine if disinfection profiling is necessary. Public water systems with ICR data must submit it to states to determine if December 31, 1999 disinfection profiling is necessary. April 1, 2000 Public water systems must begin developing a disinfection profile if their annual average (based on 4 quarters of data) for TTHM is greater than or equal to 0.064 mg/L or HAA5 is greater than or equal to 0.048 mg/L. March 31, 2001 Disinfection profile must be complete. January 1, 2002 Surface water systems or ground water under the direct influence of surface water systems serving 10,000 or more people must comply with all IESWTR provisions (e.g., turbidity standards, individual filter monitoring). For States December 16, 2000 States submit IESWTR primacy revision applications to EPA (triggers interim primacy). January 2002 States begin first round of sanitary surveys. Primacy extension deadline - all states with an extension must submit primacy December 16, 2002 revision applications to EPA. December 2004 States must complete first round of sanitary surveys for community water systems. December 2006 States must complete first round of sanitary surveys for noncommunity water

#### **Public Health Benefits** Implementation of Increased protection against gastrointestinal illnesses from the IESWTR will Cryptosporidium and other pathogens through improvements in filtration. result in . . . Reduced likelihood of endemic illness from Cryptosporidium by 110,000 to 463,000 cases annually. Reduced likelihood of outbreaks of cryptosporidiosis. Estimated impacts of National total annualized cost: \$307 million the IESWTR include . . . 92 percent of households will incur an increase of less than \$1 per month. Less than 1 percent of households will incur an increase of more than \$5 per month (about \$8 per month).

1

systems.





For additional information on the LT1ESWTR

Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at www.epa.gov/safewater/mdbp/ lt1eswtr.html; or contact your State drinking water representative.

# Long Term 1 Enhanced Surface Water Treatment Rule: A Quick Reference Guide

Overvi	ew of the Rule
Title	Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) 67 FR 1812, January 14, 2002, Vol. 67, No. 9
Purpose	Improve public health protection through the control of microbial contaminants, particularly <i>Cryptosporidium</i> . Prevent significant increases in microbial risk that might otherwise occur when systems implement the Stage 1 Disinfectants and Disinfection Byproducts Rule.
General Description	Builds upon the requirements of the 1989 Surface Water Treatment Rule (SWTR). Smaller system counterpart of the Interim Enhanced Surface Water Treatment Rule (IESWTR).
Utilities Covered	Public water systems that use surface water or ground water under the direct influence of surface water (GWUDI) and serve fewer than 10,000 people.

#### Major Provisions

#### Control of Cryptosporidium

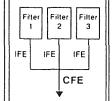
- The maximum contaminant level goal (MCLG) is set at zero.
- Filtered systems must physically remove 99% (2-log) of Cryptosporidium
- Unfiltered systems must update their watershed control programs to minimize the potential for contamination by Cryptosporidium oocysts.
- Cryptosporidium is included as an indicator of GWUDI.

Combined Filter Effluent (CFE) Turbidity Performance Standards

Specific CFE turbidity requirements depend on the type of filtration used by the system.

Conventional and direct filtration:

- ≤ 0.3 nephelometric turbidity units (NTU) in at least 95% of measurements taken each month.
- Maximum level of turbidity: 1 NTU.



Slow sand and diatomaceous earth (DE) filtration:

- Continue to meet CFE turbidity limits specified in the SWTR:
  - 1 NTU in at least 95% of measurements taken each month.
  - · Maximum level of turbidity: 5 NTU.

Alternative technologies (other than conventional, direct, slow sand, or DE):

Turbidity levels are established by the State based on filter.

- Turbidity levels are established by the State based on filter demonstration data submitted by the system.
- State-set limits must not exceed 1 NTU (in at least 95% of measurements) or 5 NTU (maximum).

#### Jubidity Monitoring Requirements

Combined Filter Effluent Performed at least every 4 hours to ensure compliance with CFE turbidity performance standards.1

Individual Filter Effluent (IFE) (for systems using conventional and direct filtration only)

Since the CFE may meet regulatory requirements even though one filter is producing high turbidity water, the IFE is measured to assist conventional and direct filtration treatment plant operators in understanding and assessing individual filter performance.

- Performed continuously (recorded at least every 15 minutes).
- Systems with two or fewer filters may conduct continuous monitoring of CFE turbidity in place of individual filter effluent turbidity monitoring.
- Certain follow-up actions are required if the IFE turbidity (or CFE for systems with two filters) exceeds 1.0 NTU in 2 consecutive readings or more (i.e., additional reporting, filter self-assessments, and/or comprehensive performance evaluations (CPEs)).

¹ This frequency may be reduced by the State to once per day for systems using slow sand/alternative filtration or for systems serving 500 persons or fewer regardless of the type of filtration used.

#### Disinfection Profiling and Benchmarking Requirements

Community and non-transient non-community public water systems must evaluate impacts on microbial risk before changing disinfection practices to ensure adequate microbial protection is maintained. This is accomplished through a process called disinfection profiling and benchmarking.

What are the disinfection profiling and benchmarking requirements?

- Systems must develop a disinfection profile, which is a graphical compilation of weekly inactivation of Giardia lamblia, taken on the same calendar day each week over 12 consecutive months. (Systems using chloramines, ozone, or chlorine dioxide for primary disinfection must also calculate inactivation of viruses). Results must be available for review by the State during sanitary surveys.
- A State may deem a profile unnecessary if the system has sample data collected after January 1, 1998–during the mornth of warmest water temperature and at maximum residence time in the distribution system–indicating TTHM levels are below 0.064 mg/L and HAA5 levels are below 0.048 mg/L.
- Prior to making a significant change to disinfection practices, systems required to develop a profile must calculate a disinfection benchmark and consult with the State. The benchmark is the calculation of the lowest monthly average of inactivation based on the disinfection profile.

#### **Additional Requirements**

Construction of new uncovered finished water reservoirs is prohibited.

#### Critical Deadlines and Requirements

March 15, 2002	Construction of uncovered finished reservoirs is prohibited.
July 1, 2003	No later than this date, systems serving between 500-9,999 persons must report to the State:  Results of optional monitoring which show levels of TTHM < 0.064 mg/L and HAA5 < 0.048 mg/L, OR  System has started profiling.
January 1, 2004	No later than this date, systems serving fewer than 500 persons must report to the State:  Results of optional monitoring which show levels of TTHM < 0.064 mg/L and HAA5 < 0.048 mg/L, OR  System has started profiling.
June 30, 2004	Systems serving between 500 and 9,999 persons must complete their disinfection profile unless the State has determined it is unnecessary.
December 31, 2004	Systems serving fewer than 500 persons must complete their disinfection profile unless the State has determined it is unnecessary.
January 14, 2005	Surface water systems or GWUDI systems serving fewer than 10,000 people must comply with the applicable LT1ESWTR provisions (e.g., turbidity standards, individual filter monitoring, <i>Cryptosporidium</i> removal requirements, updated watershed control requirements for unfiltered systems).
For States	

#### For States

January 2002	As per the IESWTR, States begin first round of sanitary surveys (at least every 3 years for community water systems and every 5 years for non-community water systems).
October 14, 2003	States are encouraged to submit final primacy applications to EPA.
January 14, 2004	Final primacy applications must be submitted to EPA unless granted an extension.
December 2004	States must complete first round of sanitary surveys for community water systems (as per the IESWTR).
January 14, 2006	Final primacy revision applications from States with approved 2-year extension agreements must be submitted to EPA.
December 2006	States must complete first round of sanitary surveys for non-community water systems (as per the IESWTR).

#### Public Health Benefits

	Implementation of the LT1ESWTR will result in	)	Increased protection against gastrointestinal illnesses from <i>Cryptosporidium</i> and other pathogens through improvements in filtration.  Reduced likelihood of endemic illness from <i>Cryptosporidium</i> by an estimated 12,000 to 41,000 cases annually. Reduced likelihood of outbreaks of cryptosporidiosis.
İ	Estimated Impacts of the LT1ESWTR include	<b>) ) )</b>	National total annualized cost: \$39.5 million. 90% of affected households will incur an increase of less than \$1.25 per month. One percent of affected households are likely to incur an increase of more than \$10 per month.





¹ The June 1989 Rule was revised as follows: Corrections and Technical Amendments, 6/19/90 and Partial Stay of Certain Provisions (Variance Criteria) 56 FR 1556-1557, Vol 56, No 10.

Note: The TCR is currently undergoing the 6 year review process and may be subject to change.

# Total Coliform Rule: A Quick Reference Guide

Overvi	ew of the Rule
Title	Total Coliform Rule (TCR) 54 FR 27544-27568, June 29, 1989, Vol. 54, No. 1241
Purpose	Improve public health protection by reducing fecal pathogens to minimal levels through control of total coliform bacteria, including fecal coliforms and Escherichia coli (E. coli).
General Description	Establishes a maximum contaminant level (MCL) based on the presence or absence of total coliforms, modifies monitoring requirements including testing for fecal coliforms or <i>E. coli</i> , requires use of a sample siting plan, and also requires sanitary surveys for systems collecting fewer than five samples per month.
Utilities Covered	The TCR applies to all public water systems.

#### **Public Health Benefits**

Implementation of the TCR has resulted in . . .

Reduction in risk of illness from disease causing organisms associated with sewage or animal wastes. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and associated headaches and fatigue.

#### What are the Major Provisions?

#### ROUTINE Sampling Requirements

- Total coliform samples must be collected at sites which are representative of water quality throughout the distribution system according to a written sample siting plan subject to state review and revision.
- Samples must be collected at regular time intervals throughout the month except groundwater systems serving 4,900 persons or fewer may collect them on the same day.
- Monthly sampling requirements are based on population served (see table on next page for the minimum sampling frequency).
- A reduced monitoring frequency may be available for systems serving 1,000 persons or fewer and using only ground water if a sanitary survey within the past 5 years shows the system is free of sanitary defects (the frequency may be no less than 1 sample/quarter for community and 1 sample/year for non-community systems).
- Each total coliform-positive routine sample must be tested for the presence of fecal coliforms or E. coli.
- If any routine sample is total coliform-positive, repeat samples are required.

#### REPEAT Sampling Requirements

- Within 24 hours of learning of a total coliform-positive ROUTINE sample result, at least 3 REPEAT samples must be collected and analyzed for total coliforms:
- One REPEAT sample must be collected from the same tap as the original sample.
- One REPEAT sample must be collected within five service connections upstream.
- > One REPEAT sample must be collected within five service connections downstream.
- > Systems that collect 1 ROUTINE sample per month or fewer must collect a 4th REPEAT sample.
- If any REPEAT sample is total coliform-positive:
- The system must analyze that total coliform-positive culture for fecal coliforms or E.coli.
- The system must collect another set of REPEAT samples, as before, unless the MCL has been violated and the system has notified the state.

#### Additional ROUTINE Sample Requirements

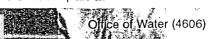
A positive ROUTINE or REPEAT total coliform result requires a minimum of five ROUTINE samples be collected the following month the system provides water to the public unless waived by the state.



For additional information on the TCR

Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at www.epa.gov/safewater/mdbp/ mdbp.html; or contact your state drinking water representative.

² The revised Public Notification Rule will extend the period allowed or public notice of monthly violations to 30 days and shorten the period for acute violations to 24 hours. These evisions are effective for all systems by May 6, 2002 and are detailed in 40 CFR Subpart Q.



Public W	Vater Syste	em ROUT	INE Moni	toring Frequ	iencies (
Population	Minimum Samples/ Month	Population	Minimum Samples/ Month	Population	Minimum Samples/ Mor/h
25-1,000*	1	21,501-25,000	25	450,001-600,000	210
1,001-2,500	2	25,001-33,000	30	600,001-780,000	240
2,501-3,300	3	33,001-41,000	40	780,001-970,000	270
3,301-4,100	4	41,001-50,000	50	970,001-1,230,000	300
4,101-4,900	5	50,001-59,000	60	1,230,001-1,520,000	330
4,901-5,800	6	59,001-70,000	70	1,520,001-1,850,000	360
5,801-6,700	7	70,001-83,000	80	1,850,001-2,270,000	390
6,701-7,600	8	83,001-96,000	90	2,270,001-3,020,000	420
7,601-8,500	9	96,001-130,000	100	3,020,001-3,960,000	450
8,501-12,900	10	130,001-220,000	120	≥ 3,960,001	480
12,901-17,200	15	220,001-320,000	150	Books introduction for an accuminate to favore United sectors as	and the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second o
17,201-21,500	20	320,001-450,000	180	THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE S	

*Includes PWSs which have at least 15 service connections, but serve <25 people.

#### What are the Other Provisions?

Systems collecting fewer than 5 ROUTINE samples per month . . .

Must have a sanitary survey every 5 years (or every 10 years if it is a non-community water system using protected and disinfected ground water).**

Systems using surface water or ground water under the direct influence of surface water (GWUDI) and meeting filtration avoidance criteria...

Must collect and have analyzed one colliform sample each day the turbidity of the source water exceeds 1 NTU. This sample must be collected from a tap near the first service connection.

" As per the IESWTR, states must conduct sanitary surveys for community surface water and GWUDI systems in this category every 3 years (unless reduced by the state based on outstanding performance).

#### **How is Compliance Determined?**

- Compliance is based on the presence or absence of total coliforms.
- Compliance is determined each calendar month the system serves water to the public (or each calendar month that sampling occurs for systems on reduced monitoring).
- The results of ROUTINE and REPEAT samples are used to calculate compliance.

#### A Monthly MCL Violation is Triggered if:

A system collecting fewer than 40 samples per month . . . Has greater than 1 ROUTINE/REPEAT sample per month which is total coliform-positive.

A system collecting at least 40 samples per month . . .

Has greater than 5.0 percent of the ROUTINE/REPEAT samples in a month total coliform-positive.

#### An Acute MCL Violation is Triggered if:

Any public water system . . .

Has any fecal coliform- or *E. coli*-positive REPEAT sample <u>or</u> has a fecal coliform- or *E. coli*-positive ROUTINE sample followed by a total coliform-positive REPEAT sample.

#### What are the Public Notification and Reporting Requirements?

For a Monthly MCL Violation

The violation must be reported to the state no later than the end of the next business day after the system learns of the violation.

The public must be notified within 14 days.2

For an Acute MCL Violation

The violation must be reported to the state no later than the end of the next business day after the system learns of the

violation.

The public must be notified within 72 hours.2

Must notify the state by the end of the day they are notified of the result or by the end of the next business day if the state office is already closed.

REPEAT samples that are fecal

coliform- or E. coli-positive . . .

Systems with ROUTINE or

# **Appendix D**

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs

-	Date	Location	Personnel	Plant Size and Flow	1 44
	6/13/2006	Tuluksak W-05-1	Garry Bowley		
•					

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.85				Primary Coagulant			Mixing		
Color	PCU	69				Coagulant Aid			Flocculation		
рН		7.33				Filter Aid			Settling		
Alkalinity	mg/l			٠		Pre pH Adjustment			Remarks		
Hardness	mg/l					Post pH Adjustment			**************		
Temp	F	36.5°				Other					
Fe	mg/l	7.92									
Mn	mg/l	0.297									
As	mg/l	_15									******
TDS	mg/l	79									

Comments & Notes	After about one hour with the water setting in a one leter beaker it starts to oxidize and change color but has no settling

Products Tested	Jar	Dose	Dose	рН	Turbidity		Color	Floc Size	1	Nater	Qual	ty mg	/1	Other
	No.	mg/l	μΙ		Settled	Filtered	Settled		Fe	Mn	As	Alk	Hard	
									-					
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Tuluksak W-05-1 6-13-06 Jar Test Sheet

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Printed 6/19/2006

CE2 Engineers, Inc	).
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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 2 of 44

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Date	Location	Personnel	Plant Size and Flow	
6/13/2006	Tuluksak W-05-2	Garry Bowley		

Water Q	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time	
Turbidity	NTU	1,99				Primary Coagulant			Mixing			
Color	PCU	74				Coagulant Aid			Flocculation	T		
рН		7.2				Filter Aid			Settling			
Alkalinity	mg/l					Pre pH Adjustment			Remarks	<u> </u>		
Hardness	mg/l					Post pH Adjustment						
Temp	F	35°				Other						
Fe	mg/l	7.98										
Mn	mg/l	0.331							***************************************		•••••	
As	mg/l	35									•••••	
TDS	mg/l	68										

Comments & Notes	After water sets in a 1 liter beaker for about one and one half hour it starts to oxidize and change color but has no noticable
settling in it.	
	***************************************

<b>Products Tested</b>	Jar	Dose	Dose	рΗ	Turbidity			Floc Size	1	Water	Qual	ty mg	/l	Other
	No.	mg/l	μl		Settled	Filtered	Settled		Fe	Mn	As	Alk	Hard	
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Tuluksak W-05-2 6-13-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 3 of 44

Date	Location	Personnel	Plant Size and Flow	
6/14/2006	Tuluksak W-05-1	Garry Bowley		

Water Qu	iality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Pro	ocedure	RPM	Time
Turbidity	NTU	0.85				Primary Coagulant			Mixing		330	2min
Color	PCU	69				Coagulant Aid			Flocculation		30	2min
pН		7.33				Filter Aid			Settling		0	1hr
Alkalinity	mg/l			٧		Pre pH Adjustment			Remarks After 5	min small	pin Flo	С
Hardness	mg/l					Post pH Adjustment			in beakers #2,3,&4 Jars 5&6 Overdo			
Temp	F	36.5°				Other			and maybe 4 still a	little pink		
Fe	mg/l	7.92							444444444444444444444444444444444444444		••••	
Mn	mg/l	0.297										
As	mg/l	15									•••••	
TDS	mg/l	79										

Comments & Notes After about one hour with the water setting in a one liter beaker it starts to oxidize and change color but has no settling

Looks like 5 mg/l is going to be optimum dose for KmNO4 See pictures 1,2&3

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	Color	Floc Size	\	Water	Qual	ity mg	/	Other
	No.	mg/I	ĵų	_	Settled	Filtered	Filtered		Fe	Mn	As	Alk	Hard	
KmNO4	1_	2			2.55	0.08	2	small pin	0.05	over				Mn Over limit low range test
	2	4			0.97	80.0	10	small pin	0.04	0.22				Good settling
	3	6			1.09	0.3	8	small pin	0.02	0.11				Good settling
	4	8				0.19		small pin	0.06	0.68				Stil A little pink overdose
	5	10						small pin						Overdose KmNO4
	6	12						small pin						Overdose KmNO4

Tuluksak W-05-1 6-14-06 Jar Test Sheet

D-	age	
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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs
Page 4 of 44

Date	Location	Personnel	Plant Size and Flow
6/15/2006	Tuluksak W-05-1	Garry Bowley	Pilot

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.88				Primary Coagulant			Mixing	320	2min
Color	PCU	72				Coagulant Aid			Flocculation	_	30min
pН		7.4				Filter Aid			Settling		30min
Alkalinity	mg/l					Pre pH Adjustment			Remarks Started with 5 m		
Hardness	mg/l					Post pH Adjustment			in all jars 330 rpm for 2min		
Temp	F	36°				Other			down to 30 rpm for 30 min t		
Fe	mg/l	7.96							to 330 rpm and added 80/20		
Mn	mg/l	0.302							Arctic Floc 12100 let run or		1
As	mg/l	15							then down to 30 rpm for 2 m	• • • • • • • • • •	
TDS	mg/l	80							to 10 rpm for 20 min let sett		(

Comments & Notes About 5 min after adding KMnO4 and turning rpm down to 30 had small pin floc present and it continued to build in all jars

Then after adding Stern Pac +Arctic Floc and turning rpm down to 10 started seeing floc formation and settling after 5min it looks a little heaver in 2,3&4

will see after readings are done.

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	Color	Floc Size	1	Water	Qual	ty mg	/1	Other
	No.	mg/I	μl		Settled	Filtered	Filtered		Fe	Mn	As	Alk	Hard	
KMnO4 Dose mg/l	1	5	5		0.32	0.06	0	Medlum	0.02	_0				
	2	5	10		0.28	0.06	0	Medium	0.01	0	0	90	2.79	As no noticeable color change
Stern Pac 80% +	3	5	15		0.42	0.07	3	Medium	0.04	0.04				
Arctic Floc12100 20%	4	5	20		0.46	0.06	0	Medlum	0.01	0.03				
Dose μΙ	5	5	25		0.69	0.07	0	Medlum	0.07	0.05				
	6	5	30		0.66	0.07	9	Medium	0.03	0.08				
														-

Tuluksak W-05-1 6-15-06 Jar Test Sheet

Page _____

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 5 of 44

Date	Location	Personnel	Plant Size and Flow
6/16/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	4.06				Primary Coagulant			Mixing		2min
Color	PCU	88				Coagulant Aid			Flocculation		2min
рН		7.1				Filter Aid			Settling		1hr
Alkalinity	mg/l	74				Pre pH Adjustment			Remarks Added KMnO4 a		
Hardness	mg/l	3.05				Post pH Adjustment			80/20 blend at the same time		
Temp	F	37				Other			for 2 min down to 30 rpm 2m		
Fe	mg/l	7.9	<u> </u>						to 10rpm 25minlet settle for		
Mn	mg/l	0.336							pin floc in all jars heaver in ic		
As	mg/l	35							lars 1,2&3 after settling jars		
TDS	mg/l	68							suspended floc and pluged gelmai		

Comments & Notes	I got greedy and added Stern Pac + Arctic Floc at the same time and it didn't remove the Mn it didn't have time to oxidize

Products Tested		Dose		рН	Turbidity	Turbidity	Color	Floc Size	Water Quality mg/l					Other
	No.	mg/l	الإ		Settled	Filtered	Filtered		Fe	Mn			Hard	
KMnO4 = mg/l dose	1	5	8		0.66	0.06	0	medium	0.02	0.28	d/r			
	2	5	10		1.1	0.05	0	medium	0.21	0.23	d/r			
	3	5	12		0.57	0.05	13	medium	0	0.48	d/r			
Stern Pac + Arctic	4	5	14		0.77	0.06	16	medlum	0	0.58	d/r			
Floc 12100 = µl	5	5	16		0.67	0.05	15	medlum	0.02	0.73	d/r			
	6	5	18		1.37	0.07	5	medium	0	0.6	d/r			

Tuluksak W-05-2 6-16-06 Jar Test Sheet

Page ____

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 6 of 44

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Date	Location	Personnel		g v v v
6/17/2006	Tuluksak W-05-1	Garry Bowley	Plant Size and Flow	
Water Quality	Raw Settled File	lened Diet Cha		

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	D				
Turbidity	NTU	0.86	1				Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Color	PCU	70				Primary Coagulant			Mixing		5min
рН		7.33	i			Coagulant Aid			Flocculation		<del>}</del>
Alkalinity		7.33	<b></b>	<b></b>		Filter Aid			Flocculation		5min
	mg/l			· .		Pre pH Adjustment			Settling	10	25mi
Hardness	mg/l				-	Post pH Adjustment		1	T		1hr
Temp	F	37				Other			Remarks: Mixed a blend of	ferric s	sulfate
Fe	mg/l	7.95				T			and arctic floc 12100 80/20 24	grams	
Mn	mg/l	0.31				<del> </del>			Ferric Sulfate to 6 grams Arctic	floc121	100
As	mg/l	15							and started jar test with oxygen	oxidize	2d
TDS	ma/l	80							water for oxidization I used air o	omnre	5501
UV254 (A)		D/R							and 3/8 copper tube with multiple	e 1/6" f	holes
Comments			1	m the water					drilled in it let run for 1 hr in 5gal	hrveko	4

Comments & Notes All this did was turn the water a little darker red brown and cloudy didn't read any of the jars because their wasn't any floc formation it didn't

Products Tested		Dose mg/l		рH	Turbidity Settled	Turbidity	True	Floc Size		W	ater Qu	rality m	ıq/I		
Ferric Sulfate Plus	1	111951				Filtered	Color		Fe	Mn	As	Alk	Hard	UV254	Other
Arctic Floc 12100	<del>-</del>	-	6		D/R	D/R	D/R	None	D/R	D/R	D/R	D/R	D/R	D/R	
	2		9												
80/20 blend	3		12											$\vdash$	
	4		15												
	5		18												
	6		21												
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Tuluksak W-05-1 6-17-06 Jar Test Sheet

Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/17/2006	Tuluksak W-05-2	Garry Bowley	
Water Quality	Raw Sottlard File	and Diet Charles House Die	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	DDes	Time
Turbidity	NTU	5.21				Primery Coagulant			Mixing	330	1
Color	PCU					Coagulant Aid			Oxidization With Air	100	1hr
рН		7.4				Filter Aid			Flocculation	30	2min
Alkalinity	mg/l					Pre pH Adjustment			Flocculation		25mi
Hardness	mg/l					Post pH Adjustment			Settling	1	30mi
Temp	F	65°				Other			Remarks: Took the water		
<u>Fe</u>	mg/l	9.42							bucket from yesterday and inje		
Mn	mg/l	0.331							3/8 copper tube with multiple 1		
As	mg/l	35							drilled in it let run for 1hr and b		
TDS	mg/t	70							into jars started test using Ster		
UV254 (A)		0.0168						,	Arctic Floc 12100 80/20 blend	ii i ac p	ius

Comments & Notes Have good floc formation in lower doses but it appears to be light in in color and airy the higher dose jars appear to be overdose 20,25 µl Will see after settling 30 min see pictures 6 & 7

Products Tested	Jar	Dose	Dose	ρН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	g/I		
. 1044043 100444	No.	mg/l	la l		Settled	Filtered	Color	PROC SIZE	Fe	Min	As	Alk		UV254	Other
Stem Pac Plus	1	L	8		1.15	0.14	0	medium	0.02	0.225	D/R	D/R	D/R	0.014	
Arctic Floc 12100	2		11		2.27	0.06	0	medium	0.02	0.119	D/R	D/R	D/R	0.012	
80/20 Blend	3		14		4.6	0.07	0	medium	0.1	0.243	D/R	D/R	D/R	0.022	
	4		17		8.32	0.2	12	medium	0.02	0.174	D/R	D/R	D/R	D/R	
•	5		20		11.3	0.07	11	small	0.03	0.184	D/R	DAR	D/R	D/R	
	6		25		22.2	0.11	D/R	cloudy	D/R	D/R	D/R	D/R	D/R		Plugged 5µl filter for 15 ml
·															Turbidity sample

Tuluksak W-05-2	6-17-06
Jar Test Sheet	

Page		

#### POTABLE WATER JAR TEST EVALUATION FORM

1	Date	Location	Personnel	Plant Size and Flow
	6/18/2006	Tuluksak W-05-1		
-				·

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.55	:			Primary Coagulant			Mixing		2min
Color	PCU	40		29		Coagulant Aid			Oxidization		30min
рH		7.2				Filter Aid			Flocculation	1	2min
Alkalinity	mg/l			·		Pre pH Adjustment			Flocculation	10	1
Hardness	mg/l					Post pH Adjustment			Settling	+	1hr
Temp	F	37				Other			Remarks: Started off with		
Fe	mg/l	7.98							mixed on high 2min turned dov		
Mn	mg/l	0.375							for 30min to oxidize Fe and Mr		
As	mg/l	35							up and added Stem Pac plus A		
TDS	mg/l	97							12100 90/10 blend then down		
UV254 (A)		0.0389							for2min down to 10rpm for 30n		

Comments & Notes I decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as I added KMnO4 to the three jars for well 2. I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend

Products Tested	Jar	Dose	Dose	pH	Turbidity	Turbidity	True	Floc Size		W	ater Qu	sality n	ıg/i		0.1
7700000 70000	No.	mg/l	μl		Settled	Filtered	Color	1100 5126	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 is mg/l dose	1	5	5	<u> </u>	0.27	0.11	0	medium	0.11	0.42				0.0247	
	2	5	10	<u> </u>	0.34	0.08	0	medium	0.04	0				0.0173	
Stem Pac plus Arctic	, 3	5	15		0.37	0.06	0	medium	0.04	0				0.0179	
Floc is µl dose	4	5	5												See sheet W-05-2
	5	5	10												See sheet W-05-2
	6	5	15												See sheet W-05-2

Tuluksak W-05-1	6-18-06
Jar Test Sheet	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow						
6/18/2006	Tuluksak VV-05-2								

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.58				Primary Coagulant			Mixing		2min
Color	PCU	43		31		Coagulant Aid			Oxidization		30mir
рН		7.11				Filter Aid			Flocculation		2min
Alkalinity	mg/l			٠		Pre pH Adjustment			Flocculation	10	
Hardness	mg/i					Post pH Adjustment			Settling		1hr
Temp	F	37				Other			Remarks: Started off with 5		
Fe	mg/l	8.43							mixed on high 2min turned dow		
Mn	mg/l	0.328							for 30min to oxidize Fe and Mn		
As	mg/l	35							up and added Stem Pac plus A		
TDS	mg/l	84							12100 90/10 blend then down t		
UV254 (A)		0.0607							for2min down to 10rpm for 30m		

Comments & Notes | I decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as ladded KMnO4 to the three jars for well 2. I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend

Products Tested	1	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		Wa	ater Qu		0.15		
	No.	mg/l	րլ		Settled	Filtered	Color	Color Flot Size		Mn	As	Alk	Hard	UV254	Other
KMnO4 is mg/l dose	1	5	5												See sheet for W-05-1
	2	5	10												See sheet for W-05-1
Stem Pac plus Arctic	3	5	15												See sheet for W-05-1
Floc is µl dose	4	5	5		0.21	0.06	_0	medium	0.02	0.125				0.0204	
	5	5	10		0.24	0.06	1	medium	0.02	0.265			<u> </u>	0.025	
	6	5	15		0.69	0.05	0	medium	0.18	0.267				0.026	
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Draduate Toetod	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Flor Cira		Wa	ater Qu	ı ality m	g/I	L	Other

Tuluksak W-05-2	6-18-06
Jar Test Sheet	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/18/2006	Tuluksak W-05-2		
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Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Timo
Turbidity	UTM	0.58				Primary Coagulant			Mixing		2min
Color	PCU	43		31		Coagulant Aid			Oxidization	_	30min
рН		7.11				Filter Aid		1	Flocculation		2min
Alkalinity	mg/l					Pre pH Adjustment			Flocculation	10	
Hardness	mg/!					Post pH Adjustment			Settling		1hr
Temp	F	37				Other			Remarks: Started off with !		
Fe	mg/I	8.43							mixed on high 2min turned dov		
Mn	mg/l	0.328							for 30min to oxidize Fe and Mn		
As	mg/l	35							up and added Stern Pac plus A		
TDS	mgЛ	84							12100 90/10 blend then down		
UV254 (A)		0.0607							for2min down to 10rpm for 30rr		

Comments & Notes I decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as I added KMnO4 to the three jars for well 2. I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend

Products Tested			Dose	рН	Turbidity	Turbidity	True	Floc Size		W:	ater Qu	sality n	ng/l		T
	No.	mg/l	hį		Settled	Filtered	Color	1 KK 312E	Fe	Min	As	Alk	Hard	UV254	Other
KMnO4 is mg/l dose	1	5	5												See sheet for W-05-1
	2	5	10							<u> </u>					See sheet for W-05-1
Stem Pac plus Arctic	3	5	15												See sheet for W-05-1
Floc is µl dose	4	5	5		0.21	0.06	0	medium	0.02	0.125				0.0204	*
•	5	5	10		0.24	0.06	1	medium	0.02	0.265			<del></del>	0.025	
	8	5	15		0.69	0.05	0	medium	0.18	0.267				0.026	

Tuluksak W-05-2	6-18-06
Jar Test Sheet	

Page	
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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/19/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.58				Primary Coegulant	•		Mixing	330	2min
Color	PCU	41				Coagulant Aid			Oxidization	18	30min
рН		7.15				Filter Aid			Flocculation	30	2min
Alkalinity	mg/i					Pre pH Adjustment			Flocculation	10	15min
Hardness	mg/l					Post pH Adjustment			Settling	0	1hr
Temp	F	37°				Other			Remarks: Started with KM	nO4 5 n	ng/l
Fe	mg/l	8.1							all jars mixed SP + AF12100 7	0/30 ble	end
Mn	mg/i	0.376							and did three jars for each well		
As	mg/l	15									
TDS	mg/l	96									
UV254 (A)		0.0182									

Commen	rts & Notes	Had good floc in all three jars for each well 2 floc smaller than well 1
į		

	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		W:	ter Qu	ality m	ıgΛ		O11
Products Tested		mgvī			Settled	Filtered	Color	FIOC 3129	Fe	Mn	As	Alk		UV254	Other
KMn04 dose mg/l	1	5	5		0.39	0.07	0	medium	0.02	0.375	d/r	ďr	d/r	0.006	
	2	5	10		0.58	0.11	5	medium	0.07	0.164	d∕r	d/r	d/r	0.0072	
	3	5	15		8.0	0.11	5	medium	0.04	0.155	d∕r	d∕r	d١r	0.0054	
Stern Pac plus Arctic															
Floc12100 dose µl															

Tuluksak W-05-1 6-19-06 Jar Test Sheet

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Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/19/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	עזע	0.6				Primary Coagulant			Mixing		2min
Color	PCU	43				Congulant Aid			Oxidization		30mii
рН		7.1				Filter Aid			Flocculation		2min
Alkalinity	mg/l			٠		Pre pH Adjustment			Flocculation		15mir
Hardness	mg/l					Post pH Adjustment			Settling		1hr
Temp	F	37				Other			Remarks: Started with KM		
Fe	mg/l	8.43							all jars mixed SP + AF12100 7		
Mn	mg/l	0.328						2	and did three jars for each well		
As	mg/l	35									
TDS	mg/l	84									
UV254 (A)		0.0399									

	Comments & Notes	Had good floc in all three jars for each well 2 floc smaller than well 1
i		مية المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب المراقب ال
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Products Tested	Jar	Dose	Dose	pН		Turbidity Filtered	True	Floc Size	Water Quality mg/l						Other
	No.	mg/l	<u>µ</u>		Settled		Color	1 AC 3126	Fe	Mn	As	Alk	Hard	UV254	Other
KMn04 dose mg/l	4	5	5		0.4	0.06	13	small	0.05	0.638	ď∕r	d∕r	d/r	0.0089	
	5	5	10		0.57	0.18	9	smail	0.04	0.448	d∕r	d/r	d/r	0.0085	
	6	5	15		0.73	0.07	12	small	0.07	0.485	d∕r	ďτ	d/r	0.0086	
Stem Pac plus Arctic															
Floc12100 dose µì															
70/30 blend															
					i i	Î									<del></del>

Tuluksak W-05-2 6-19-06 Jar Test Sheet

Page ____

Printed 6/22/2006

#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 13 of 44

Date	Location	Personnel	Plant Size and Flow	
6/19/2006	Tuluksak W-05-1	Garry Bowley		

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	עדע	0.58				Primary Coagulant			Mixing	<del></del>	2min
Color	PCU	41				Coagulant Aid			Oxidization		30mir
рН		7.15				Filter Aid			Flocculation		2min
Alkalinity	mg/l					Pre pH Adjustment			Flocculation		15min
Hardness	mg/l					Post pH Adjustment			Settling		1hr
Temp	F	37*				Other			Remarks: Started with KM		
Fe	mg/l	8.1							all jars mixed A C H + AF1210		
Mn	mg/l	0.376							blend and did jar test to find or		
As	mg/l	15							for well 1		
TDS	mg/i	96									
UV254 (A)		0.0182									

Comments & Notes As soon as I added the KMnO4 to the jars the water turned pink as if it was an over dose I used the same water from this mornings test but decided to run test anyway had good floc with KMnO4 water stayed a little bit pink until I added A C H blend will retest tomorrow

Products Tested	Jar	Dose	Dose	рΗ	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	rg/l		
(IOUND ICSES	No.	mg/l	hi		Settled	Filtered	Color	FIOC Size	Fe	₩n	As	Alk	Hard	UV254	Other
KMn04 dose mg/i	1	5	5		0.53	0.15	32	medium	0.01	0.012	ďτ	d∕r	d∕r	dΛr	
	2	5	10		0.28	0.07	31	medium	0.03	0	d/r	d/r	d∕r	-0.005	
	3	5	15		0.18	0.07	26	medium	0.05	0	ď٢	d٢	ďſ	-0.004	
A C H plus Arctic	4	5	20		0.2	0.1	5	medium	0.02	0	d∕r	d/r	d/r	d/r	
Floc12100 dose µl	5	5	25		0.12	0.1	10	medium	0.01	0	d∕r	d/r	d/r	dλ	
80/20 blend	6	5	30		0.12	0.08	15	medium	0.01	0	d∕r	d/r	d∕r	άλτ	

Tuluksak W-05-1 6-19-06 A Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/20/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.6				Primary Coagulant			Mixing	<del>-</del>	2min
Color	PCU	42				Coagulant Aid			Oxidization	<del></del>	30min
рН		7.21				Filter Aid			Mixing		2min
Alkalinity	mg/l	D/R		ų		Pre pH Adjustment			Flocculation	<del></del>	20min
Hardness	mg/f	D/R				Post pH Adjustment			Settling		30min
Temp	F	37°				Other			Remarks: Started with cold		1
Fe	mg/l	8.1							jars added KMnO4 had small p		
Mn	mg/l	0.378							it didn't oxidize as well as when		
As	mg/l	15							to 50° then added ACH plus Ar		
TDS	mg/l	94							12100 80/20 biend		•
UV254 (A)		0.0135	0.0230								

Comments & Notes

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	g/I		
1 TOUGGE TESTER	No.	mg/I	μΙ		Settled	Filtered	Color	/ ACC SIZE	Fe	Min	As	Alk		UV254	Other
KMn04 mg/l dose	1	5	10		0.78	0.07	2	small	0.01	0	ďr	d/r	d/r	0.0166	will read UV254 again after
	2	5	15		0.53	0.09	20	small	0.02	0	d∕r	d/r	d/r		setting in jars over night
	3	5	20		0.48	0.1	3	small	0	0	d/r	d/r	d∕r	0.0124	
ACH plus AF12100										•					
80/20 blend µl dose															
	7													0.0142	
	2													0.0141	
	3													0.0122	

Tuluksak W-05-1	6-20-06
Jar Test Sheet	

Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 15 of 44

Date	Location	Personnel	Plant Size and Flow
6/20/2006	Tuluksak W-05-2	Garry Bowley	:

Water Qu	ality	Raw	Settled	Filtered	D <del>i</del> st	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.6				Primary Coagulant			Mixing	1	2min
Color	PCU	42				Coagulant Aid -			Oxidization		30min
рН		7.21				Fitter Aid			Mixing		2min
Alkalinity	mg/l	D/R				Pre pH Adjustment			Flocculation		20min
Hardness	mg/l	D/R				Post pH Adjustment			Settling		30min
Temp	F	37*				Other			Remarks: Started with cold		·
Fe	mg/i	8.44							jars added KMnO4 had small p		
Mn	mg/l	0.341			·				it didn't oxidize as well as when		
As	mg/l	15							to 50° then added ACH plus Ar		
TDS	mg/i	84							12100 80/20 blend		
UV254 (A)		0.0269						-			

Comments & Notes	

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	ıg/I	·····	
riodocus (esteu	No.	mg/l	g/I μI		Settled	Filtered	Color	FIOC SIZE	Fe	Min	As	Alk		UV254	Other
KMnO4 mg/l Dose	4	5	10		0.57	0.11	16	small	0	0	D/R	D/R	D/R	0.0108	Will read UV254 again after
	5	5	15		0.76	0.13	6	small	0	0	D/R	D/R			setting in jars over night
ACH'Plus AF12100	6	5	20		0.9	0.07	19	small	0.04	0	D/R	D/R		0.0123	
80/20 blend µl Dose															
	4													0.0099	
	5													0.0142	
	6													0.012	
															· ·

Tutuksak W-05-2 6-20-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/21/2006	Tuluksak W-05-1	Garry Bowley	
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Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	lar Teeti	ng Procedure	Inc.	Tee
Turbidity	NTU	1.27				Primary Coagulant		Journal	Mixing	KmnO4	RPM	<del>}</del>
Color	PCU	35				Coagulant Aid			Oxidization	Татиго-4	1	2min 30mi
pH		7.2/7.5	cold/warm			Filter Aid			Mixing	ACH+AF12100		2min
Alkalinity	mg/l	D/R				Pre pH Adjustment	None		Flocculation	12.100		15mi
Hardness -	mg/I	D/R				Post pH Adjustment	None		Settling		-	30mi
Temp	F	37	·			Other			Remarks:	Started with KMn		
Fe	mg/l	9.09							it then let it o	doze and then add		
Mn	mg/1	0.361								oc 12100 90/10 ble		
As	mg/I	D/R(15)										
TDS	mg/I	101										
UV254 (A)		0.0201						<del>                                     </del>	<del> </del>			

-	Comments & Notes	Builds good floc and settles fairly fast
J	i	والمراجعة المراجعة والمراجعة والمراع
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Products Tested		Dose	i	рH	Turbidity	Turbidity	True	Floc Size		W:	ater Qu	ality m	rg/l		0.1
	No.	mg/l	l hi		Settled	Filtered	Color	1 WC 3128	Fø	Min	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5	5	7.57	0.3	0.07	16	medium	0.03	0.188	D/R	D/R		0.0149	
	2	5	10	7.65	0.31	0.05	D	medium	0.01	0.073	D/R	D/R		0.0129	
ACH plus Arctic Floc	3	5	15	7.65	0.32	0.07	7	medium	0.03	0.073	D/R	D/R	·D/R	0.0161	in the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se
12100 Dose µl	4	5	20	7.65	0.19	0.05	0	medium		0.085	D/R	D/R		0.0134	
90/10 blend	5	5	25	7.61	0.36	0.05	8	medium	0.02	0.073	D/R	D/R		0.0099	
	6	5	30	7.62	0.3	0.08	0	medium	0	0.086	D/R	D/R		0.0111	
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Tuluksak W-05-1 6-21-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 17 of 44

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Date	Location	Personnel	Plant Size and Flow
6/21/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Test	ing Procedure	RPM	Time
Turbidity	עדע	1.71				Primary Coagulant			Mixing	KMnO4		2min
Color	PCU	38				Coagulant Aid			Oxidization			30mir
рН		7.4				Filter Aid			Mixing	ACH+AF12100		2min
Alkalinity	mg/l	D/R				Pre pH Adjustment			Flocculation			15mir
Hardness	mg/l	D/R		·		Post pH Adjustment			Settling			30mir
Temp	F	37°				Other			Remarks:	Started with KMr		
Fe	mg/l	9.24							let it oxidize	then added ACH p		
Mn	mg/l	0.0343							Floc 12100 9			
As	mg/l	D/R(35)										
TDS	mg∕i	84										
UV254 (A)		0.0375										

Comments & Notes With the KMnO4 after 10 min. it was starting to build small pin floc but it is light in color well W-05-1 has same size floc but is red in color tincreased KMnO4 dose for this well

Products Tested	Jar	Dose	Dose	рН	Turbidity	* 1 * 1	True	Floc Size		W	ster Qu	ality m	g/I		
Products rested	No.	mg/i	μl		Settled	Filtered	Filtered Color	1.00 0.20	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7.5	5	7.66	0.71	0.05	17	large	0.01	0.041	D/R	D/R	D/R	0.0212	
	2	7.5	10	7.62	0.41	0.1	4	large	0.01	0.048	D/R	D/R	D/R	0.0422	
ACH plus Arctic Floc	3	7.5	15	7.57	0.58	0.04	4	large	0	0.002	D/R	D/R	D/R	0.0212	
12100 Dose µi	4	10	20	7.59	0.34	0.08	14	large	0	0	D/R	D/R	DAR	0.024	Over dose KMnO4
	5	7.5	25	7.6	0.33	0.06	4	large	0	0	D/R	D/R	D/R	0.0199	
	6	7.5	30	7.61	0.34	0.06	0	large	0	0	D/R	D/R	D/R	0.013	

Tuluksak W-05-2	6-21-06
Jar Test Sheet	

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date		Location		Perse	onnel			Plant Size and Flow							
6/22/2006	<u> </u>	Tuluksak V	N-05-1	Garry	Bowley										
Water Q	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar To	esting Procedure	RPM	Time			
Turbidity	NTU	1.02				Primary Coagulant			Mixing	KMnO4	<del>                                     </del>	2min			
Color	PCU	37				Coagulant Aid			Oxidizatio	ın	-	30min			
ρH		74				Citor Aid			Adinina	8014.857000	220	2			

ACH+AF 70/30 | 330|2min Alkalinity mg/l DIR Pre pH Adjustment Flocculation 15 20min Hardness mg/l D/R Post pH Adjustment Settling 0 30min Temp F 37° Other Started with KMnO4 had Remarks: Fe 9.03 mg/i good size floc in all jars addad ACH plus Mn 0.372 mg/l Arctic floc 12100 turned speed up to mix As D/R(15) mg/l then down but it didn't build floc as big as TDS mg/l 99 it was with just the KMnO4 floc goes from UV254 (A) 0.0203 small to large with increased dose

Comments & Notes	Looks like two much Arctic Floc12100 the floc appears to be coated and stays suspended has very slow settling in the lighter doses

Products Tested	3	Dose		рН	Turbidity	Turbidity	True	Floc Size		Wa	ater Qu	ality m	g/I		043
	No.	mg/i	μl		Settled	Filtered	Color	1100 320	Fe	Mn	A5	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	5	5	D/R	0.65	0.1	11	smail	0.02	0.04	D/R	D/R	D/R	0.0151	
	2	5	10	D/R	0.53	0.06	0		0.02	0.064	D/R	D/R	D/R	0.0154	
	3	5	15	D/R	0.63	0.07	0		0	0.102	D/R	D/R	D/R	0.0185	
ACH plus Arctic Floc	4	5	20	D/R	0.54	0.08	2		0.02	0.095	D/R	D/R	D/R	0.0136	
12100 70/30 blend	5	5	25	D/R	0.49	0.1	0		0.01	0.112	D/R	D/R	D/R	0.0168	
Dose µl	6	5	30	D/R	0.31	0.11	1	barge	0.01	0.111	D/R	D/R		0.0205	
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Tuluksak W-05-1 6-22-06 Jar Test Sheet

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CE2 Engineers, Inc.

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow						
6/22/2006	Tuluksak W-05-2	Garry Bowley							

Water Q	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	MU	1.51				Primary Coagulant			Mixing KMnO4	312	2min
Color	PCU	39				Coagulant Aid			Oxidization	15	30min
рН		7.4				Filter Aid			Mixing ACH+AF 70/30	312	2min
Alkalinity	mg/l	D/R		is		Pre pH Adjustment			Flocculation	15	20min
Hardness	mg/l	D/R				Post pH Adjustment			Settling	0	30min
Temp	F	37°				Other			Remarks: Started with KM	nO4 had	j
Fe	mg/l	9.21							good size floc in all jars addad	ACH plu	JS SL
Mn	rng/l	0.0344							Arctic floc 12100 turned speed	up to m	ix
As	mg/1	D/R							then down but it didn't build flo	as big	<b>8</b> \$
TDS	mg/l	86							it was with just the KMnO4		
UV254 (A)		0.0373									

Comments & Notes	Looks like two much Arctic Floc12100 the floc appears to be coated and stays suspended has very slow settling in all jars
1	
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Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		₩z	nter Qu	ality m	g/T		Other
11000001163160	No.	mg/l	μi		Settled	Filtered	Color	1100 3026	Fe	Mn	ÁS	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7	5	D/R	0.87	0.1	21	Small	0.01	0.081	D/R	D/R	D/R	0.016	
	2	7	10	D/R	0.41	0.09	0	Small	0.01	0.093	D/R	D/R	D/R	0.0189	
	3	7	15	D/R	0.42	0.08	0	Small	0.02	0.137	D/R	D/R	D/R	0.0121	
ACH plus Arctic Floc	4	7	20	D/R	0.84	0.08	0	Small	0.02	0.07	D/R	D/R	D/R	0.0137	
12100 70/30 blend	5	_ 7	25	DIR	1.16	0.1	0	Small	0.14	0.089	D/R	D/R	D/R	0.0198	
Dose µl	6	7	30	D/R	0.52	0.1	0	Smail	0.03	0.101	D/R	D/R	D/R	0.0304	

Tukksak W-05-2 6-22-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/23/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU					Primary Coagulant			Mixing KMnO4		2min
Color	PCU	40				Coagulant Aid			Oxidization		30mir
pH		7.4				Filter Aid			Mixing Pax XL-9 +AF		3min
Alkalinity	mg/l					Pre pH Adjustment		į i	Flocculation	<del></del>	20min
Hardness	mg/l					Post pH Adjustment			Settling		30mir
Temp	F	37°				Other			Remarks: Noticed color in		
Fe	mg/I	6.39							jars was a little two pink when		
Mn	mg/I								the KMnO4 into them so I redu		
As	mg/l								to 4 mg/l and checked raw wa		
TDS	mg/i								noticed slight odor in it continu		
UV254 (A)		0.0265							with Pax XL-9 plus Arctic Floc		

Comments & Notes Had a lot of pin floc with the KMnO4 in all jars put the first three stayed a little bit pink until after I added the Pax XL-9 plus arctic floc 12100 and reduced speed had large floc after 10min on slow speed has settlin during flocculation and is clear between floc

Products Tested	ı	Dose	1	рН	Turbidity	Turbidity	True	Floc Size		Wa	ter Qu	ality n	ıg/l		
	No.	mg/l	Ш		Settled	Filtered	Color	100 3129	Fe	Min	As	Ak	Hard	UV254	Other
KmnO4 dose mg/l	1	5	5		0.54	0.07	0	medium	0.08	0.03				0.0233	
	2	5	10		1.6	0.08	15	medium	0.04	0.101				0.0215	Overdose KMnO4
	3	5	15		0.8	0.08	15	medium	0.03	0.364				0.0237	Overdose KMnO4
PAX XL-9 plus Arctic	4	4	20		0.42	0.07	0	large	0.01	0.168				0.0187	
Floc 12100 dose µl	5	4	25		0.6	0.09	0	large	0.03	0.352				0.0199	
90/10 blend	6	4	30		0.5	0.07	0	large		0.093				0.0194	
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Tuluksak W-05-1 6-23-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date		Location		Perso	onnel			Plant Size ar	nd Flow			
6/23/2006	3/2006 Tuluksak W-05-2			Garry	Bowley							
Water Qua	lity	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Te	sting Procedure	RPM	Time
Turbidity	עדע					Primary Coagulant			Mixing	KMnO4	310	2min
Color	PCU					Coagulant Aid			Oxidization		15	30min

Trailer Qua	HILY	<u> </u>	Secred	- intered	Dest	Chemical Usage	Product	Dose mg/l	Jar Testi	ng Procedure	RPM	Time
Turbidity	UTU					Primary Coagulant			Mixing	KMnO4	310	2min
Color	PCU					Coagulant Aid			Oxidization		15	30min
рH						Filter Aid			Mixing	Pax XL-9+AF 90/10		2min
Alkalinity	mg/I			٠		Pre pH Adjustment			Flocculation			20min
Hardness	mg/I					Post pH Adjustment			Settling		-	45min
Temp	F					Other			Remarks:		<u> </u>	1
Fe	mg/l	8.34										
Mn	mg/l						······································		<u> </u>			
As	mg/i										•	
TDS	mg/l										<del></del>	
UV254 (A)		0.0347										

Comments & Notes Has good oxidization and pin floc with KMnO4 10min after adding the Pax XL-9 plus AF12100 and mixing it has good floc formation smaller in lower doses but large in higher dose has settling during mixing and is clear between floc but it also looks like this is going to have some floaters (see picture)

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size		Wa	iter Qu	ality m	ng/l		
	No.	mg/l	μl		Settled	Filtered	Color	FIOC SIZE	Fe	Min	As	Alk		UV254	Other
KMnO4 dose mg/l	1	7	5		0.57	0.05	7	sma@	0.02	0.07				0.0292	
	2	7	10		0.5	0.07	0	smali	0.01	0.302				0.0286	
	3	7	15		0.71	0.16	0	medium	0.02	0.138				0.0264	
Pax XI-9 plus Arctic	4	7	20		0.44	0.07	0	medium	0	0				0.0385	
Floc 12100 dose µl	5	7	25		0.87	0.06	0	large	0.04	0.016				0.0274	
90/10 blend	6	7	30		0.68	0.07	0	large	0.03	0				0.0211	
	<b> </b>	<u> </u>													
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Tuluksak W-05-2	6-23-06
Jar Test Sheet	

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/24/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	rality	Raw	Settled	Fil	itered	Dist	Water Quality	Raw	Filtered	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.62					Ammonia (as Nitrogen)	mg/1 0.36		Mixing KMnO4		3min
Color	PCU	40					Dissolved Oxygen mg/l	5.7		Oxidization		30min
pН		7.35	mV -13.2				Hydrogen Sulfide mg/l	0.04		Mixing Pax XL-9+AF12100 70/30		3min
Alkalinity	mg/s	90		<u> </u>			Carbon Dioxoid mg/l	45		Flocculation		20min
Hardness	mg/l	2.79								Settling		35min
Temp	F	37*								Remarks:	<u>_</u>	10011111
Fe	mg/l	5.01	Ferrous n	1g/]	2.05							
Mn	mg/l	0.334										
As	mg/l	15										<del></del>
TDS	mg/i	82 Cond	178.0 µs	Sal 0.	.1‰							
UV254 (A)		0.0271										

1	_	
1	Comments & Notes	Checked the water malify this morning and noted change in total into and adjusted KMADA does for instant
1	1	Checked raw water quality this morning and noted change in total iron and adjusted KMnO4 dose for jar test
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1	l .	بيشد بر بيشانولوردو ويد در بيشدند ويود ويده المسائلة ويدو ويده المسائلة ويدو ويده المسائلة ويدو والمراز ويدو ويدو ويود ويدو ويدو ويود ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو ويدو وي
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Products Tested	1	Dose		рΗ	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	grī		O44
	No.	mg/I	<u>μ</u> Ι		Settled	Filtered	Color	1 rot size	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	4	5	7.15	0.62	0.11	5	Small	0	0	D/R	D/R	D/R	0.0218	
	2	4	10	7.18	0.64	0.11	11	Small	0	0	D/R	D/R	D/R	0.0157	
Pax XL-9 Plus Arctic	3	4	15	7.23	1.19	0.12	15	Small	0	0	D/R	D/R	D/R	0.0168	
Floc 12100 70/30	4	4	20	7.3	1.33	0.12	4	Small	0.04	0.001	D/R	D/R	D/R	0.0162	
olend Dose µl	5	4	25	7.31	1.91	0.21	15	Smail	0	0	D/R	D/R	D/R	0.0141	
	6	4	30	7.29	2.62	0.25	17	Small	0.04	0.001	D/R	D/R	D/R	0.0162	
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Tuluksak W-05-1 6-24-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/24/2006	Tuluksak W-05-2	Garry Bowley	
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Water Qu	ıality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Filtered	Jar Testing Procedure	RPM	Time
Turbidity	UTM	0.69				Ammonia (as Nitrogen)	mg/l 0.96		Mixing KMnO4	1 1	3min
Color	PCU	45				Dissolved Oxygen mg/l	5.8		Oxidization	1	30min
рH		7.31	mV -12.9			Hydrogen Sulfide mg/l	0.02		Mixing Pax XL-9+AF12100 70/30	<del></del>	3min
Alkalinity	mg/l	75		۰		Carbon Dioxoid mg/l	60		Flocculation	1	20min
Hardness	mg/l	3.05							Settling		35min
Temp	F	37*							Remarks:		
Fe	mg/i	9.63	Ferrous m	ng/1 2.87							<del></del>
Mn	mg/l	0.279								······································	
As	mg/l	15									
TDS	mg/l	83 Cond	179.8 µs 5	Sal 0.1%							
UV254 (A)		0.0279									

Comments & Notes Checked raw water quality this morning and started jar test with Pax XL-9 plus Arctic Floc 12100 70/30 blend it had small floc and the settling was a little slow and a little cloudy on the bottom.

Products Tested	ŧ	E .	Dose	pН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	ıg/l	,	044
	No.	mg/i	ul		Settled	Fätered	Color	1100 3128	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7	5	7.56	0.6	0.14	20	Small	0	_0	D/R	D/R	D/R	0.0247	
	2	7	10	7.7	0.48	0.09	13	Small	0	0	D/R	D/R	D/R	0.0283	
Pax XL-9 Plus Arctic	3_	7	15	7.77	0.52	0.09	9	Small	0	0	D/R	D/R	D/R	0.035	
Floc 12100 70/30	4	7	20	7.78	0.96	0.09	14	Small	0	0	D/R	D/R	D/R	0.0272	
blend Dose µ1	5	7_	25	7.76	1.16	0.09	0	Smalf	٥	0	D/R	D/R		0.0202	
	8	7	30	7.78	1.06	0.1	12	Small	0.01	0	D/R	D/R		0.0173	
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Tuluksak W-05-2 6-24-06 Jar Test Sheet

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Printed 6/26/2006

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/25/2008	Tutuksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	F	iltered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.17					Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min
Color	PCU	35					Dissolved Oxygen mg/l			Oxidization		30min
рН		7.35	mV -13.1				Hydrogen Sulfide mg/l			Mixing Pax XL-9+AF12100 80/20		3min
Alkalinity	mg/l	90			٥		Carbon Dioxoid mg/l			Flocculation		25min
Hardness	mg/l	2.79								Settling		40min
Temp	F	35"							1	Remarks:		
Fe	mg/l	8.64	Ferrous r	ng/l	D/R							
Mn	mg/l	0.325		T				· · · · · · · · · · · · · · · · · · ·	İ			
As	mg/l	15										
TDS	mg/l	80 Con	d. 198.5µs	Sal.	.0 1‰							
UV254 (A)		0.0261		T								-
01207 (1)		0.0201	<u> </u>						L			

Comments & Notes Checked raw water quality this morning the iron is back up to 8.63 mg/l and temp is down 2° NTU is as low as I have seen it on raw water in this well. Continued jar test adjusted KMinO4 Dose for higher iron and used Pax XL-9 plus Arctic Floc 12100 80/20 blend built pretty good floc kind of small but was clear between it settling rate is a little slow but condenses in the bottom of jars.

Products Tested	Jar	Dose	Dose	рH	Turbidity	Turbidity	True	Floc Size		Wa	iter Qu	ality m	ıg/l		
1,000cc reaco	No.	mg/i	иl		Settled	Filtered	Color	710C 312B	Fe	Mn	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5	5	7.38	0.31	0.08	0	Small	0.02	0.022	D/R	D/R	D/R	0.0178	
	2	5	10	7.38	0.46	0.07	0	Small	0.01	0.026	D/R	D/R	D/R	0.0165	
Pax XL-9 Plus Arctic	3	5	15	7.36	0.44	0.09	0	Smat	0	0.026	D/R	D/R	D/R	0.0169	,
Floc 12100 80/20	4	5	20	7.35	0.51	0.07	0	Small	0.02	0.029	D/R	D/R	D/R	0.015	
Biend Dose µi	5	5	25	7.35	0.7	0.09	0	Small	0.04	0.05	D/R	D/R	D/R	0.0161	
	6	5	30	7.3	0.89	0.11	0	Small	0.02	0.089	D/R	D/R	D/R	0.0135	
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Tutuksak W-05-1 6-25-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

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Date	Location	Personnel	Plant Size and Flow
6/25/2006	Tuluksak W-05-2	Garry Bowley	
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ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPU	Time
NTU	0.19				Ammonia (as Nitrogen)	mg/l				3min
PCU	37				Dissolved Oxygen mg/l					30mi
	7.29	mV -11.6			Hydrogen Sulfide mg/l				<del>                                     </del>	3min
mg/l	75				Carbon Dioxoid mg/l			Flocculation	-	25mir
mg/i	3.05							Settling		35mii
F	35°							Remarks:		100
mg/l	9.8	Ferrous n	ng/l							
mg/l	0.277									
mg/l	35									
mg/l	82 Cond	l. 185.5µs 3	Sai .0 1%							
	0.0529									
	MTU PCU mg/l mg/l F mg/l mg/l	NTU 0.19 PCU 37 7.29 mg/l 75 mg/l 3.05 F 35' mg/l 9.8 mg/l 0.277 mg/l 35 mg/l 82 Cond	NTU 0.19 PCU 37 7.29 mV -11.6 mg/l 75 mg/l 3.05 F 35' mg/l 9.8 Ferrous n mg/l 0.277 mg/l 35 mg/l 82 Cond 185.5µs 3	NTU 0.19 PCU 37 7.29 mV -11.6 mg/l 75 mg/l 3.05 F 35' mg/l 9.8 Ferrous mg/l mg/l 0.277 mg/l 35 mg/l 82 Cond 185.5µs Sal.0 1‰	NTU 0.19 PCU 37 7.29 mV -11.6 mg/l 75 mg/l 3.05 F 35' mg/l 9.8 Ferrous mg/l mg/l 0.277 mg/l 35 mg/l 82 Cond. 185.5µs Sal.0 1‰	NTU         0.19         Ammonia (as Nitrogen)           PCU         37         Dissolved Oxygen mg/l           7.29         mV -11.6         Hydrogen Sulfide mg/l           mg/l         75         Carbon Dioxoid mg/l           mg/l         3.05         Img/l           F         35°         Img/l           mg/l         9.8         Ferrous mg/l           mg/l         0.277         Img/l           mg/l         35         Img/l           mg/l         82         Cond. 185.5µs Sal .0 1‰	NTU         0.19         Ammonia (as Nitrogen)         mg/l           PCU         37         Dissolved Oxygen mg/l           7.29         mV -11.6         Hydrogen Sulfide mg/l           mg/l         75         Carbon Dioxoid mg/l           mg/l         3.05         Terrous mg/l           mg/l         9.8         Ferrous mg/l           mg/l         0.277         Terrous mg/l           mg/l         35         Terrous mg/l           mg/l         32         Cond. 185.5µs Sal .0 1‰	NTU         0.19         Ammonia (as Nitrogen)         mg/l           PCU         37         Dissolved Oxygen mg/l           7.29         mV -11.6         Hydrogen Sulfide mg/l           mg/l         75         Carbon Dioxoid mg/l           mg/l         3.05         The control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the cont	NTU         0.19         Ammonia (as Nitrogen)         mg/l         Mixing         KMnO4           PCU         37         Dissolved Oxygen mg/l         Oxidization           7.29         mV -11.6         Hydrogen Sulfide mg/l         Mixing         Pax XL-9+AF12100 80/20           mg/l         7.5         Carbon Dioxoid mg/l         Flocculation           mg/l         3.05         Settling           F         35'         Remarks:           mg/l         9.8         Ferrous mg/l           mg/l         0.277         Remarks:           mg/l         35         Settling           mg/l         35         Settling	NTU         0.19         Ammonia (as Nitrogen)         mg/l         Mixing         KMnO4         312           PCU         37         Dissolved Oxygen mg/l         Oxidization         14           7.29         mV -11.6         Hydrogen Sulfide mg/l         Mixing         Pax XL-9+AF12100 80/20         312           mg/l         3.05         Flocculation         14           mg/l         3.05         Settling         0           F         35'         Remarks:           mg/l         0.277         Remarks:         0           mg/l         35         No.277         No.

Comments & Notes checked raw water quality this morning the only difference was the temp down 2° continued jar test using Pax XL-9 plus Arctic Floc 12100 80°20 blend it bullt nice floc and settled out good

Products Tested	4	Dose	1	pН	Turbidity	Turbidity	True	Floc Size		W	ter Qu	ality m	ıg/l		
	No.	mg/l	Lh _I		Settled	Filtered	Color	7.00 0128	Fe	Min	As	Alk		UV254	Other
KMnO4 Dase mg/l	1	7	5	7.56	0.34	0.08	0	Medium	0.02	0.022	D/R	D/R		0.0297	
	2	7	10	7.69	0.43	0.07	0	Medium	0.04	0.013	D/R	D/R	D/R	0.0287	
Pax XL-9 plus Arctic	3	7	15	7.7	0.56	0.08	0	Medkum	0.03	0	D/R	D/R	D/R	0.0195	
Floc 12100 80/20	4	7	20	7.73	0.68	0.08	0	Medium	0.02	0.039	D/R	D/R	D/R	0.019	
olend Dose µl	5	7	25	7.73	0.69	0.07	0	Medium	0.03	0.018	D/R	D/R	D/R	0.0173	
	6	7	30	7.75	0.75	0.06	0	Medium	0	0.051	D/R	D/R	D/R	0.0331	
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Tuluksak W-05-2 6-25-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow					
6/26/2006	Tuluksak W-05-1	Garry Bowley						

Water Qu	ıality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	POM	Time	
Turbidity	NTU	0.28				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min	
Color	PCU	34				Dissolved Oxygen mg/l			Oxidization		30min	
pH		7.44	mV -19.8			Hydrogen Sulfide mg/l			Mixing Nalco 8185		3min	
Alkalinity	mg/l			*		Carbon Dioxoid mg/l			Flocculation		25min	
Hardness	mg/l					·			Settling		45min	
Temp	F	34.7							Remarks: Started jar test after che			
Fe	mg/l	8.88	Ferrous m	1g/l					water this morning the KMnO4 coodize			
Mn	mg/l	0.36							lots of pin floc with the dose of 5mg/li			
As	mg/l								the iron is back up and the temp is do		****	
TDS	mg/1	81 Con	nd 185.0 µs	Sal 0.1‰					flocculation run 5min longer because this is slow			
UV254 (A)	1	0.0311							reacting kind of cloudy			

Comments & Notes Settling rate is a little slow floc is small and you won't have a very long filter run it plugged up the 5µl syringe filter about half way through the sampling

Products Tested	K .	Dose	1	pН	Turbidity	Turbidity	True	Floc Size		W	ter Qu	ality m	ıg/l		
	No.	mg/l	hl		Settled	Filtered	Color	1100 010	Fe	Min	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	5	5	D/R	1.17	0.08	0	Small	0.03	0.143	D/R	D/R		0.0218	· · · · · · · · · · · · · · · · · · ·
	2	5	10	D/R	0.7	80.0	0	Small	0.02	0.165	DIR	DÆ	D/R	0.011	
Nalco 8185 Dose μl	3	5	15	D/R	0.42	0.07	0	Small	0	0.05	D/R	D/R		0.0091	
	4	5	20	D/R	0.69	0.09	0	Small	0.04	0.085	D/R	D/R		0.0281	
	5	5	25	D/R	0.57	0.1	0	Small	0.06	0.065	D/R	DAR	D/R	0.0228	
	8	5	30	D/R	0.72	0.15	0	Small	0.07	0.432	D/R	D/R	D/R	0.0246	
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Tuluksak W-05-1 6-26-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/26/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.17				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4	310	3min
Color	PCU	50				Dissolved Oxygen mg/l			Oxidization	14	30min
pН		7.36	mV -15.3			Hydrogen Sutfide mg/l			Mixing Nalco 8185	310	3min
Alkalinity	mg/l			~		Carbon Dioxoid mg/l			Flocculation	14	20min
Hardness	mg/l								Settling	0	40min
Temp	F	35.4*							Remarks: Checked raw water this	momin	ng it
Fe	mg/l	9.84	Ferrous	mg/l					is about the same as yesterday temp	is .4" hi	gher
Mn	mg/l	0.351							This well builds better looking floc fas	ter than	well
As	mg/l							·	05-1 with 8185 in all jars with different	doses	
TDS	mg/l	83 Con	d 189.1 µs	Sal 0.1‰							
UV254 (A)		0.069									

Comments & Notes Settling rate is a little slow but the water looks clear floc stayed suspended and then settled down this well will have about twice the filter run time with nalco 8185 than W-05-1

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		Wa	rter Qu	ality m	ığı		Other
Products rested	No.	mg/l	μl		Settled	Filtered	Color	rioc Size	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7	5	D/R	0.44	0.07	0	Medum	0.05	0.077	D/R	D/R	D/R	0.0356	
	2	7	10	DAR	0.32	0.07	0	Medum	0.06	0.07	D/R	D/R	D/R	0.0133	
Nalco 8185 Dose µl	3	7	15	DAR	0.53	0.09	0	Medum	0.02	0.024	D/R	D/R	D/R	0.0087	
	4	7	20	D/R	0.97	0.1	0	Medum	0.04	0	D/R	D/R	D/R	0.0191	
	5	7	25	D/R	0.55	0.1	0	Medum	0.04	0	D/R	D/R	D/R	0.0057	
	6	7	30	D/R	0.56	0.15	0	Medum	0.09	0.054	D/R	D/R	D/R	0.0333	
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Tuluksak W-05-2 6-26-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow					
6/27/2006	Tuluksak W-05-1	Garry Bowley						

Water Qu	ality	Raw	Settled	1	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	Inne	1
Turbidity	NTU	0.9		T			Ammonia (as Nitrogen)	mg/l	- TOMEO	Mixing KMnO4	<del></del>	Time
Color	PCU	41					Dissolved Oxygen mg/l			Oxidization		2min
рН		7.25	mV				Hydrogen Sulfide mg/l			Mixing Stem Pac Plus Arctic Flor		30mir
Alkalinity	mg/l						Carbon Dioxoid mg/l			Flocculation		2min
Hardness	mg/l			$\bot$						Settling		30mir
Temp	F	35°	<u> </u>	$\perp$						Remarks: I didn't like what was ha		
<u>Fe</u>	mg/l		Ferrous	mg/	1					the 300 gal tank after adding chemica		
Mn	mg/l	0.404		4						this jar test.		
As	mg/l											
TDS	mg/l	Cond	ps	Sa	%-							
UV254 (A)	1			T								

Comments & Notes After taking readings it would appear that the KMn04 dose in the 300 gal tank is a little bit of an overdose looking at turbidity and apparent color for both the 300gal tank and the jar with 6mg/l KMnO4 have close to the same turbidity (see pictures for today)

<b>Products Tested</b>		Dose		Hq	Turbidity	Turbidity	True	Floc Size		W	ater Qu	zality m	IQ/I		
	No.	mg/l	וע		Settled	Filtered	Cotor	1 100 322	Fe	Mn	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5	10		0.41	80.0	0	smail						0.207	
	2	6	10		2.99	0.25	0	smail							
SP + AF 80/20 µl	3	7	10												OVERDOSE KMnO4
Out of 300 gal tank	4		10		2.65	0.08	0	small	0	0.09					
								<del> </del>							
·							······································								

Tuluksak W-05-1 6	-27-06
Jar Test Sheet	

Page	

Appendix D - Jar & Pilot Study Logs Page 29 of 44

CE2 Engineers, Inc.

#### PILOT TESTING LOG

Date .	Location	Water Source	Personnel
6/27/2006	Tuluksak W-05-01	Raw Water	Garry Bowley

Raw V	Vater (	Quality	Chemicals Used	Dose mg/l	Treatment Vessel Informati	on
Turbldity	NTU	0,9	KMnO4	5 mg/l	Flow Rate GPM	
Color	PCU	41			Vessel Description	GPM/sq ft
рН		7.25	Stern Pac Plus	11 mg/l		
Alkalinity	mg/l		Arctic Floc 12100			
Hardness	mg/l		80/20 Blend			
Temp	F	35°				
Fe	mg/i	11.44			Other Notes I didn't like what was h	appening
Mn	mg/l	0.404			with the water in the 300 gal tank and di	
As	mg/i				test to determine what was going on with	
TDS	mg/l				in the 300gal tank	*************
UV254 (A)						•••••••

Treatment Process Objective	
	Hauled water in and preheated to 54° added 5 grams KMnO4 to it mixed on high
	oxidize for 30min turned speed up and added 11 ml of Stern Pac plus Arctic
Floc 12100 80/20/ blend to it took	one minute to add 11 ml mixed on high for 5min then down to about 14 rpm
for 25min and turned mixer off wat	er stayed turning for 30min started taking readings at norts on tank

INVALCE OF Tage Quelin		
Sketch of Test Setup		
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Tuluksak W-05-1 8-27-08 Pilot Testing Sheet

Page ____

Printed 6/28/2006

Appendix D - Jar & Pilot Study Logs Page 30 of 44

#### CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Time	(S)tart (M)iddle (E)nd	Description of Process Step, Test Results, Adjustments
8/27/2008	3:00pm		45min after stopping mixer took turbidity readings on the three taps on tank
		ITan	NTU 9.67 through 1.2µl filter 0.10
· · · · · · · · · · · · · · · · · · ·		Тор	Ptco 307 through .45µl filter 15
		Middle	NTU 9.67 through 1.2µl filter 0.10
			Ptco 382 through .45µl filter 17
and the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of t		Bottom	NTU 9.67 through 1.2µl filter 0.10
		Dollori	Ptco 387 through .45µl filter 34
	5:00pm		
		Тор	NTU 4.95 through 1.2µl filter 0.28 Ptco 107 through .45µl filter 10
			100 107 Kill Ough . 40pt litter 10
		Middle	NTU 8.85 through 1.2µl filter 0.40
-		<u> </u>	Ptco 200 through .45µl filter 15
		D-4	NET 1 40 0 Abrough 4 0 d 60 c 000
		Bottom	NTU 10.9 through 1.2µl filter 0.62 Ptco 285 through .45µl filter 22
			The Lot another Population LL
	10:00pm	1	NTIL 240 Married 40 LOV
		Тор	NTU 3.10 through 1.2µl filter 0.10
		Middle	NTU 4.32 through 1.2µl filter 0.11
		Bottom	NTU 5.09 through 1.2µl filter 0.07
			Fe 0.02
-			
1		1 1	

Tuluksak	W-05-1	6-27-06
Pllot Test	na Shee	t

# PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 31 of 44

Date 6/28/2006	Water Source W-05-1	Personnel Garry Bowley

Raw V	Vater (	Quality	Chemicals Used	Dose mg/l	Treatment Vessel Informa	tion
Turbidity	NTU	0.9			Flow Rate GPM	0.5
Color	PCU	41			Vessel Description	GPM/sq ft
рН		7.25			8" X 60" Clear PVC Multi Media 1.5	
Alkalinity	mg/l					
Hardness	mg/i					
Temp	F	35*				
Fe	mg/l	11.44			Other Notes	
Mn	mg/I	0.404			***************************************	••••••
As	mg/l	35			***************************************	
TDS	mg/i	82				************
UV254 (A)	]	0.0269				

Treatment Process Objective	To remove Iron, Manganese, Arsenic and Color
Taxatanant Danasaa Danasiatia	
Oridation Consulation 2.10	Raw Water hauled and batch treated in 300gal tank (see figure 4- Chemical
Oxidation, Coagulation, Settlemen	t, And Multimedia Filtration)
	***************************************

Sketch of Test Setup		
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Tuluksak W-05-1 6-28-06 Pilot Testing Sheet

Page ____

Printed 7/2/2008

Appendix D - Jar & Pilot Study Logs Page 32 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

Tlme	(S)tart (M)iddle (E)nd	Description of Process Step, Test Results, Adjustments
9:00am		Water readings in the 300 gal tank before starting through filter at the three taps
	Тор	NTU settled 1.94 through 1.2µl filter 0.09
		Fe 0.03
		Ptco 0
		Mn 0.454
		PH 7.28
· · · · · · · · · · · · · · · · · · ·		
	Middle	NTU settled 2.65 through 1.2µl filter 0.13
		Fe 0.03
		Ptco 0
<del></del>		Mn 0.454
		PH 7.16
	Bottom	NTU_settled 2.69 through 1.2µl filter 0.12
		Fe 0.03
~		Ptco 0
		Mn 0.454
		PH 7.28
10:30am		Started water through filter ran it filter to waste for 15min and took readings
11:00am		NTU 0.29
		Fe 0.00
		Ptco 0
		Mn Over limit low range
		PH 7.26
11:15am	1	Checked tap water quality because of Mn being high
	The second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second na	NTU 0.35
and the said of the said of the said of the said of the said of the said of the said of the said of the said of	1	Fe 0.02
	The second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second name of the second na	Ptco 31
		Mn Over limit low range high range 3.4mg/l
		PH 6.80
1:30am		NTU 0.19
		Fe 0.00
	San San San San San San San San San San	Pitco 2
		Mn High range 2.1mg/l
	l li	PH 7.24
		Time (M)iddle (E)nd  9:00am  Top  Middle  Bottom  11:00am  11:15am

Tuluksak W-05-1 6-28-06 Pilot Testing Sheet

Page ____

Printed 7/2/2008

Appendix D - Jar & Pilot Study Logs Page 33 of 44

CE2 Engineers, Inc.

#### PILOT TESTING LOG

OLZ LI	igineers, i		PILOT TESTING LOG			
Date	Time	(M)iddie	Description of Process Step, Test Results, Adjustments			
6/28/2006	11:00am		Raw Water quality check	Time		
			UV254 0.0269	1:45pm	Out of center tap on tank pushe	
			NTU 1.02		through 1,2µl filter	
			Fe 9.24		NTU 0.09	
			Ptco 41		Mn 0.052	
			Mn 0.612		Fe 0.00	
			PH 7.35	Mild Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the C	Ptco 0	
	12:00pm		NTU 0.08	2:00pm	NTU 0.07	
			Fe 0.01		Fe 0.00	
			Ptco 0		Ptco 0	
			Mn 1.2		Mn 0.4	
			PH 7.21		PH 7.25	
			UV254 0.0179		UV254 D/R	
	12:30pm		NTU 0.07	2:30pm	NTU 0.07	
			Fe 0.00		Fe 0.00	
			Ptco 0		Ptco 0	
			Mn 0.9		Mn 0.3	
			PH 7.26		PH 7.30	
			UV254 D/R		UV254 D/R	
	4 5 6					
	1:00pm		NTU 0.07	3:00pm	NTU 0.07	
			Fe 0.00		Fe 0.00	
			Ptco 0		Ptco 2	
			<u> Mn 0.8</u>		Mn D/R	
			PH 7.16		PH 7.28	
			JV254 D/R		UV254 D/R	
1	1;30pm		NTU 0.07	3:30pm	NTU 0.07	
			e 0.00		Fe 0.00	
		The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	Pico 0		Ptco 0	
		A STATE OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PAR	<u>/n 0.6</u>		Mn 0.4 High range	
		The second lives and the second lives are a second lives and the second lives are a second lives and the second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a second lives are a sec	PH 7.16		PH D/R	
			JV254 D/R		UV254 D/R	

Tulu	ksak W-05-1	6-28-08
Pilot	Testing She	et

Appendix D - Jar & Pilot Study Logs Page 34 of 44

# CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Time	(S)tart (M)iddie (E)nd	Description of Process Step, Test Results, Adjustments					
6/28/2008				Time				
	4:00pm		NTU 0.07	6:15pm	Stopped filter process Air scour			
			Fø 0.00		and backwash to try and reduce			
			Ptco 0		the high Mn level the filter cleane			
			Mn D/R		in 2mln but ran the treated water			
			PH 7.28		through for 8min then started filte			
			UV254 D/R		to waste took readings after 10m			
	4,20		ALTILAAT	10.00				
	4:30pm		NTU 0.07	6:30pm	NTU 0.07			
			Fe 0.00		Fe 0.00			
			Ptco 0		Ptco 0			
			Mn D/R		Mn 0.561			
			PH 7.26		PH 7.25			
		<u> </u>	As 3ppb		UV254 D/R			
	5;00pm		NTU 0.07	7:00pm	NTILOOT			
	J.Jopin		Fe 0.00	[7:00pm	NTU 0.07			
			Ptco 1		Fe 0.00			
		And the second second	Mn 0.4		Ptco 0			
			PH 7.28		Mn 0.519			
		-	UV254 D/R		PH 7.30			
	THE PROPERTY OF THE PARTY OF TH		OVACY DIN		UV254 D/R			
	6:30pm		NTU 0.07	7:30pm	NTU 0.07			
			Fe 0.00		Fe 0.00			
	4		Ptco 0		Ptco 1			
			Mn 0.8		Mn 0.507			
			PH D/R		PH 7.28			
			UV254 D/R		UV254 D/R			
]	8:00pm		NTU 0.07	7:40pm	Shut down process			
			-e 0,00					
			Ptco 0					
	-		Mn 0.6					
			PH D/R					
			JV254 D/R					

Tuluksak W-05-1	6-28-06
Pilot Testing Shee	rt

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnet	Plant Size and Flow				
6/29/2006	Tuluksak W-05-1	Garry Bowley					

Water Quality Raw Settle		Raw	Settled Filtered Dist Water Quality Raw				Settled Filt	d Filtered Dist Water Quality Raw Tree			Treated	Jar Testing Procedure	15552	T==
Turbidity	NTU	0.38				Ammonia (as Nitrogen)	mg/I	1.00.00			Time			
Color	PCU	14				Dissolved Oxygen mg/l	11191	<del> </del>			3min			
pН		7.64	mV		· · · · · · · · · · · · · · · · · · ·	Hydrogen Sutfide mg/l			Oxidization		35mir			
Alkalinity	mg/l		1		<del></del>				Mixing Coagulant Blend	330	3min			
			<del> </del>			Carbon Dioxoid mg/l	<del></del>		Flocculation	14	30min			
Hardness	mg/l								Settling	n	1hr			
Temp	F	34.6							Remarks:					
Fe	mg/l	9.88												
Mn	mg/i	8.0												
As	mg/l	35					**************************************							
TDS	mg/l	82												
UV254 (A)		0.0369												

Comments & Notes	
	The Same of the Higher Taw Water manganese
l .	

Products Tested	a	Dose	0	pH	Turbidity	Turbidity	True	Floc Size		₩:	ater Qu	rality n	ng/l	·····	
	No.	mg/l	իր	<u> </u>	Settled	Filtered	Color	1100 0120	Fe	Mn	As	Alk		UV254	Other
KMinO4 Dose mg/l	1	4	10	7.61	1.52			smell							
SP+AF 80/20	2	4.5	10	7.55	0.65	0.07	12	small	0.07	0.223					
101-04	1	-	-												
KMnO4	14	1-4	10	7.82	0.24	0.09	0	smell	0.02	0.05					
ACH+ AF 80/20	5	5			Overdose	KMnO4									
	6	4.5	10	7.52	0.5	80.0	0	medium	0.02	0.022					looks like this will work for
	<del> </del>		-												the batch treatment
	┼─							ļ	~						
	<del> </del>		-				-	<del> </del>							
	+-		<del> </del>							<b>  </b>					
	<del>                                     </del>		<del> </del>							<b></b>					
	1		<u> </u>					)		1 [					

Tutuksak W-05-1 6-29-06 Jar Test Sheet

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Appendix D - Jar & Pilot Study Logs Page 36 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Location	Water Source	Personnel
6/29/2008	Tuluksak	W-05-1	Garry Bowley

Raw V	Vater	Quality	Chemicals Used	Dose mg/l	Treatment Vessel Information				
Turbidity	NTU	0.38	KMnO4	4.22	Flow Rate GPM	0.5			
Color	PCU	14			Vessel Description	GPM/sq ft			
рН		7.64			8" X 60" clear PVC Multimedia				
Alkalinity	mg/l		ACH plus Arctic Floc	11					
Hardness	mg/l		12100 80/20 blend						
Temp	F	34.8							
Fe	mg/l	9.68			Other Notes Heated water to 48.5' a	dded the			
Mn	Mg∕I	0.8			KMnO4 rapid mixed 5min turned down sl	ow let it			
As	Ngm	35			oxidize for 35min then added 11ml of ACH + AF				
TDS	mg/l	81			80/20 bland rapid mix 5min slow 35min let settle				
UV254 (A)		0.0369			overnight				

Treatment Process Objective	To Remove Iron, Manganese, Arsenic and Color to below the MCL					
Treatment Process Description	Raw Water hauled heated and batch treated in 300gal tank ( See Figure 4 -					
Chemical Oxidation, Coagulation, 5	Settlement, And Multimedia Filtration					

Sketch of Test Setup		kengan da samun di samun di samun di samun da samun da samun da samun da samun da samun da samun da samun da s Samun da samun da samun di samun di samun di samun da samun da samun da samun da samun da samun da samun da sa	

Tuluksak W-05-1 6-29-06 Pilot Testing Sheet

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Printed 7/2/2006

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow				
6/30/2006	Tuluksak W-05-1	Garry Bowley					

Water Qu	ality	Rew	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	DDIS	Time
Turbidity	NTU	0.67				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min
Color	PCU	30				Dissolved Oxygen mg/l			Oxidization		35mir
рН		7.45				Hydrogen Sulfide mg/l			Mixing Pax XL-9 plus Arctic Fk		3min
Alkalinity	mg/l	D/R				Carbon Dioxoid mg/l			Flocculation 70/30 blend		30mir
Hardness	mg/l	D/R							Settling		45mir
Temp	F	35.4							Remarks: Did jar test to determ		
Fe	mg/l	9.6							next batch treatment referred to my		
Mn	mg/l	8.0							manganese reduction	10000 101	nesi
As	mg/l	35							mangarese redución		
TDS	mg/l	80									
UV254 (A)		0.0298									

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	bar	Dose	noce	I nH	Turbidity	Turbidity	7-:-								
Products Tested	1	mg/i	1	b	Settled		True	Floc Size				ıality m			Other
	NO.					Filtered	Color		Fe	Mn	As_	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1-1-	4.5	9	7.51	1.05	0.17	2	small	0	0.024	D/R	D/R	D/R	D/R	
	2	4.5	12	7.5	0.68	0.06	0	small	0	0	D/R	D/R	D/R	<del> </del>	This looks good will use this
Pax XL-9 plus Arctic	3	4.5	15	7.49	0.89	0.1	0	small	0	0	D/R	D/R		ŧ	
Fioc 12100 70/30								G.741			LXIT	DIK	D/R	DVR	Dose
Blend Dose µl														<del> </del>	
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Tuluksak W-05-1	8-30-06
Jar Test Sheet	

Page	
5-	

PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 38 of 44

Date	Time	(S)tart (M)Iddle (E)nd	Description of Process Step, Test Results, Adjustments				
5/30/2006		1 12/11		Time			
	4:30pm	NTU	0.07	7:00pm			
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		Ptco	3			itch used XL-9 plus	
		Mn	0.12		12100 70/3	THE RESERVE TO SERVE THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY	
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		Fe	0		Fe		
		Ptco	8		Ptco		
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		As	3		A5		
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			0		Ptco		
		Mn	0.092		Mn		
		PH	7.82		PH		
		UV254	D/R		UV254	rated Contains Containing Conversion to search the search throat the State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State of State	
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		the same of the same of the same of	0		Fe		
			0		Ptco		
			D/R		Mn		
		PH :	7.62		PH		
		UV254	0.0108		UV254		
		A8 3	3		As		

Tuluksak W-05-1 6-30-08 Pilot Testing Sheet

Page ____

Printed 7/3/2008

Appendix D - Jar & Pilot Study Logs Page 39 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Time	(S)tart (M)iddle (E)nd	Description of Pro	Description of Process Step, Test Results, Adjustments					
6/30/2006		After filter	to waste for 15min	Time					
	10:15am	NTU	0.12	1:15pm	NTU	0.06			
		Fe	0.02		Fe	0			
		Ptco	0		Ptco	0			
		Mn	0.482		Mn	D/R			
		PH	7.66 Temp: 56.5°		PH	7.62			
		UV254	0.0118		UV254	D/R			
		As	3		As	D/R			
	10:20am	Started wa	ter into 165 gal holding tank						
	10:45am	NTU	0.09	2:20pm	NTU	0.07			
		Fe	0.01		Fe	0			
		Ptco	10		Ptco	0			
		Mn	0.41		Mn	0.185			
		PH	7.65		PH	7.6			
		UV254	0.0108		UV254	D/R			
		As	3		As	D/R			
	11:30am	NTU	0.07	3:00pm	NTU	0.07			
		Fe	0		Fe	0			
		Ptco	10		Ptco	3			
		Mn	0.254		Mn	0.149			
		PH	7.65		PH	7.63			
		UV254	D/R		UV254	D/R			
		As	3		As	D/R			
-									
	12:00pm	NTU	0.07	3:30pm	NTU	0.08			
		Fe	0.01		Fe	0			
		Ptco	1		Ptco	6			
	-	Mn	0.21		Mn	D/R			
		PH	7.62		PH	7.6			
		UV254	D/R		UV254	D/R			
		A8	3		As	D/R			
	2:30pm	NTU	0.08	4:00pm	NTU	0.07			
		Fe	0		Fø	0			
		Ptco	0		Ptco	3			
		Mn	0.208		Mn	D/R			
		PH :	7.62		Committee of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Cont	7.6			
		UV254	0.0108			D/R			
i	T	As :	3			D/R			

Tuluksak W-	05-1	6-30-06
Pilot Testing	Shee	t

Appendix D - Jar & Pilot Study Logs Page 40 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

D-4-	[1				
Date	Location	Water Source	Personnel		
6/30/2006	Tuluksak W-05-1		1		
W JUI A UUU	I UIUNSAK VV-UO- I		Garry Bowley		

Raw V	Vater	Quality	Chemicals Used	Dose mg/l	Treatment Vessel Information	ווי
Turbidity	NTU	0.38	KMnO4	4.22	Flow Rate GPM	0.5
Color	PCU	14			Vessel Description	GPM/sq ft
pН		7.84			8" X 60" clear PVC Multimedia	1.5
Alkalinity	mg/l		ACH plus Arctic Floc	11	The arrivation of the second	1.5
Hardness	mg/l		12100 80/20 blend			
Temp	F	34.6				
Fe	mg/l	9.66			Other Notes Heated water to 48.5° s	dded the
Mn	mg/l	0.8	37000	- Andrews on the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Cont	KMnO4 rapid mixed 5min turned down sl	
As .	mg/l	35			oxidize for 35min then added 11ml of AC	
TDS	mg/l	81			80/20 blend rapid mix 5min slow 35min le	
UV254 (A)		0.0369			ovemight	

To Remove Iron, Manganese, Arsenic and Color to below the MCL
Raw Water hauled heated and batch treated in 300gal tank ( See Figure 4 -
Settlement, And Multimedia Filtration
te yestersay afternoon )

	Sketch	of	Test	Setup
ı				

Tuluksak W-05-1 6-30-06 Pilot Testing Sheet

Page _____

Printed 7/3/2008

# POTABLE WATER JAR TEST EVALUATION FORM

- 1	2			
- 1	Date	Location	Personnel	
- 1			i di sotti lei	Plant Size and Flow
- 1	7/1 <b>/2</b> 006	Tutuksak W-05-1		The same and a row
		100-1	Garry Bowley	1
1	W-4 0 - 154			
	Water Quality	Raner Sottlard Elle	prod Diet 144 C III	

Water Qu	sality	Raw	Settled	Filtered	Dist	Water Quality	Raw					
Turbidity	NTU	0.65		1			raw	Treated	Jar Test	ing Procedure	RPM	Time
Color	PCU		1	<del>                                     </del>		Ammonia (as Nitrogen)	mg/l		Mixing K	MnO4		3min
	100		<del> </del>	-		Dissolved Oxygen mg/l			Oxidization			<del></del>
pH		7.5	mV			Hydrogen Sulfide mg/l				1.0-1		35min
Alkalinity	mg/il	D/R				Carbon Dioxoid mg/l				L-9 plus AF 12100	330	3min
Hardness	mg/l	DVR				Tourson Blokera Ingil			Floccutation 7	0/30 blend	14	35min
Temp	F	35.4	1	1				<u> </u>	Settling		0	45min
Fe									Remarks:			
	mg/l	9.66	Ferrous m	g/I		1						
Mn	mg/l	8.0	L	1 1								
As	mg/l	35										
TDS	mg/l	82 Co	nd us	Sal %				-	<u> </u>			
UV254 (A)		0.0267										

Comments & Notes Dumped what was mixed late yesterday did jar test hauled water and heated it to 54°. This water starts to oxidize after about 1 and 1/2 to 2 HR of setting and reduces the dose rate of the amount of Potassium Permanganate in order to oxidize it by about 1 mg/l. Also the mixing of the coagulant blend in the large vessel is very important to the water quality

Products Tested		Dose mg/i		рН	Turbidity Settled	Turbidity	True	Floc Size		W	ater Qu	ality m	ıg/l		
KMnO4 Dose mg/l	40.		- Pi	<del> </del>		Filtered	Color		Fe	Mn	As	Alk		UV254	Other
	<del>'</del>	5	<del> </del>	<u> </u>	0.68	0.22		medium			D/R	D/R	DIR	D/R	KMnO4 Only
Af 12100 dose µt	2	5	2		0.47	0.25	13	small	0.03		D/R	D/R			TOTAL OTHY
Kemiron Pax XL-9	3	5	12		0.31	0.07	0	small	0.00	_			D/R	DAR	
Plus Arctic Floc12100	4	5	12		1.05	0.07				0	D/R	D/R	D/R	D/R	
70/30 blend Dose µl					1.00	0.07	2	Sme£!	0	0	D/R	D/R	D/R	D/R	One liter out of 300gal tank
							·								after KMnO4 dose
				-											
			-												
													. 1		

Tutuksak W-05-1 7-1-06 Jar Test Sheet

Page	

# POTABLE WATER JAR TEST EVALUATION FORM

Date		Location			Person	nnei			Pla	nt Size and Flow		
7/3/2006		Tuluksak \	N-05-1		Garry I	Bowley						
Water Qu	ality	Raw	Settled	Filte	bened	Dist	Water Quality	Raw	Treated	i Jar Testing Procedure	RPU	Time
Turbidity	NTU	0.36					Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min
Color	PCU	51					Dissolved Oxygen mg/l			Oxidization		35min
pН		7.62	mV				Hydrogen Sulfide mg/l			Mixing XL-9 Plus AF 75/25 blend		3min
Alkalinity	mg/l	D/R					Carbon Dioxoid mg/l			Flocculation		25min
Hardness	mg/l	D/R							1	Settling		40min
Temp	F	35.2°								Remarks: Dumped the 300 gal tank		
Fe	mg/l	6.97	Ferrous r	ng/l						batch treated Saturday afternoon becau		
Mn	mg/l	0.7							1	cloudy high trubidity and the Mn level w		
As	mg/l	35								like it just didn't bulid good floc. Checked		
TDS	mg/l	80 Con	ed µs	Sal	‰					water quality both wells and a quick jar		
UV254 (A)										The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		
Comment	s & Na	ries										

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	Comments & Notes
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Products Tested	1	Dose		рН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality n	ig/l		
	No.	mg/l	la!		Settled	Filtered	Color	TICK SIZE	Fe	Min	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5.5	10		0.89	0.12	6	small	0.12	0.043	D/R	D/R	D/R		
	2	5.5	15		0.9	0.07	0	medium	0.01	0.034	D/R	D/R	D/R		
Kerniron Pax XL-9	3	5.5	20		0.94	0.07	0	medium	0	0.045	D/R	D/R	D/R		
Plus Arctic Floc															
12100 Dose µl															
	-														

# POTABLE WATER JAR TEST EVALUATION FORM

Date		Location			Perso	onnel			Ti-	Plant	Size and Flo	<u> </u>		
7/3/2006		Tuluksak '	W-05-2		Garry	Bowley								
Water Qu	iality	Raw	Settled	Filt	ered	Dist	Water Quality	Ranw	Trea	ted	Jar T	esting Procedure	RPM	Time
Turbidity	NTU	0.51					Ammonia (as Nitrogen)	mg/l			Mixing	KMnO4	-	3min
Color	PCU	58					Dissolved Oxygen mg/l				Oxidization		<del></del>	35min
pH		7.6	mV				Hydrogen Sulfide mg/l				Mixing	XL-9 Plus AF 75/25 blend	330	3min
Alkalinity	mg/l	D/R					Carbon Dioxoid mg/l				Flocculation		<del>                                     </del>	25min
Hardness	mg/l	D/R							1		Settling		<del></del>	40min
Temp	F	35.2°									Remarks:	Dumped the 300 gal tan		
Fe	mg/l	8.12	Ferrous	mg/l							<del>                                     </del>	Saturday afternoon beca		
Mn	mg/i	8.0							<del> </del>		<del>}</del>	trubidity and the Mn level v		
As	mg/l	35									1	In't build good floc.Checks		
TDS	mg/l	82 Con	d us	Sai	%				1		1			
UV254 (A)				T					<del> </del>		water quality	both wells and a quick jar	१८३६	

	Comments & Notes
-	
٠,	

Products Tested	3	ř	Dose	pН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality n	<del>1</del> 19/1	1	04
	No.	mg/i	hl		Settled	Filtered	Color	I AUC SIZE	Fe	Min	As	Alk		UV254	Other
KMnO4 Dose mg/l	4	6.2	10		0.48	0.07	1	medium	0	0.206	D/R	D/R	D/R		
	5	6.2	15		0.76	0.06	0	medium	0	0.387	D/R	D/R	D/R		
Kemiron Pax XL-9	8	6.2	20		1.13	0.09	0	medium	0	0.323		D/R	DAR		
Plus Arctic Floc												<u> </u>			
12100 Dose μΙ							-						<del>                                     </del>		
													<del> </del>	1	
												<del> </del>			
												<u> </u>		11	
				`									<b> </b>		
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							······································								
										<del>                                     </del>		t	<del>                                     </del>		

# PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 44 of 44

Date	Time	(S)tart (M)Iddle (E)nd	Description of	Process Step,	Test Res	ulta, Adjustments
7/4/2008				Time		
	8:30am					
				5:00pm		
	Тор	UTN	1.67 Settled overnight	Bottom	NTU	3.48 Settled 1hr
			0.1 Through 1.2µl filter		NTU	0.1 Through 1.2µl filter
			0.02		Fe	0
		Mn	0.127		Mn	0.11
		Ptco	8 Through .45µl		Ptco	0 Through .45µl
	Middle	NTU	2.8 Settled overnight			
		עדא	0.08 Through 1.2µl filter			
, , , , , , , , , , , , , , , , , , , ,		Fe	0			
		Mn	0.11			
		Ptco	7 Through .45µl			
	Bortom	UTN	5.20 Settled Overnight			
		UTM	0.06 Through 1.2µl filter			
		Fe	0			
200 200 200 200 200 200 200 200 200 200		Mn.	0.04			
		Ptco	3 Through .45µl			
-	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		tor mount and ran it on slow		Name of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last o	
	dropped ou	t In one hou	r the water is clearer than it	s been and the	speed that	floc dropped is good.
······································	5;00pm					
	Тор	Water Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the Company of the	2.84 Settled 1hr			
			0.1 Through 1.2µl filter			
		Fe				
		THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT NAMED IN COLUMN TRANSPORT	D/R			
		Ptco	0 Through .45µl			
	Middle		1.44 Settled 1hr			
Way 1,9214444			0.08 Through 1.2µl filter			
		Fe	Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of the Commence of th			
		THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	D/R			
		Plco	0 Through .45µl			
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				1 1-	T-	

Tuluksak W-05-1 7-3-08 Pilot Testing Sheet

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CE2	En	gineers	Inc
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# POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs

			Page 1 of 4	4
Date	Location	Personnel	Plant Size and Flow	
			5.25 and 7.677	
6/13/2006	Tuluksak W-05-1	Garry Bowley		
G/ 10/2000	Turantour TT TO T			

Water Qu	ıality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/i	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.85				Primary Coagulant			Mixing		
Color	PCU	69				Coagulant Aid			Flocculation		
рН		7.33				Filter Aid			Settling		
Alkalinity	mg/l			٠		Pre pH Adjustment			Remarks		
Hardness	mg/l					Post pH Adjustment			****************	******	
Temp	F	36.5°				Other			******************		******
Fe	mg/l	7.92							***************************************		
Mn	mg/l	0.297									
As	mg/l	15									
TDS	mg/I	79									

Comments & Notes	After about one hour with the water setting in a one leter beaker it starts to oxidize and change color but has no settling
	***************************************

Products Tested	Jar	Dose	Dose	рН	Turbidity Settled	Turbidity		Floc Size	١			/1	Other	
	No.	mg/l	μl		Settled	Filtered	Settled		Fe	Mn	As	Alk	Hard	
	l													
		,												
						_								-

Tuluksak W-05-1 6-13-06 Jar Test Sheet

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CE2 Engineers, Inc	CE2	En	gine	ers,	Inc
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# POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 2 of 44

				1 age 2 01 44
Date	Location	Personnel	Plant Size and Flow	
6/13/2006	Tuluksak W-05-2	Garry Bowley		

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM Tim
Turbldity	NTU	1.99				Primary Coagulant			Mixing	
Color	PCU	74				Coagulant Aid			Flocculation	
рН		7.2				Filter Aid			Settling	
Alkalinity	mg/l			v		Pre pH Adjustment			Remarks	
Hardness	mg/l					Post pH Adjustment			***************************************	
Temp	F	35°				Other				
Fe	mg/l	7.98								
Mn	mg/l	0.331								
As	_mg/l	35								
TDS	mg/l	68								

Comments & Notes	After water sets in a 1 liter beaker for about one and one half hour it starts to oxidize and change color but has no noticable
settling in it.	

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity		Floc Size	1	Water	Quali	ty mg	/I	Other
	No.	mg/l	μl		Settled	Filtered	Settled		Fe	Mn	As	Alk	Hard	
	1													
	<del>                                     </del>													
	<del> </del> -													
	<del> </del>													
														·
														-
	+										-			4

Tuluksak W-05-2 6-13-06 Jar Test Sheet

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Printed 6/19/2006

#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 3 of 44

			1450 01
Date	Location	Personnel	Plant Size and Flow
6/14/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	uality_	Raw	Settled	Filtered	Dist	Chomical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM Time
Turbidity	NTU	0.85				Primary Coagulant			Mixing	330 2min
Color	PCU	69				Coagulant Aid			Flocculation	30 2min
рН		7.33				Filter Aid			Settling	0 1hr
Alkalinity	mg/l			q		Pre pH Adjustment			Remarks After 5min small	pin Floc
Hardness	mg/l					Post pH Adjustment			in beakers #2,3,&4 Jars 5&6	
Temp	F	36.5°				Other			and maybe 4 still a little pink	
Fe	mg/l	7.92							***************************************	
Mn	mg/i	0.297								
As	mg/l	15								
TDS	mg/l	79								

Comments & Notes After about one hour with the water setting in a one liter beaker it starts to oxidize and change color but has no settling

Looks like 5 mg/l is going to be optimum dose for KmNO4 See pictures 1,2&3

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	Color	Floc Size	1	Water	Quali	ty mg	/1	Other
	No.	mg/l	μl		Settled	Filtered	Filtered		Fe	Mn	As	Alk	Hard	
KmNO4	1_	2			2.55	0.08	2	small pin	0.05	over				Mn Over limit low range test
	2	4			0.97	0.08	10	small pin	0.04	0.22				Good settling
	3	6			1.09	0.3	8	small pin	0.02	0.11				Good settling
	4	8			_	0.19		small pin	0.06	0.68				Stil A little pink overdose
	5	10						small pin						Overdose KmNO4
	6	12						small pin						Overdose KmNO4

Tuluksak W-05-1 6-14-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 4 of 44

Date	Location	Personnel	Plant Size and Flow
6/15/2006	Tuluksak W-05-1	Garry Bowley	Pilot

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Test	ing Procedure	RPM	Time
Turbidity	NTU	0.88				Primary Coagulant			Mixing		320	2min
Color	PCU	72				Coagulant Aid			Flocculation	n	30	30min
pН		7.4				Filter Aid			Settling		0	30min
Alkalinity	mg/l					Pre pH Adjustment			Remarks	Started with 5 mg	/I KMr	104
Hardness	mg/l					Post pH Adjustment			in all jars 3	30 rpm for 2min th	en tur	ned
Temp	F	36°				Other			down to 30	rpm for 30 min th	en bac	k up
Fe _	mg/l	7.96							to 330 rpm	and added 80/20	Stern	Pac
Mn	mg/l	0.302							Arctic Floc	12100 let run on	high 2	min
As	mg/l	15							then down	to 30 rpm for 2 mi	n then	down
TDS	mg/l	80							to 10 rpm fo	or 20 min let settle	30mlr	п

Comments & Notes About 5 min after adding KMnO4 and turning rpm down to 30 had small pin floc present and it continued to build in all jars
Then after adding Stern Pac +Arctic Floc and turning rpm down to 10 started seeing floc formation and settling after 5min it looks a little heaver in 2,3&4
will see after readings are done.

Products Tested	Jar	Dose	Dose	рΗ	Turbidity	Turbidity	Color	Floc Size	١	Nater	Qual	ty mg	/1	Other
	No.	mg/l	μl		Settled	Filtered	Filtered		Fe	Mn	As	Alk	Hard	
KMnO4 Dose mg/l	1	5	5		0.32	0.06	0	Medlum	0.02	0				
	2	5	10		0.28	0.06	0	Medlum	0.01	0	0	90	2.79	As no noticeable color change
Stern Pac 80% +	3	5	15		0.42	0.07	3	Medlum	0.04	0.04				
Arctic Floc12100 20%	4	5	20		0.46	0.06	0	Medlum	0.01	0.03				
Dose μl	5	5	25		0.69	0.07	0	Medium	0.07	0.05				
	6	5	30		0.66	0.07	9	Medlum	0.03	0.08				
	-													
							•							

Tuluksak W-05-1 6-15-06 Jar Test Sheet

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Printed 6/17/2006

CE2	Engine	ers,	Inc.
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# POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 5 of 44

Date	Location	Personnel	Plant Size and Flow
6/16/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ıality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	4.08				Primary Coagulant			Mixing		2min
Color	PCU	88				Coagulant Aid			Flocculation	1	2min
Ηq		7.1				Filter Aid			Settling		1hr
Alkalinity	mg/l	74				Pre pH Adjustment			Remarks Added KMnO4 a		
Hardness	mg/l	3.05				Post pH Adjustment			80/20 blend at the same time		*****
Temp	F	37				Other		1	for 2 min down to 30 rpm 2m		
Fe	mg/l	7.9							to 10rpm 25minlet settle for		
Mn	mg/l	0.336						1	pin floc in all jars heaver in lo		
As	mg/l	35							Jars 1,2&3 after settling jars		
TDS	mg/l	68						1	suspended floc and pluged of		

Comments & Notes	I got greedy and added Stern Pac + Arctic Floc at the same time and it didn't remove the Mn it didn't have time to oxidize
1	

<b>Products Tested</b>	•	Dose		рН	Turbldity	Turbidity	Color	Floc Size	/	Nater	Quali	ty mg	//	Other
	No.	mg/l	μl		Settled	Filtered	Filtered		Fe	Mn			Hard	
KMnO4 = mg/l dose	1	5	8		0.66	0.06	0	medium	0.02	0.28	d/r			
	2	5	10		1.1	0.05	0	medium	0.21	0.23	d/r			
	3	5	12		0.57	0.05	13	medium	0	0.48	d/r			
Stern Pac + Arctic	4	5	14		0.77	0.06	16	medium	_ 0	0.58	d/r			
Floc 12100 = µl	5	5	16		0.67	0.05	15	medium	0.02	0.73	d/r			
·	6	5	18		1.37	0.07	5	medlum	0	0.6	d/r			
				_		1			1					

Tuluksak W-05-2 6-16-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/17/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time	
Turbidity	NTU	0.86				Primary Coagulant			Mixing		5min	
Color	PCU	70				Coagulant Aid			Flocculation		5min	
рН		7.33				Filter Aid			Flocculation		25min	
Alkalinity	mg/l					Pre pH Adjustment			Settling	1	1hr	
Hardness	mg/l					Post pH Adjustment			Remarks: Mixed a blend or			
Temp	F	37*				Other			and arctic floc 12100 80/20 24 grams			
Fe	mg/l	7.95					7		Ferric Sulfate to 6 grams Arctic floc12100			
Mn	mg/l	0.31							and started jar test with oxygen oxidized			
As	mg/l	15							water for oxidization I used air compressor			
TDS	mg/l	80							and 3/8 copper tube with multiple 1/6" holes			
UV254 (A)		D/R							drilled in it let run for 1 hr in 5gal bucket			

Comments & Notes	All this did was turn the water a little darker red brown and cloudy didn't read any of the jars because their wasn't any floc formation it didn't
work at all	

Products Tested	Jar	Dose	Dose µl	Turbidity Settled	Turbidity Filtered	True Color	Floc Size	Water Quality mg/l						
110dbcts 165tbd	No.	Mgm						Fe	Mn	As	Alk		UV254	Other
Ferric Sulfate Plus	1		6	D/R	D/R	D/R	None	D/R	D/R	D/R	D/R	D/R	D/R	
Arctic Floc 12100	2		9											
80/20 blend	3		12											
	4		15											
	5		18											
	6		21											

Tuluksak W-05-1	6-17-06
Jar Test Sheet	

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
8/17/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	5.21				Primary Coagulant			Mixing	330	2min
Color	PCU					Coagulant Aid			Oxidization With Air		1hr
рН		7.4				Filter Aid			Flocculation	30	2min
Alkalinity	mg/l			a a		Pre pH Adjustment			Flocculation	10	25min
Hardness	mg/l					Post pH Adjustment			Settling	0	30min
Temp	F	65°				Other			Remarks: Took the water l	eft in 5	gal.
Fe	mg/l	9.42							bucket from yesterday and inje	cted air	rused
Mn	rng/l	0.331							3/8 copper tube with multiple 1.	/16" ho	les
As	mg/l	35							drilled in it let run for 1hr and tr	ansferr	ed
TDS	mg/I	70							into jars started test using Ster	n Pac p	olus
UV254 (A)		0.0168							Arctic Floc 12100 80/20 blend		

Comments & Notes Have good floc formation in lower doses but it appears to be light in in color and airy the higher dose jars appear to be overdose 20,25 µl
Will see after settling 30 min see pictures 6 & 7

Products Tested	Jar	Dose	Dose	рΗ	Turbidity	Turbidity	True	Floc Size		₩a	iter Qu	ality m			Other
Products rested	No.	mg/I	μl		Settled	Filtered	Color	PROC SIZE	Fe	Mn	As	Alk	Hard	UV254	Ould
Stern Pac Plus	1_		8_		1.15	0.14	0	medium	0.02	0.225	D/R	D/R	D/R	0.014	
Arctic Floc 12100	2		11		2.27	0.06	0	medium	0.02	0.119	D/R	D/R	D/R	0.012	
80/20 Blend	3		14		4.6	0.07	0	medium	0.1	0.243	D/R	D/R	D/R	0.022	
	4		17		8.32	0.2	12	medium	0.02	0.174	D/R	D/R	D/R	D/R	
	5		20		11.3	0.07	11	small	0.03	0.184	D/R	D/R	D/R	D/R	
	8		25		22.2	0.11	D/R	cloudy	D/R	D/R	D/R	D/R	D/R	D/R	Plugged 5µl filter for 15 ml
															Turbidity sample
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Tuluksak W-05-2	6-17-06
Jar Test Sheet	

# POTABLE WATER JAR TEST EVALUATION FORM

Date		Location	Personnel	Plant Size and Flow
6/18/	/2006	Tuluksak W-05-1		
				<u> </u>

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mo/i	Jar Testing Procedure	Ippus	Time
Turbidity	NTU	0.55				Primary Coagulant			Mixing	<del></del>	2min
Color	PCU	40		29		Coagulant Aid			Oxidization		30min
pΗ		7.2				Filter Aid			Flocculation	1	2min
Alkalinity	mg/l			v		Pre pH Adjustment			Flocculation	10	<del> </del>
Hardness	mg/l					Post pH Adjustment			Settling	+	1hr
Temp	F	37				Other			Remarks: Started off with 5		
Fe	mg/l	7.98							mixed on high 2min turned dow		
Mn	mg/l	0.375						4	for 30min to oxidize Fe and Mn		
As	mg/l	35							up and added Stem Pac plus A		
TDS	mg/l	97							12100 90/10 blend then down		
UV254 (A)		0.0389							for2min down to 10rpm for 30m		

Comments & Notes 1 decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as I added KMnO4 to the three jars for well 2 I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend

Products Tested	1	2	Dose	рН	Turbidity	Turbidity	True	Floc Size		W	nter Qu	sality m	rg/Ĭ		
	No.	mg/l	<u> 141</u>		Settled	Filtered	Color	FIOC Size	Fe	Mn	As	Alk		UV254	Other
KMnO4 is mg/l dose	1	5_	5		0.27	0.11	0	medium	0.11	0.42				0.0247	
	2	5	10		0.34	0.08	0	medium	0.04	0				0.0173	
Stem Pac plus Arctic	. 3	5	15		0.37	0.06	0	medium	0.04	0				0.0179	
Floc is µl dose	4	5	5												See sheet W-05-2
	5	5	10	·											See sheet W-05-2
	6	5_	15												See sheet W-05-2
	<u> </u>														
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Tuluksak W-05-1	6-18-06
Jar Test Sheet	

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Garry Bowley 907-695-6095

CE2 Engineers, Inc.

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/18/2006	Tuluksak W-05-2		

Water Qu	uality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.58				Primary Coagulant			Mixing		2min
Color	PCU	43		31		Coagulant Aid			Oxidization		30min
pН		7.11				Filter Aid			Flocculation		2min
Alkalinity	mg/l			V		Pre pH Adjustment			Flocculation	10	
Hardness	mg/l					Post pH Adjustment			Settling	0	1hr
Temp	F	37				Other			Remarks: Started off with 5	ma/l KN	√InO4
Fe	mg/l	8.43							mixed on high 2min turned down	to 30ri	pm
Mn	mg/l	0.328							for 30min to oxidize Fe and Mn t		
As	mg/l	35							up and added Stem Pac plus Ar		
TDS	mg/l	84							12100 90/10 blend then down to		
UV254 (A)		0.0607							for2min down to 10rpm for 30mi		

Comments & Notes | I decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as I added KMnO4 to the three jars for well 2. I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		Wa	ater Qu	ality m	ıg/I		
	No.	mg/l	μl		Settled	Filtered	Color	FIOC Size	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 is mg/l dose	1	5	5												See sheet for W-05-1
	2	5	10												See sheet for W-05-1
Stern Pac plus Arctic	3	5	15												See sheet for W-05-1
Floc is µl dose	4	5	5		0.21	0.06	0	medium	0.02	0.125				0.0204	
	5	5	10		0.24	0.06	1	medium	0.02	0.265				0.025	
	6	5	15		0.69	0.05	0	medium	0.18	0.267				0.026	
		-	-												
		-													
														<del> </del>	,
Draducto Tactad	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Flor Siza		Wa	ater Qu	ality m	g/I		Other

Tuluksak W-05-2 6-18-06 Jar Test Sheet

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	
6/18/2006	Tuluksak W-05-2	Plant Size and Flow	٦
Water Quality	Raw Sattled Eile		

Water Qu	Jality	Raw	Settled	Filtered	Dist	Chemical Usage					
Turbidity	NTU	0.58					Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Color	PCU			- 24		Primary Coagulant			Mixing		2min
рН	- 00		<del> </del>	31		Coagulant Aid			Oxidization		
		7.11				Filter Aid			Flocculation	<del></del>	30mir
Alkalinity	mg/l			٠		Pre pH Adjustment		1		30	2min
Hardness	mg/l					Post pH Adjustment			Flocculation	10	30
Temp	F	37				Other			Settling	0	1hr
Fe	mg/i	8.43							Remarks: Started off with	5ma/1 KI	MnO4
Mn	mg/l	0.328				<del></del>			mixed on high 2min turned dow	vn to 30	nom
As	mg/l	35							for 30min to oxidize Fe and Mn	turned	Dm.
TDS	mg/l	84							up and added Stern Pac plus A	ratic Flo	OC.
UV254 (A)		0.0607							12100 90/10 blend then down	to 30mr	m
Commante									for2min down to 10rpm for 30m		

Comments & Notes I decided to do three jars for each well KMnO4 at 5mg/l in all jars 5,10,15 µl for each well of SP+AF12100 90/10 blend. As soon as I added KMnO4 to the three jars for well 2. I noticed a difference in the color between wells see pictures (8,9,10,11) also had better floc formation and oxidization in the three jars for well 1 before adding coagulant blend.

Products Tested		Dose mg/l		рН	1 - 1	Turbidity	True	Floc Size		W	ater Q	ality n	ng/I		
KMnO4 is mg/l dose	1	5	5		Settled	Filtered	Color		Fe	Mn	As	AJk		UV254	Other
	2	5	10												See sheet for W-05-1
Stern Pac plus Arctic	3	5	15												See sheet for W-05-1
Floc is µl dose	4	5	5		0.21	0.06	0	medium	0.03	0.425					See sheet for W-05-1
•	5	5	10		0.24	0.06	1	medium		0.125				0.0204	
	6	5	15		0.69	0.05	0	medium		0.267				0.025 0.026	
														0.020	
		$\dashv$													

Tuluksak W-05-2 6-18-06 Jar Test Sheet

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## POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/19/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/i	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.58				Primary Coagulant	•		Mixing	330	2min
Color	PCU	41				Coagulant Aid			Oxidization		30min
рН		7.15				Filter Aid			Flocculation	30	2min
Alkalinity	mg/I					Pre pH Adjustment			Flocculation	10	15min
Hardness	mg/l					Post pH Adjustment			Settling	0	1hr
Temp_	F	37*				Other			Remarks: Started with KMi	104 5 r	ng/l
Fe	mg/l	8.1							all jars mixed SP + AF12100 7	)/30 bk	end
Mn	mg/l	0.376							and did three jars for each well		
As	mg/l	15									
TDS	mg/l	96									
UV254 (A)	,	0.0182									

	Comments & Notes Had good floc in all three jars for

D - 1 - 1 - 7 - 1 - 1	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		W:	ater Qu	ality n	rg/I		Other
Products Tested	No.	mg/i	μi		Settled	Filtered	Color	LIOC 2176	Fe	Mn	As	Alk	Hard	UV254	Other
KMm04 dose mg/l	1	5	5		0.39	0.07	0	medium	0.02	0.375	d/r	d∕r	d/r	0.006	
	2	5	10		0.58	0.11	5	medium	0.07	0.164	dir	d∕r	d/r	0.0072	
	3	5	15		0.8	0.11	5	medium	0.04	0.155	ď٢	d/r	d/r	0.0054	
Stern Pac plus Arctic															
Floc12100 dose µl															
	-	-		-											
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Tuluksak W-05-1 6-19-06 Jar Test Sheet

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### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/19/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.6				Primary Coagulant			Mixing		2min
Color	PCU	43				Coagulant Aid			Oxidization		30mii
pH		7.1				Filter Aid			Flocculation		2min
Alkalinity	mg/l					Pre pH Adjustment			Flocculation		15mir
Hardness	mg/l					Post pH Adjustment			Settling		1hr
Temp	F	37				Other			Remarks: Started with KM		
Fe	mg/l	8.43							all jars mixed SP + AF12100 7		
Mn	mg/l	0.328							and did three jars for each wel		
As	mg/l	35									-
TDS	mg/l	84									
UV254 (A)	}	0.0399									<del></del>

10	omments & Notes	Had good floc in all three jars for each well 2 floc smaller than well 1
1-	A 140500	THE GOOD THE BIT STOTE COUNTY WAIT Z THE STITLING STREET THAT WAIT I
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Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size	1	W	ater Qu	ality n	g/l		
rioducts rested	No.	mgri	րլ		Settled	Filtered	Color	FROC SIZE	Fe	Mn	As	Alk		UV254	Other
KMn04 dose mg/l	4	5	5		0.4	0.06	13	small	0.05	0.638	d∕r	d/r	d/r	0.0089	
	5	5	10		0.57	0.18	9	small	0.04	0.448	d∕r	ď٢	d/r	0.0085	
	6	5	15		0.73	0.07	12	smail	0.07	0.485	d∕r	ďr	d/r	0.0086	
Stern Pac plus Arctic															
Floc12100 dose µl															
70/30 blend															
															,

Tuluksak W-05-2 6-19-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/19/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/i	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.58				Primary Coagulant			Mixing		2min
Color	PCU	41				Coagulant Aid			Oxidization		30mir
рН		7.15				Filter Aid			Flocculation		2min
Alkalinity	mg/l			v		Pre pH Adjustment			Flocculation		15mir
Hardness	mg/l					Post pH Adjustment			Settling		1hr
Temp	F	37 <b>°</b>				Other			Remarks: Started with KMnO4 5 mg/l		
Fe	mg/l	8.1							all jars mixed A C H + AF1210		
Mn	mg/l	0.376							blend and did jar test to find or		
As	mg/l	15						1	for well 1		
TDS	mg/l	96	L								
UV254 (A)		0.0182									

Comments & Notes As soon as I added the KMnO4 to the jars the water turned pink as if it was an over dose I used the same water from this mornings test but decided to run test anyway had good floc with KMnO4 water stayed a little bit pink until I added A C H blend will retest tomorrow

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size		W	nter Qu	ality m	ng/l		
FIOURCIS I ESTERI	No.	mg/l	μl		Settled	Filtered	Color	710C 3IZE	Fe	₩n	As	Alk	Hard	UV254	Other
KMn04 dose mg/i	1	5	5		0.53	0.15	32	medium	0.01	0.012	d∕r	d∕r	d/r	d/τ	
	2	5	10		0.28	0.07	31	medium	0.03	0	d/r	d/r	ďΓ	-0.005	
	3	5	15		0.16	0.07	26	medium	0.05	0	_d/r	d∕r	ďr	-0.004	
A C H plus Arctic	4	5	20		0.2	0.1	5	medium	0.02	0	ď∕r	d/r	d∕r	d/τ	
Floc12100 dose µl	5	5	25		0.12	0.1	10	medium	0.01	0	d∕r	d∕r	d∕r	d/r	
80/20 blend	6	5	30		0.12	0.06	15	medium	0.01	a	d/r	d/r	d∕r	ά/r	
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Tuluksak W-05-1	6-19-06 A
Jar Test Sheet	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/20/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	g Procedure RPM Time		
Turbidity	NTU	0.6				Primary Coagulant			Mixing		0 2min	
Color	PCU	42				Coagulant Aid			Oxidization		15 30min	
рН		7.21				Filter Aid			Mixing		2min	
Alkalinity	mg/l	D/R		·		Pre pH Adjustment			Flocculation		20min	
Hardness	mg/i	D/R				Post pH Adjustment			Settling		30min	
Temp	F	37°				Other			Remarks: Started with col-			
Fe	mg/l	8.1							jars added KMnO4 had small p			
Mn	mg/l	0.378							it didn't oxidize as well as whe	n it is he	eated	
As	mg/l	15							to 50" then added ACH plus A			
TDS	mg/l	94	ام						12100 80/20 blend		-	
UV254 (A)		0.0135	0.0230					<del>-  </del>				

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-	Comments & Notes
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Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	19/1		Other
	No.	mg/l	ul.		Settled	Filtered	Color	. 200	Fe	Mn	As	Alk	Hard	UV254	Other
KMn04 mg/l dose	1	5	10		0.78	0.07	2	small	0.01	0	d/r	d∕r	d/r	0.0166	will read UV254 again after
	2	5	15		0.53	0.09	20	small	0.02	0	d/r	d√r	ďΓ	0.0185	setting in jars over night
	3	5	20		0.48	0.1	3	small	0	0	d/r	d/r	d/r	0.0124	
ACH plus AF12100										٠					
30/20 blend µl dose															
	1													0.0142	
	2													0.0141	
	3													0.0122	
	1														
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Tuluksak W-05-1 6-20-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 15 of 44

Date	Location	Personnel	Plant Size and Flow	Tage 15 of 14
6/20/2006	Tuluksak W-05-2	Garry Bowley		
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Water Q	uality	Raw	Settled	Filtered	D <del>i</del> st	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time	
Turbidity	NTU	0.6				Primary Coagulant			Mixing	<del></del>	2min	
Color	PCU	42				Coagulant Aid			Oxidization		30min	
рН		7.21				Filter Aid			Mixing		2min	
Alkalinity	mg/1	D/R				Pre pH Adjustment			Flocculation		20min	
Hardness	mg/l	D/R		-		Post pH Adjustment			Settling		30min	
Temp	F	37*				Other			Remarks: Started with cold			
Fe	mg/l	8.44							jars added KMnO4 had small p			
Mn	mg/l	0.341								it didn't oxidize as well as when it is heate		
As	mg/l	15							to 50° then added ACH plus Arctic Floc			
TDS	mg/i	84							12100 80/20 blend			
UV254 (A)		0.0269								······································		

	Comments & Notes
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Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	ıg/i		Other
PIOURILES ( BELOW)	No.	mg/l	lul_		Settled	Filtered	Color	1 IOC SIZE	Fe	Man	As	Alk	Hard	UV254	
KMnO4 mg/l Dose	4	5	10		0.57	0.11	16	small	0	0	D/R	D/R	D/R	0.0108	Will read UV254 again after
	5	5	15		0.76	0.13	6	small	0	0	D/R	D/R		7	setting in jars over night
ACH Plus AF12100	_6	5_	20		0.9	0.07	19	small	0.04	0	D/R	D/R		0.0123	
80/20 blend µl Dose															
	4													0.0099	
	5													0.0142	
	6													0.012	
															-

Tuluksak W-05-2 6-20-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/21/2006	Tuluksak W-05-1	Garry Bowley	
34/-4 - 6 434			

Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing	Procedure IF	DES.	Time
Turbidity	NTU	1.27	·			Primary Coagulant			1	nnO4		<del></del>
Color	PCU	35				Coagulant Aid			Oxidization	WIO4		2min 30mir
pH		7.2/7.5	cold/warm			Filter Aid				H+AF12100		2min
Alkalinity	mg/l	D/R				Pre pH Adjustment	None		Flocculation		-	15mir
Hardness	mg/l	D/R				Post pH Adjustment	None_		Settling			30mir
Temp	F	37"				Other			Remarks: Sta	arted with KMnO		
Fe	mg/l	9.09							it then let it oxidiz			
Mn	mg/l	0.361					1	1	plus Arctic Floc 1			
As	mg/1	D/R(15)										
TDS	mg/I	101										
UV254 (A)		0.0201										

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On Charles	ه المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة المناسبة ا	
	المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة المنافقة الم	

Products Tested	9	Dose	1 .	pН	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	ng/l	1	0.1
	No.	mg/l	<u> </u>		Settled	Filtered	Color	i ioc size	Fø	Min	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	5	5	7.57	0.3	0.07	16	medium	0.03	0.188	D/R	D/R	D/R	0.0149	
	2	5	10	7.65	0.31	0.05	0	medium	0.01	0.073	D/R	D/R	D/R	0.0129	
ACH plus Arctic Floc	3	5	15	7.65	0.32	0.07	7	medium	0.03	0.073	D/R	D/R	·D/R	0.0161	
12100 Dose µl	4	5	20	7.65	0.19	0.05	0	medium	0.04	0.085	D/R	D/R	D/R	0.0134	
90/10 blend	5	5	25	7.61	0.36	0.05	8	medium	0.02	0.073	D/R	D/R	D/R	0.0099	<del></del>
	6	5	30	7.62	0.3	0.06	0	medium	0	0.086	D/R	D/R	D/R	0.0111	
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Tuluksak W-05-1 6-21-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 17 of 44

Date	Location	Personnel	Plant Size and Flow
6/21/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	tered Dist	Chemical Usage	Product	Dose mg/l	Jar Testi	ng Procedure	RPM	Time
Turbidity	שדע	1.71				Primary Coagulant			Mixing	KMnO4	<del> </del>	2min
Color	PCU	38				Coagulant Aid			Oxidization			30mi
рH		7.4				Filter Aid			Mixing	ACH+AF12100	1	2min
Alkalinity	mg/l	D/R				Pre pH Adjustment			Flocculation			15mi
Hardness	mg/l	D/R				Post pH Adjustment			Settling		1	30mi
Temp	F	37*				Other			Remarks:	Started with KMn		
Fe	mg/l	9.24							let it oxidize then added ACH plus Arct			
Mn	mg/l	0.0343							Floc 12100 90		507.40	
As	mg/l	D/R(35)										
TDS	mg/l	84										
UV254 (A)		0.0375							1			

Comments & Notes With the KMnO4 after 10 min. it was starting to build small pin floc but it is light in color well W-05-1 has same size floc but is red in color tincreased KMnO4 dose for this well

Products Tested	Jar	Dose	Dose	pΗ	Turbidity	Turbidity	True	Floc Size		W	ater Qu	ality m	g/I		
Products residu	No.	mg/l	μl		Settled	Filtered	Color	FICE SIZE	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7.5	5	7.66	0.71	0.05	17	large	0.01	0.041	D/R	D/R	D/R	0.0212	
	2	7.5	10	7.62	0.41	0.1	4	large	0.01	0.048	D/R	D/R	D/R	0.0422	
ACH plus Arctic Floc	3	7.5	15	7.57	0.58	0.04	4	large	٥	0.002	D/R	D/R	D/R	0.0212	
12100 Dose µi	4_	10	20	7.59	0.34	0.08	14	large	0	0	D/R	D/R	DAR	0.024	Over dose KMnO4
	5	7.5	25	7.6	0.33	0.06	4	large	0	0	DIR	D/R	DIR	0.0196	
	6	7.5	30	7.61	0.34	0.06	0	large	0	0	D/R	D/R	D/R	0.013	
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Tuluksak W-05-2 6-21-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

	Date	Location	Personnel	Plant Size and Flow
ļ	6/22/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ıality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM	Time
Turbidity	NTU	1.02				Primary Coagulant			Mixing KMnO4		2min
Color	PCU	37				Coagulant Aid			Oxidization	15	30min
рН		7.4				Filter Aid			Mixing ACH+AF 70/30	330	2min
Alkalinity	.mg/l	D/R		٠	_	Pre pH Adjustment		-	Flocculation	15	20min
Hardness	mg/l	D/R				Post pH Adjustment			Settling	0	30min
Temp	F	37"				Other			Remarks: Started with KMi	104 ha	d
Fe	mg/i	9.03							good size floc in all jars addad.	ACH pl	บร
Mn	mg/l	0.372							Arctic floc 12100 turned speed	up to n	nix
As	mg/l	D/R(15)							then down but it didn't build floo	as big	as
TDS	mg/!	99							it was with just the KMnO4 floc		
UV254 (A)		0.0203							small to large with increased dose		

П		
	Comments & Notes	Looks like two much Arctic Floc12100 the floc appears to be coated and stays suspended has very slow settling in the lighter doses

Products Tested	a l	1	Dose	рН	Turbidity	Turbidity	True	Floc Size		Wa	ter Qu	ality m	g/I		<b>M</b> L
	No.	mg/i	μΙ		Settled	Filtered	Color	7100 3128	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	5	5	D/R	0.65	0.1	11	small	0.02	0.04	D/R	D/R	D/R	0.0151	
	2	5	10	D/R	0.53	0.06	0		0.02	0.064	D/R	D/R	D/R	0.0154	
	3	5	15	D/R	0.63	0.07	0		0	0.102	D/R	D/R	D/R	0.0185	
ACH plus Arctic Floc	4	5	20	D/R	0.54	0.08	2		0.02	0.095	D/R	D/R	D/R	0.0136	
12100 70/30 blend	5	5	25	D/R	0.49	0.1	0		0.01	0.112	D/R	D/R	D/R	0.0168	
Dose µl	6	5	30	D/R	0.31	0.11	1	large	0.01	0.111	D/R	D/R	D/R	0.0205	
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Tuluksak W-05-1 6-22-06 Jar Test Sheet

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#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location		Perso	nnel			Plant Size an	d Flow		
6/22/2006	Tuluksak W	1-05-2	Garry	Bowley						
184-4 O - 894										
Water Quality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedure	RPM!	Time
Transfer arms	1 4 5 4	1 1							<del>                                     </del>	

ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing Procedu	re RPM	Time
NTU	1.51				Primary Coagulant					2 2min
PCU	39				Coegulant Aid			<del>                                     </del>		5 30min
	7.4				Filter Aid			<del> </del>		2 2min
mg/l	D/R		<i>u</i>		Pre pH Adjustment			Flocculation	<del></del>	5 20min
mg/f	D/R				Post pH Adjustment			Settling		30min
F	37°				Other			<del>}</del>		
mg/l	9.21							†" <del>"""""""""""""""""""""""""""""""""""</del>		
mg/l	0.0344									
mg/l	D/R							Y		
mg/l	86									9 445
	0.0373							init jok dio remio	¥	
	MTU PCU mg/l mg/l F mg/l mg/l mg/l	NTU 1.51 PCU 39 7.4 mg/l D/R mg/l D/R F 37' mg/l 9.21 mg/l 0.0344 mg/l D/R mg/l 86	NTU 1.51 PCU 39 7.4 mg/l D/R mg/l D/R F 37' mg/l 9.21 mg/l 0.0344 mg/l D/R mg/l B6	NTU 1.51 PCU 39 7.4 mg/l D/R mg/l D/R F 37' mg/l 9.21 mg/l 0.0344 mg/l D/R mg/l B6	NTU 1.51 PCU 39 7.4 mg/l D/R mg/l D/R F 37' mg/l 9.21 mg/l 0.0344 mg/l D/R mg/l B6	NTU         1.51         Primary Coagulant           PCU         39         Coagulant Aid           7.4         Filter Aid           mg/l         D/R         Pre pH Adjustment           mg/l         D/R         Post pH Adjustment           F         37°         Other           mg/l         9.21         Other           mg/l         D/R         D/R           mg/l         D/R         Other	NTU         1.51         Primary Coagulant           PCU         39         Coagulant Aid           7.4         Filter Aid           mg/l         D/R         Pre pH Adjustment           mg/l         D/R         Post pH Adjustment           F         37'         Other           mg/l         9.21         Other           mg/l         D/R         Post pH Adjustment           mg/l         9.21         Other           mg/l         D/R         Other	NTU   1.51	NTU 1.51 Primary Coagulant Mixing KMnO4 PCU 39 Coagulant Aid Oxidization  7.4 Filter Aid Mixing ACH+AF 70  Mixing ACH+AF 70  Mixing ACH+AF 70  Mixing ACH+AF 70  Mixing ACH+AF 70  Pre pH Adjustment Flocculation  Post pH Adjustment Settling  F 37' Other Remarks: Started with  mg/l 9.21 good size floc in all jars ac  mg/l 0.0344  mg/l D/R  mg/l D/R  mg/l D/R  mg/l B6	NTU 1.51 Primary Coagulant Mixing KMnO4 31: PCU 39 Coegulant Aid Oxidization 1:  T.4 Filter Aid Mixing ACH+AF 70/30 31:  Mg/I D/R Pre pH Adjustment Flocculation 1:  Moxing ACH+AF 70/30 31:  Pre pH Adjustment Settling Focculation 1:  Total Pre pH Adjustment Settling Focculation 1:  Total Pre pH Adjustment Settling Flocculation 1:  Total Pre pH Adjustment Settling Flocculation 1:  Total Primary Coagulant Mixing KMnO4 31:  Total Primary Coagulant Mi

Comments & Notes	Looks like two much Arctic Floc12100 the floc appears to be coated and stays suspended has very slow settling in all jars

Products Tested	2	1	Dose	pН	1	Turbidity	True	Floc Size		Wa	nter Qu	ality m	g/ľ		O41
	No.	mg/l	μi		Settled	Filtered	Color	rioc Size	Fe	Mn	ÁS	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7	5	D/R	0.87	0.1	21	Small	0.01	0.081	D/R	D/R	D/R	0.016	
	2	7	10	D/R	0.41	0.09	0	Smaili	0.01	0.093	D/R	D/R	D/R	0.0169	
	3	7	15	D/R	0.42	0.08	0	Small	0.02	0.137	DIR	D/R	D/R	0.0121	
ACH plus Arctic Floc	4	7	20	D/R	0.84	80.0	0	Smail	0.02	0.07	D/R	D/R	D/R	0.0137	
12100 70/30 blend	5	7	25	D/R	1.16	0.1	0	Small	0.14	0.089	D/R	D/R	D/R	0.0198	
Dose µl	6	7	30	D/R	0.52	0.1	0	Small	0.03	0.101	D/R	D/R	D/R	0.0304	
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Tuiuksak W-05-2 6-22-06 Jar Test Sheet

Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/23/2006	Tuluksak W-05-1	Garry Bowley	
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Water Qu	ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Testing P	rocedure RP	M Time
Turbidity	NTU					Primary Coagulant			Mixing KM		30 2min
Color	PCU	40				Coagulant Aid			Oxidization		15 30mir
pH		7.4				Filter Aid			Mixing Pax	XL-9+AF 3	30 3min
Alkalinity	mg/l			ů		Pre pH Adjustment			Flocculation		14 20mic
Hardness	mg/l	Ì				Post pH Adjustment			Settling		0 30mir
Temp	F	37°				Other				ced color in the f	
Fe	mg/l	6.39							jars was a little two		
Mn	mg/I								the KMnO4 into th		
As	mg/l								to 4 mg/l and chec		
TDS	mg/i								noticed slight odor		
UV254 (A)		0.0265							with Pax XL-9 plus		

Comments & Notes Had a lot of pin floc with the KMnO4 in all jars put the first three stayed a little bit pink until after I added the Pax XL-9 plus arctic floc 12100 and reduced speed had large floc after 10min on slow speed has settlin during flocculation and is clear between floc

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Elas Cha		Wa	rter Qu	ality m	ra/i		
	No.	mg/l	μl		Settled	Filtered	Color	Floc Size	Fe	Mn	As	Alk		UV254	Other
KmnO4 dose mg/l	1	5	5		0.54	0.07	0	medium	0.06	0.03				0.0233	
	2	5	10		1.6	0.08	15	medium	0.04	0.101				0.0215	Overdose KMnO4
	3	5	15		0.8	0.08	15	medium	0.03	0.364				0.0237	Overdose KMnO4
PAX XL-9 plus Arctic	4	4	20		0.42	0.07	0	large	0.01	0.168				0.0187	
Floc 12100 dose µl	5	4	25		0.6	0.09	0	large	0.03	0.352				0.0199	
90/10 blend	6	4	30		0.5	0.07	0	large	0.01	0.093				0.0194	
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Tuluksak W-05-1	6-23-06
Jar Test Sheet	

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#### POTABLE WATER JAR TEST EVALUATION FORM

	Location		Perso	nnel			Plant Size ar	id Flow			
	Tuluksak V	Y-05-2	Garry	Bowley							
ality	Raw	Settled	Filtered	Dist	Chemical Usage	Product	Dose mg/l	Jar Test	ing Procedure	RPM	Time
UTN					Primary Coagulant			· · · · · · · · · · · · · · · · · · ·	<del></del>	<del> </del>	2min
PCU					Coagulant Aid			Oxidization			30min
					Filter Aid			Mixing	Pax XL-9+AF 90/10		2min
mg/l					Pre pH Adjustment			1		<del></del>	20min
mg/l					Post pH Adjustment		1	<del></del>			45min
F					Other						10
mg/l	8.34										
mg/l											
mg/l							1				
	0.0347										
	mg/l mg/l F mg/l mg/l	Tukuksak Wality Raw NTU PCU mg/l mg/l F mg/l 8.34 mg/l mg/l mg/l	Tukuksak W-05-2 ality Raw Settled NTU PCU mg/l mg/l F mg/l 8.34 mg/l mg/l mg/l	Tuluksak W-05-2 Garry  ality Raw Settled Filtered  NTU  PCU  mg/l  mg/l  F  mg/l  mg/l  mg/l  mg/l  mg/l  mg/l  mg/l	Tuluksak W-05-2 Garry Bowley  ality Raw Settled Filtered Dist  NTU  PCU  mg/l  mg/l  F  mg/l  8.34  mg/l  mg/l  mg/l	Tuluksak W-05-2  Garry Bowley  Alifty Raw Settled Filtered Dist Chemical Usage Primary Coagulant PCU Coagulant Aid Filter Aid Filter Aid Pre pH Adjustment Post pH Adjustment F Other  Mg/l  Mg/l  Mg/l  Mg/l  Mg/l  Mg/l  Mg/l	Tuluksak W-05-2 Garry Bowley  alifty Raw Settled Filtered Dist Chemical Usage Product  NTU Primary Coagulant  Coagulant Aid  Filter Aid  mg/l Pre pH Adjustment  Post pH Adjustment  The mg/l Ray Settled Filtered Dist Chemical Usage Product  Primary Coagulant  For pH Adjustment  Other  mg/l 8.34  mg/l Ray Raw Settled Filtered Dist Chemical Usage Product  Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Primary Coagulant  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemical Usage Product  Other Chemica	Tukuksak W-05-2 Garry Bowley  ality Raw Settled Filtered Dist Chemical Usage Product Dose mg/l  NTU Primary Coagulant  Coagulant Aid  Filter Aid  mg/l Pre pH Adjustment  Post pH Adjustment  F Other  mg/l 8.34  mg/l 9.34  mg/l 9.34	Tuluksak W-05-2 Garry Bowley  alify Raw Settled Filtered Dist Chemical Usage Product Dose mg/l Jar Test NTU Primary Coagulant Mixing PCU Coagulant Aid Oxidization Filter Aid Mixing  mg/l Pre pH Adjustment Flocculation  Post pH Adjustment Settling  F Other Remarks:  mg/l 8.34  mg/l  mg/l  mg/l	Tuluksak W-05-2 Garry Bowley    Settled   Filtered   Dist   Chemical Usage   Product   Dose mg/l   Jar Testing Procedure	Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Tuluksak W-05-2  Garry Bowley  Product  Dose mg/l  Jar Testing Procedure  RPM  Mixing KMnO4 310  Oxidization 15  Filter Aid Mixing Pax XL-9+AF 90/10 310  Fre pH Adjustment  Flocculation 15  Post pH Adjustment  Flocculation 15  Settling 0  Other  Remarks:

Comments & Notes Has good oxidization and pin floc with KMnO4 10min after adding the Pax XL-9 plus AF12100 and mixing it has good floc formation smaller in lower closes but large in higher close has settling during mixing and is clear between floc but it also looks like this is going to have some floaters (see picture)

Products Tested	3	Į.	Dose	pН	Turbidity	Turbidity	True	Floc Size		W/	iter Qu	ality n	1g/l		OM
	No.	mg/l			Settled	Filtered	Color	1 NOC 3128	Fe	Min	As	Alk	Hard	UV254	Other
KMnO4 dose mg/l	1_1_	7	5		0.57	0.05	7	smail	0.02	0.07				0.0292	
	2	7	10		0.5	0.07	0	small	0.01	0.302				0.0286	
	3	7	15		0.71	0.16	0	medium	0.02	0.138				0.0284	
Pax XL-9 plus Arctic	4	7	20		0.44	0.07	0	medium	0	0				0.0385	
Floc 12100 dose µl	5	7	25		0.87	0.08	0	large	0.04	0.016				0.0274	
90/10 blend	6	7	30		0.68	0.07	0	large	0.03	0				0.0211	
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Tuluksak W-05-2 6-23-06 Jar Test Sheet

Page ____

Printed 6/24/2006

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/24/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Filtered	Jar Testing Procedure	RPM	Time
Turbidity	עדע	0.62				Ammonia (as Nitrogen)	mg/l 0.36		Mixing KMnO4		3min
Color	PCU	40				Dissolved Oxygen mg/l	5.7		Oxidization	<del></del>	30min
рН		7.35	mV -13.2			Hydrogen Sulfide mg/l	0.04		Mixing Pax XL-9+AF12100 70/30		3min
Alkalinity	mg/s	90		·		Carbon Dioxoid mg/l	45		Flocculation		20min
Hardness	mg/l	2.79							Settling	<del>}</del>	35min
Temp	F	37*							Remarks:		100
Fe	mg/l	5.01	Ferrous r	ng/l 2.05							
Mn	mg/l	0.334								·	
As	mg/l	15									
TDS	mg/l	82 Cond	178.0 µs	Sal 0.1%							
UV254 (A)		0.0271								<del></del>	

Comments & Notes	Checked raw water quality this morning and noted change in total iron and adjusted KMnO4 dose for jar test
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Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		W:	nter Qu	ality m	gri		
	No.	mg/l	<u> </u>		Settled	Filtered	Color	PIOC 3128	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	4	5	7.15	0.62	0.11	5	Small	0	0	D/R	D/R	D/R	0.0218	
	2	4	10	7.18	0.64	0.11	11	Small	0	0	D/R	D/R	D/R	0.0157	
Pax XL-9 Plus Arctic	_ 3	4	15	7.23	1.19	0.12	15	Small	0	0	D/R	D/R	D/R	0.0168	· · · · · · · · · · · · · · · · · · ·
Floc 12100 70/30	4	4	20	7.3	1.33	0.12	4	Small	0.04	0.001	D/R	DAR	D/R	0.0162	** <u> </u>
blend Dose µl	5	4	25	7.31	1.91	0.21	15	Small	0	0	D/R	D/R	D/R	0.0141	
	6	4	30	7.29	2.62	0.25	17	Small	0.04	0.001	D/R	D/R	D/R	0.0162	
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Tuluksak W-05-1 6-24-06 Jar Test Sheet

Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/24/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Filtered	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.69				Ammonia (as Nitrogen)	mg/l 0.96		Mixing KMnO4		3min
Color	PCU	45				Dissolved Oxygen mg/l	5.8		Oxidization	14	30min
pH		7.31	mV -12.9			Hydrogen Sulfide mg/l	0.02		Mixing Pax XL-9+AF12100 70/30	312	3min
Alkalinity	mg/l	75				Carbon Dioxoid mg/l	60		Flocculation		20min
Hardness	mg/l	3.05							Settling	0	35min
Temp	F	37*							Remarks:		
Fe	mg/l	9.63	Ferrous m	g/l 2.87							
Mn	mg/l	0.279									
As	mg/l	15									
TDS	mg/l	83 Cond	179.8 µs S	al 0.1%							
UV254 (A)		0.0279									

Comments & Notes Checked raw water quality this morning and started jar test with Pax XL-9 plus Arctic Floc 12100 70/30 blend it had small floc and the settling was a little slow and a little cloudy on the bottom.

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size	Water Quality mg/l						04	
77044043 700404	No.	mg/i	μΙ		Settled	Filtered	Color Floc Size		Fe	Min	As	Alk		UV254	Other	
KMnO4 Dose mg/l	1	7	5	7.56	0.6	0.14	20	Small	0	0	D/R	D/R	D/R	0.0247		
	2	7	10	7.7	0.48	0.09	13	Small	0	0	D/R	D/R	D/R	0.0283		
Pax XL-9 Plus Arctic	3_	7	15	7.77	0.52	0.09	9	Small	0	0	D/R	D/R	D/R	0.035		
Floc 12100 70/30	4	7	20	7.78	0.96	0.09	14	Small	0	0	D/R	D/R	D/R	0.0272		
blend Dose µl	5	7	25	7.76	1.16	0.09	0	Small	0	0	D/R	D/R	D/R	0.0202		
	8	7	30	7.78	1.06	0.1	12	Small	0.01	0	D/R	D/R	D/R	0.0173		
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Tuluksak W-05-2	6-24-06
Jar Test Sheet	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/25/2006	Tutuksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.17				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4	330	3min
Color	PCU	35				Dissolved Oxygen mg/l			Oxidization	14	30min
рН		7.35	mV -13.1			Hydrogen Sulfide mg/l			Mixing Pax XL-9+AF12100 80/20	330	3min
Alkalinity	mg/l	90		*		Carbon Dioxoid mg/l			Flocculation	14	25min
Hardness	mg/l	2.79							Settling	0	40min
Temp	F	351							Remarks:		
Fe	mg/l	8.64	Ferrous m	g/I D/R							
Mn	mg/l	0.325									
As	mg/l	15									
TDS	mg/l	80 Con	d. 198.5µs S	Sal .0 1‰							
UV254 (A)		0.0261									

Comments & Notes Checked raw water quality this morning the iron is back up to 8.63 mg/l and temp is down 2° NTU is as low as 1 have seen it on raw water in this well. Continued jar test adjusted KMnO4 Dose for higher iron and used Pax XL-9 plus Arctic Floc 12100 80/20 blend built pretty good floc kind of small but was clear between it settling rate is a little slow but condenses in the bottom of jars.

Products Tested	Jar	Dose	Dose	рН	Turbidity	Turbidity	True	Floc Size	Water Quality mg/l						Other	
Products rested	No.	mg/i	μl		Settled	Filtered	Color Floc Size		Fe	Mn	As	Alk	Hard	UV254	Other	
KMnO4 Dose mg/l	1	5	5	7.38	0.31	0.08	0	Small	0.02	0.022	D/R	D/R	D/R	0.0178		
	2	5	10	7.38	0.46	0.07	00	Small	0.01	0.026	D/R	D/R	D/R	0.0165		
Pax XL-9 Plus Arctic	3	5	15	7.36	0.44	0.09	0	Smat	0	0.026	D/R	D/R	DAR	0.0169		
Floc 12100 80/20	4	5	20	7.35	0.51	0.07	0	Small	0.02	0.029	D/R	D/R	DAR	0.015		
Biend Dose µi	5	5	25	7.35	0.7	0.09	0	Small	0.04	0.05	D/R	D/R	D/R	0.0161		
	6	5	30	7.3	0.89	D.11	0	Small	0.02	0.089	D/R	D/R	DAR	0.0135		
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Tutuksak W-05-1 6-25-06 Jar Test Sheet

Page		
	Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/25/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.19				Ammonia (as Nitrogen)	ന്യൂദ		Mixing KMnO4		3min
Color	PCU	37				Dissolved Oxygen mg/l			Oxidization		30min
рH		7.29	mV -11.6	3		Hydrogen Sulfide mg/l			Mixing Pax XL-9+AF12100 80/20		3min
Alkalinity	mg/i	75				Carbon Dioxoid mg/l			Flocculation		25min
Hardness	mg/i	3.05							Settling		35min
Temp	F	35*							Remarks:		
Fe	mg/l	9.8	Ferrous	mg/l							
Mn	mg/l	0.277									
As	mg/l	35									
TDS	mg/l	82 Cond	d. 185.5µs	Sal .0 1%							
UV254 (A)		0.0529									

Comments & Notes checked raw water quality this morning the only difference was the temp down 2° continued jar test using Pax XL-9 plus Arctic Floc 12100 80°20 blend it built nice floc and settled out good

Products Tested	Jar	Dose	Dose	рH	Turbidity	Turbidity	True	Elon Cina		W:	ter Qu	ality m	g/Ϊ		
11000000 100000	No.	mg/l	μl		Settled	Filtered	Color	Color Floc Size		Mn	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	7	5	7.58	0.34	0.08	0	Medium	0.02	0.022	D/R	D/R	D/R	0.0297	
	2	7	10	7.69	0.43	0.07	0	Medium	0.04	0.013	D/R	D/R	D/R	0.0287	
Pax XL-9 plus Arctic	3	7	15	7.7	0.56	0.08	0	Medium	0.03	0	D/R	D/R	D/R	0.0195	
Floc 12100 80/20	4	7	20	7.73	0.68	0.08	0	Medium	0.02	0.039	D/R	D/R	D/R	0.019	
blend Dose µl	5	7	25	7.73	0.69	0.07	0	Medium	0.03	0.018	D/R	D/R	D/R	0.0173	
	6	7	30	7.75	0.75	0.06	0	Medium	0	0.051	D/R	D/R	D/R	0.0331	
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Tuluksak W-05-2 6-25-06 Jar Test Sheet

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Printed 6/26/2006

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/26/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.28				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4	330	3min
Color	PCU	34				Dissolved Oxygen mg/l			Oxidization	14	30min
рH		7.44	mV -19.8			Hydrogen Sulfide mg/l			Mixing Nalco 8165	330	3min
Alkalinity	mg/l			· ·		Carbon Dioxoid mg/l			Flocculation	14	25min
Hardness	mg/l					•			Settling	0	45min
Temp	F	34.7°							Remarks: Started jar test after che	cking r	<b>2W</b>
Fe	mg/l	8.88	Ferrous m	ng/1					water this morning the KMnO4 oxidize	s and f	oms
Mn	mg/l	0.36							lots of pin floc with the dose of 5mg/l i	1 this w	ell
As	mg/l								the iron is back up and the temp is do	vn .3° l	let
TDS	mg/l	81 Con	d 185.0 µs	Sal 0.1‰					flocculation run 5min longer because	his is s	low
UV254 (A)		0.0311							reacting kind of cloudy		

Comments & Notes Settling rate is a little slow floc is small and you won't have a very long filter run it plugged up the 5µl syringe filter about half way through the sampling

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size		Wa	ter Qu	ality m	ıg/l		Other
riococts resteu	No.	mg/i	μſ		Settled	Filtered	Color	FRUC 3128	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	5	5	D/R	1.17	0.08	0	Small	0.03	0.143	D/R	D/R	D/R	0.0218	
	2	5	10	D/R	0.7	0.08	0_	Small	0.02	0.165	D/R	D/R	D/R	0.011	
Nalco 8185 Dose µl	3	5	15	D/R	0.42	0.07	0	Small	0	0.05	D/R	D/R	D/R	0.0091	
	4	5	20	D/R	0.69	0.09	0	Smail	0.04	0.085	D/R	D/R	D/R	0.0281	
	5	5	25	D/R	0.57	0.1	0	Small	0.06	0.065	D/R	DAR	D/R	0.0228	
	6	5	30	D/R	0.72	0.15	0	Small	0.07	0.432	D/R	D/R	D/R	0.0246	

Tuluksak W-05-1 6-26-06 Jar Test Sheet

Page	

#### POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/26/2006	Tuluksak W-05-2	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.17				Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min
Color	PCU	50				Dissolved Oxygen rng/l	- X		Oxidization	<del></del>	30min
pH		7.36	mV -15.3			Hydrogen Sulfide mg/l			Mixing Nalco 8185		3min
Alkalinity	mg/i			·		Carbon Dioxoid mg/l			Flocculation		20min
Hardness	mg/l								Settling		40min
Temp	F	35.4*							Remarks: Checked raw water thi		
Fe	mg/l	9.84	Ferrous m	īg/l					is about the same as yesterday temp		
Mn	mg/l	0.351							This well builds better looking floc fas		
As	mg/l							·	05-1 with 8185 in all jars with differer		
TDS	mg/l	83 Cor	nd 189.1 µs	Sal 0.1‰							
UV254 (A)		0.069									

Comments & Notes Settling rate is a little slow but the water looks clear floc stayed suspended and then settled down this well will have about twice the filter run time with nako 8185 than W-05-1

Products Tested	Jar	Dose	Dose	pН	Turbidity	Turbidity	True	Floc Size	Water Quality mg/l					O11	
	No.	mg/l	<u>ul</u>		Settled	Filtered	Color	FIUC SIZE	Fe	Mn	As	Alk	Hard	UV254	Other
KMnO4 Dose mg/l	1	7	5	D/R	0.44	0.07	0	Medum	0.05	0.077	D/R	D/R	D/R	0.0358	
<u> </u>	2	7	10	DAR	0.32	0.07	0	Medum	0.06	0.07	D/R	D/R	D/R	0.0133	
Nako 8185 Dose µl	3	7	15	D/R	0.53	0.09	0	Medum	0.02	0.024	D/R	D/R	D/R	0.0087	
	4	7	20	DIR	0.97	0.1	0	Medum	0.04	0	D/R	D/R	D/R	0.0191	
	5	7	25	D/R	0.55	0.1	0	Medum	0.04	0	D/R	D/R	D/R	0.0057	
	6	7	30	D/R	0.56	0.15	0	Medum	0.09	0.054	D/R	D/R	D/R	0.0333	
	<u> </u>														
	<u> </u>		<u> </u>												
	1														
	1														

Tuluksak W-05-2 6-26-06 Jar Test Sheet

Page		

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/27/2006	Tuluksak W-05-1	Garry Bowley	
			<u> </u>

Water Qu	ality	Raw	Settled	F	iltered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	DOM	Time
Turbidity	NTU	0.9					Ammonia (as Nitrogen)	mg/I		Mixing KMnO4	<del></del>	2min
Color	PCU	41					Dissolved Oxygen mg/l	<u>V</u>		Oxidization	<del></del>	30mi
рН		7.25	mV				Hydrogen Sulfide mg/l			Mixing Stem Pac Plus Arctic Floo	<del></del>	2min
Alkalinity	mg/l				-		Carbon Dioxoid mg/l			Flocculation	<del></del>	30mi
Hardness	mg/l									Settling	1	1hr
Temp	F	35°								Remarks: I didn't like what was ha		
Fe	mg/l	11.44	Ferrous	mg/i						the 300 gal tank after adding chemica		
Mn	mg/l	0.404								this jar test.	3010	<u> </u>
As	mg/l											
TDS	mg/l	Cond	μs	Sal	‱							
UV254 (A)												

Comments & Notes After taking readings it would appear that the KMn04 dose in the 300 gal tank is a little bit of an overdose looking at turbidity and apparent color for both the 300gal tank and the jar with 6mg/l KMnO4 have close to the same turbidity (see pictures for today)

Products Tested		Dose		Нq	Turbidity	Turbidity	True	Floc Size		W	ater Qu	sality n	19/1		
	No.	mg/i	μΙ		Settled	Filtered	Color	. AC Size	Fe	Min	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5	10		0.41	0.08	0	smail							
	2	6	10		2.99	0.25	0	small							
SP + AF 80/20 µl	3	7	10												OVERDOSE KMn04
Out of 300 gal tank	4		10		2.65	0.08	0	small	0	0.09					
	┼														
	+					<del></del>		<b> </b>							
								<del>                                     </del>							
	}														
	<u> </u>					1		1 1		} }					

Tuluksak W-05-1 6-27-06 Jar Test Sheet

Page ____

Printed 6/28/2006

Appendix D - Jar & Pilot Study Logs Page 29 of 44

CE2 Engineers, Inc.

PILOT TESTING LOG

Date	Location	Water Source	Personnel
	Tuluksak W-05-01	Raw Water	Garry Bowley

Raw V	Vater (	Quality	Chemicals Used	Dose mg/l	Treatment Vessel Information	n
Turbidity	NTU	0.9	KMnO4	5 mg/l	Flow Rate GPM	
Color	PCU	41			Vessel Description	GPM/sq ft
рН		7.25	Stern Pac Plus	11 mg/l		
Alkalinity	mg/l		Arctic Floc 12100			
Hardness	mg/l		80/20 Blend			
Temp	F	35°				
Fe	mg/i	11.44			Other Notes I didn't like what was hi	ppening
Mn	mg/l	0.404			with the water in the 300 gal tank and did	quick jar
As	mg/i				test to determine what was going on with	the water
TDS	mg/l				in the 300gal tank	
UV254 (A)						

Treatment Process Objective
,
Treatment Process Description Hauled water in and preheated to 54° added 5 grams KMnO4 to it mixed on high
for 5min then turned down and let oxidize for 30min turned speed up and added 11 ml of Stern Pac plus Arctic
Floc 12100 80/20/ blend to it took one minute to add 11 ml mixed on high for 5min then down to about 14 rpm
for 25min and turned mixer off water stayed turning for 30min started taking readings at ports on tank
Sketch of Test Setup

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Tuluksak W-05-1 6-27-06	ak Pilanti ang Propinsing Silanti kan isang pada ang kanan isang pangahang bang pangan dan milang bang pangang

Tuluksak W-05-1 6-27-08 Pilot Testing Sheet

Page ____

Printed 8/28/2006

Appendix D - Jar & Pilot Study Logs Page 30 of 44

# CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Time	(S)tart (M)iddle (E)nd	Description of Process Step, Test Results, Adjustments
6/27/2008	3:00pm		45min after stopping mixer took turbidity readings on the three taps on tank
		Тор	NTU 9.67 through 1.2µl filter 0.10
		_	Ptco 307 through .45µl filter 15
		Middle	NTU 9.67 through 1.2µl filter 0.10
			Ptco 382 through .45µl filter 17
		Bottom	NTU 9.67 through 1.2µl fliter 0.10
			Ptco 387 through .45µl filter 34
	E-00-		
	5:00pm	Тор	NTU 4.95 through 1.2µl filter 0.28
		100	Ptco 107 through .45µl filter 10
			·
		Middle	NTU 8.85 through 1.2µl filter 0.40
		ļ	Ptco 200 through .45µl filter 15
		Bottom	NTU 10.9 through 1.2µl filter 0.62
			Ptco 265 through .45µl filter 22
	10:00pm		
		Тор	NTU 3.10 through 1.2µl filter 0.10
d-version and the Stephen			
		1	
		Middle	NTU 4.32 through 1.2µl filter 0.11
	<del></del>		
		Bottom	NTU 5.09 through 1.2µl filter 0.07
			Fe 0.02
	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		

Tuluksak W-05-1 6-27-06 Pilot Testing Sheet

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Appendix D - Jar & Pilot Study Logs Page 31 of 44

CE2 Engineers, Inc.

PILOT TESTING LOG

Date 6/28/2006		Location Tuluksak		Wate W-05	r Source -1	Personnel Garry Bowley						
Raw V	Nater (	Quality	Chemicals Us	ed	Dose mg/l	Treatment Vessel Information						
Turbidity	NTU	0.9		Flow Rate GPM					0.5			
Color	PCU	41				Vessel Descriptio	n		GPM/sq ft			
рН		7.25				8" X 60" Clear PV	C Multi Media	1.5	GPM/sq ft			
Alkalinity	mg/l											
Hardness	mg/l											
Temp	F	35*										
Fe	mg/l	11.44				Other Notes						
Mn	mg/l	0.404										
As	mg/l	35										
TDS	mg/l	82										
UV254 (A)		0.0269										
Treatment	Proce	es Objecth	ve To remove	lron,M	langanese,A	Arsenic and Color	•		•••••			
			tion Raw Water ement, And Multim			treated in 300gal	ank (see figure	4- Che	mical			
				••••••			* * * * * * * * * * * * * * * * * * * *	•••••	*********			
				******				*****	************			
Sketch of	Test S	Sketch of Test Setup										

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	والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة والمراجعة	

Tuluksak W-05-1 6-28-06 Pilot Testing Sheet

Page ____

Printed 7/2/2006

Appendix D - Jar & Pilot Study Logs Page 32 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Tlme	(S)tart (M)iddle (E)nd	Description of Process Step, Test Results, Adjustments
6/28/2008	9:00am		Water readings in the 300 gal tank before starting through filter at the three taps
		Тор	NTU settled 1.94 through 1.2µl filter 0.09
			Fe 0.03
			Ptco 0
	**************************************		Mn 0.454
		-	PH 7.26
		Middle	NTU settled 2.65 through 1.2µl filter 0.13
			Fe 0.03
			Ptco 0
			Mn 0.454
	·	ļ	PH 7.16
		Bottom	NTU settled 2.69 through 1.2µl filter 0.12
	- A CONTRACTOR OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF		Fe 0.03
			Ptco 0
			Mn 0.454
			PH 7.26
	10:30am		Started water through filter ran it filter to waste for 15min and took readings
	11:00am		NTU 0.29
			Fe 0.00
			Ptco 0
			Mn Over limit low range
			PH 7.26
	11:15am		Checked tap water quality because of Mn being high
			NTU 0.35
			Fe 0.02
			Ptco 31
			Mn Over limit low range high range 3.4mg/l
			PH 6.80
1	1:30am		NTU 0.19
			Fe 0.00
			Ptca 2
		And the second second	
- 1		1	Mn High range 2.1mg/l

Tulukeak W-05-1 6-28-06 Pilot Testing Sheet

Page	
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Appendix D - Jar & Pilot Study Logs Page 33 of 44

CE2 Engineers, Inc.

# PILOT TESTING LOG

Date	Time	(M)iddie (E)nd	Description of Process Step, Test Results, Adjustments				
6/28/2006	11:00am		Raw Water quality check	Time			
			UV254 0.0269	1:45pm	Out of center tap on tank pushed		
			NTU 1.02		through 1.2µl filter		
			Fe 9.24		NTU 0.09		
			Ptco 41		Mn 0.052		
			Mn 0.812		Fe 0.00		
			PH 7.35		Ptco 0		
	12:00pm	-	NTU 0.08	2:00pm	NTU 0.07		
			Fe 0.01		Fe 0.00		
			Ptco 0		Ptco 0		
			Mn 1.2		Mn 0.4		
			PH 7.21		PH 7.25		
			UV254 0.0179		UV254 D/R		
	12:30pm		NTU 0.07	2:30pm	NTU 0.07		
			Fe 0.00		Fe 0.00		
			Ptco 0		Ptco 0		
			Mn 0.9		Mn 0.3		
			PH 7.26		PH 7.30		
			UV254 D/R		UV254 D/R		
	1:00pm		NTU 0.07	3:00pm	NTU 0.07		
			e 0.00		Fe 0.00		
			Ptco 0		Ptco 2		
_			Mn 0.8		Mn D/R		
		Action to the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	PH 7.18		PH 7.28		
		<u> </u>	JV254 D/R		UV254 D/R		
	-						
	:30pm		NTU 0.07	3:30pm	NTU 0.07		
			e 0.00		Fe 0.00		
			Pico O		Ptco 0		
		- Company of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the l	1n 0.8		Mn 0.4 High range		
	-		PH 7.16		PH D/R		
			V254 D/R		UV254 D/R		

Tuluksak W-05-1 6-28-06 Pilot Testing Sheet

Page ____

Printed 7/2/2006

# PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 34 of 44

Date	Tlme	(8)tart (M)iddle (E)nd	Description of Process Step, Test Results, Adjustments					
6/28/2008	The same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the sa			Time				
	4:00pm		NTU 0.07	6:15pm	Stopped filter process Air scour			
			Fe 0.00		and backwash to try and reduce			
			Ptco 0		the high Mn level the filter cleane			
162			Mn D/R		in 2mln but ran the treated water			
			PH 7.28		through for 8min then started filte			
			UV254 D/R		to waste took readings after 10m			
	4:30pm		NTU 0.07	6:30pm	NTU 0.07			
			Fe 0.00		Fe 0.00			
			Ptco 0		Ptco 0			
			Mn D/R		Mn 0.561			
			PH 7.26		PH 7.25			
		>	As 3ppb		UV254 D/R			
	5:00pm		AITHAAT					
	0,00pm		NTU 0.07	7:00pm	NTU 0.07			
			Fe 0.00		Fe 0.00			
			Ptco 1		Ptco 0			
			Mn 0.4		Mn 0.519			
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			JV254 D/R	-	UV254 D/R			
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Tuluksak W-05-1 6-28-08 Pilot Testing Sheet

Page ____

# CE2 Engineers, Inc.

# POTABLE WATER JAR TEST EVALUATION FORM

Date	Location	Personnel	Plant Size and Flow
6/29/2006	Tuluksak W-05-1	Garry Bowley	

Water Qu	ality	Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.38				Ammonia (as Nitrogen)	mg/I		Mixing KMnO4		3min
Color	PCU	14				Dissolved Oxygen mg/l			Oxidization		35min
pН		7.64	mV			Hydrogen Sutfide mg/l			Mixing Coagulant Blend		3min
Alkalinity	mg/i			4		Carbon Dioxoid mg/l			Flocculation		30min
Hardness	mg/l								Settling		1hr
Temp	F	34.6							Remarks:		
Fe	mg/l	9.88									
Mn	mg/l	8.0									
As	mg/l	35									
TDS	mg/l	82									~
UV254 (A)		0.0369									

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Products Tested	ı	Dose		pН	Turbidity	Turbidity	True	Floc Size		₩:	ster Qu	ality n	ıg/l		Out
7,000000	No.	mg/i	μl		Settled	Filtered	Color	1.100 3126	Fe	Mn	As	Alk	Hard	UV254	Other
(MnO4 Dose mg/l	1	4	10	7.61	1.52			small							
SP+AF 80/20	2	4.5	10	7.55	0.65	0.07	12	small	0.07	0.223					
KMnO4	4	4	10	7.62	0.24	0.09	0	smali	0.02	0.05					
ACH+AF 80/20	5	5			Overdose	KMnO4									
	6	4.5	10	7.52	0.5	80.0	0	medium	0.02	0.022					looks like this will work for
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Tuluksak W-05-1 6-29-06 Jar Test Sheet

Page_

Printed 7/2/2006

Appendix D - Jar & Pilot Study Logs Page 36 of 44

CE2 Engineers, Inc.

#### PILOT TESTING LOG

Date 6/29/20		l .	ocation fuluksak			Source 05-1	Personnel Garry Bowley				
Raw V	Vater	Quality	Chemicals Use	ed [	Dose mg/l	ng/i Treatment Vessel Information					
Turbidity	NTU	0.38	KMnO4		4.22	Flow Rate GPM		0.5			
Color	PCU	14				Vessel Description	n	GPM/sq ft			
рН		7.64				8* X 60" clear PV	C Multimedia	1.5			
Alkalinity	mg/l		ACH plus Arctic F	Floc	11						
Hardness	mg/l		12100 80/20 bit	end							
Temp	F	34.8									
Fe	mg/l	9.66			**************************************	Other Notes	Heated water to 48.5' a	dded the			
Mn	mg/l	0.8					ed 5min turned down sl				
As	mg/l	35				oxidize for 35min then added 11ml of ACH + Al					
TDS	mg/l	81				80/20 bland rapid mix 5min slow 35min let settle					
UV254 (A)		0.0369				overnight					

Treatment Process Objective	To Remove Iron, Manganese, Arsenic and Color to below the MCL
Treatment Process Description Chemical Oxidation, Coagulation,	Raw Water hauled,heated and batch treated in 300gal tank ( See Figure 4 - Settlement, And Multimedia Filtration
•••••	

Sketch of Test Setup	од на применент на применент на применент на применент на применент на применент на применент на применент на п Применент на применент на приме	-
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Tuluksak W-05-1 6-29-06 Pilot Testing Sheet

Page ____

Printed 7/2/2006

Date

CE2 Engineers, Inc.

Location

Personnel

# POTABLE WATER JAR TEST EVALUATION FORM

Appendix D - Jar & Pilot Study Logs Page 37 of 44

6/30/2006		Tuluksak 1	W-05-1	ì	Bowley			Piant	Size and Flor	W		
Water Qu		Raw	Settled	Filtered	Dist	Water Quality	Raw	Treated	las T	ortina December	7===	
Turbidity	NTU	0.67				Ammonia (as Nitrogen)	rng/f		Mixing	esting Procedure		Time
Color	PCU	30				Dissolved Oxygen mg/l		<del> </del>		KMnO4	330	3min
рH		7.45						1	Oxidization		14	35mir
Alkalinity	mg/l	D/R				Hydrogen Sulfide mg/I		-	Mixing	Pax XL-9 plus Arctic Floc	330	3min
Hardness	mg/l	D/R				Carbon Dioxoid mg/l			Flocculation	70/30 blend	7	30mir
Temp	F	35.4				-			Settling			45min
Fe	mg/i	9.6							Remarks:	Did jar test to determine		
Mn	mg/l	0.8							next batch tre	atment referred to my not	es for	best
As	mg/t	35				-		<u> </u>	manganese n			
TDS	mg/l	80						<b> </b>				
UV254 (A)		0.0298										
Comments	2 Not	the Mark	11-04-	202244		1			<u> </u>			

Comments & Notes	The KMnO4 dose seems to be critical in this water.
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Products Tested		Dose		рН	Turbidity Settled	Turbidity	True	Floc Size		W	ater Qu	Jality m	ıg/l		
KMnO4 Dose mg/l	1	4.5		754		Filtered	Color		Fe	Mn	As	Alk		UV254	Other
tumo 4 Boso mor	<del>  '</del> -	1	9	7.51	1.05	0.17	2	small	0	0.024	D/R	D/R	D/R	D/R	
	2	4.5	12	7.5	0.66	0.06	0	small	0	0	D/R	D/R			
Pax XL-9 plus Arctic	3	4.5	15	7.49	0.89	0.1	0	small		-			D/R	DAR	This looks good will use this
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Tuluksak W-05-1 6-30-06 Jar Test Sheet

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# PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 38 of 44

Date	Time	(S)tart (M)lddle (E)nd	Description of Process Step, Test Results, Adjustments						
6/30/2008				Time					
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		UV254	D/R						
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		PH	7.65		PH				
		UV254	0.0108		UV254				
		As	3		As	1			
	5:30pm	NTU	0.07		NTU				
		Fe	0		Fe				
		Ptco	5		Ptco				
		Mn	D/R		Mn				
		PH	7.65		PH				
		UV254	D/R		UV254				
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Tuluksak W-05-1 6-30-06 Pllot Testing Sheet

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Printed 7/3/2008

# PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 39 of 44

Date	Time	(S)tar (M)lddl (E)nd	B Description of P	rocea	a Step, 1	est Resul	s, Adjustments
8/30/2006		After filte			Time	1	
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						As	D/R

Tuluksak W-05-1 6-30-06 Pilot Testing Sheet

Page

Appendix D - Jar & Pilot Study Logs Page 40 of 44

# CE2 Engineers, Inc.

# PILOT TESTING LOG

Date 6/30/2006	Location Tuluksak W-05-1			r Source		Personnel Garry Bowley
Raw Water	Quality	Chemicals Us	ed	Dose mg/l	Treatn	nent Vessel Information

Raw	Vater	Quality	Chemicals Used	Dose mg/	Treatment Vessel Information						
Turbidity	NTU	0.38	KMnO4	4.22	Flow Rate GPM	0.5					
Color	PCU	14			Vessel Description	GPM/sq ft					
рН		7.64			8" X 60" clear PVC Multimedia	1.5					
Alkalinity	mg/l		ACH plus Arctic Floc	11		1.0					
Hardness	mg/l		12100 80/20 blend								
Temp	F	34.8									
Fe	mg/l	9.66			Other Notes Heated water to 48.6° s	ddad tho					
Mn	mg/l	0.8			KMnO4 rapid mixed 5min turned down sli						
As	mg/l	35			oxidize for 35min then added 11ml of AC						
TDS	mg/I	81			80/20 blend rapid mix 5min slow 35min le						
UV254 (A)		0,0369			ovemlaht	,					

Treatment Process Objective	To Remove Iron, Manganese, Arsenic and Color to below the MCL
Treetment Droope Decedation	PaulMakakakakak
Treatment Process Description	Raw Water hauled heated and batch treated in 300gal tank ( See Figure 4 -
Cuantical Oxidation Coadmation	Dettiement, And Multimedia Filtration
( Note: this batch was started is	te yestersay afternoon )
	***************************************

etch of Test Setup		
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*		

Tuluksak W-05-1 6-30-06 Pilot Testing Sheet

Page ____

Printed 7/3/2008

# POTABLE WATER JAR TEST EVALUATION FORM

				. 0.04
	Date	Location	Personnel	Direct Circumstati
	7/1/2006	Tutuksak W-05-1	Garry Bowley	Plant Size and Flow
1	Mater Ourline	D		

Water Qu	uality	Raw	Settled	Filters	d Dist	Water Quality	Raw	7	T		
Turbidity	MIU	0.85						Treated	Jar Testing Procedure	RPM	Time
Color	PCU	37		<del> </del>		Ammonia (as Nitrogen)	mg/l		Mixing KMnO4	330	3min
	. 00		1			Dissolved Oxygen mg/l			Oxidization		35mir
pН		7.5	m∨			Hydrogen Sulfide mg/l			Mixing XL-9 plus AF 12100		-
Alkalinity	mg/l	D/R				Carbon Dioxoid mg/l			12.00	330	3min
Hardness	mg/l	D/R				The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		<del> </del>	Floccutation 70/30 blend	14	35mir
Temp	E	35.4			<del></del>				Settling	0	45mir
			1						Remarks:		
Fe	mg/l	9.66	Ferrous mo	γI							
Mn	mg/l	0.8									
As	mg/i	35									
TDS	mg/l	82 Co	nd us	Sal %	1						
UV254 (A)		0.0267				1					
^											

Comments & Notes Dumped what was mixed late yesterday did jar test hauled water and heated it to 54°. This water starts to oxidize after about 1 and 1/2 to 2 HR of setting and reduces the dose rate of the amount of Potassium Permanganate in order to oxidize it by about 1 mg/L. Also the mixing of the coagulant blend in the large vessel is very important to the water quality

Products Tested		Dose		рН		Turbidity	True	Floc Size		W	ater Qu	ality m	M		
104.045	NO.	mg/i	μι_		Settled	Filtered	Color	1 100 3228	Fe	Ma				UV254	Other
KMnO4 Dose mg/l	1	5			0.68	0.22		medium			D/R	D/R			
Af 12100 dose µt	2	5	2		0.47	0.25	13	small	0.03		D/R		D/R		KMnO4 Only
Kemiron Pax XL-9	3	5	12		0.31	0.07	0	small	0.00	0		D/R	D/R	DAR	
Plus Arctic Floc12100	4	5	12		1.05	0.07	2				D/R	D/R	D/R	D/R	
70/30 blend Dose µl					1.00	0.07		Berns	0	0	D/R	D/R	D/R	D/R	One liter out of 300gal tank
								<b></b>	I						after KMnO4 dose
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Tutuksak W-05-1 7-1-06 Jar Test Sheet

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# POTABLE WATER JAR TEST EVALUATION FORM

Date		Location			Perso	nnel			Plant	t Size and Flow		
7/3/2006		Tuluksak \	W-05-1		Garry	Bowley						
Water Qu	ality	Raw	Settled	Filt	ered	Dist	Water Quality	Raw	Treated	Jar Testing Procedure	RPM	Time
Turbidity	NTU	0.36					Ammonia (as Nitrogen)	mg/l		Mixing KMnO4		3min
Color	PCU	51					Dissolved Oxygen mg/i			Oxidization		35min
p <b>iH</b>		7.62	mV				Hydrogen Sulfide mg/l			Mixing XL-9 Plus AF 75/25 blend		3min
Alkalinity	mg/l	D/R					Carbon Dioxoid mg/l			Flocculation		25min
Hardness	mg/l	D/R								Settling		40min
Temp	F	35.2°						· · · · · · · · · · · · · · · · · · ·		Remarks: Dumped the 300 gal tank		
Fe	mg/l	6.97	Ferrous	mg/i				<del></del>		batch treated Saturday afternoon becau		
Мп	mg/l	0.7							<b>†</b>	cloudy high trubidity and the Mn level w		
As-	mg/î	35							<del> </del>	like it just didn't bulid good floc. Checked		
TDS	ma/l	80 Con	ed us	Sal	%0							
UV254 (A)						-				water quality both wells and a quick jar	test	

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Products Tested	1	Dose		pН	Turbidity	Turbidity	True	Floc Size		W	ter Qu	ality m	ıg/l		0.11
	No.	mg/l	l hi		Settled	Filtered	Color	I AC Size	Fe	Mn	As	Alk		UV254	Other
KMnO4 Dose mg/l	1	5.5	10		0.89	0.12	6	small	0.12	0.043	D/R	D/R	D/R		
	2	5.5	15		0.9	0.07	0	medium		0.034		D/R	D/R		
Kemiron Pax XL-9	3	5.5	20		0.94	0.07	0	medium		0.045		D/R	D/R		
Plus Arctic Floc															
12100 Dose µl															
	<del></del>														
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Tuluksak W-05-1 7-3-06 Jar Test Sheet

98

#### CE2 Engineers, Inc.

### POTABLE WATER JAR TEST EVALUATION FORM

Date		Location			Persor	nnel			Plan	nt Size and Flow				
7/3/2006		Tuluksak	W-05-2		Garty E	Bowley			-	IL OLLE BILL I KIN				
Water Qu	ıality	Raw	Settled	Filte	red	Dist	Water Quality	Raw	Treated					
Turbidity	UTN	0.51					Ammonia (as Nitrogen)	mg/l	Heaten		<del></del>	Time		
Color	PCU	58					Dissolved Oxygen mg/l	1119/1		Mixing KMnO4	<del></del>	3min		
рН		7.6	mV	1			Hydrogen Sulfide mg/l		<b> </b>	Oxidization	<del></del>	35min		
Alkalinity	mg/l	D/R					Carbon Dioxoid mg/l		<del> </del>	Mixing XL-9 Plus AF 75/25 blend		3min		
Hardness	mg/l	D/R					TO THE PROPERTY OF THE PARTY OF		<del> </del>	Flocculation	<del></del>	25min		
Temp	F	35.2°								Settling		40min		
Fe	mg/ī	8.12	Ferrous i	ma/l						Remarks: Dumped the 300 gal tai				
Mn	mg/l	8.0		7				· · · · · · · · · · · · · · · · · · ·	<del> </del>	batch treated Saturday afternoon bec				
As	mgΛ	35		1					<del> </del>	cloudy high trubidity and the Mn level				
TDS	mg/l	82 Con	d us	Sai	%=					like it just didn't bulid good floc.Check				
UV254 (A)			1	<del></del>	~				<u> </u>	water quality both wells and a quick ja	r test			
									<u> </u>					
Comments	s & No	les est												

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	Comments & Notes
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Products Tested			Dose	pН		Turbidity	True	Floc Size		W	ater Qu	ality n	ng/l		
101.010	4 Dana 4		Settled	led Filtered Col		olor		Mn	As	Alk		UV254	Other		
KMnO4 Dose mg/l	4	6.2	10		0.48	0.07	1	medium	0	0.206	D/R	D/R	D/R		
	5	6.2	15		0.78	0.06	0	medium	0	0.387	D/R	D/R	D/R	1	<b>.</b>
Kemiron Pax XL-9	6	6.2	20		1.13	0.09	0	medium	0	0.323			<del> </del>		
Plus Arctic Floc								i i i conditi		0.323	D/R	D/R	DAR		
12100 Dose µl										<del>                                     </del>					
				$\neg \neg$											
•						<del></del>		<del> </del>							
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Tutuksak W-05-2 7-3-06 Jar Test Sheet CE2 Engineers, Inc.

#### PILOT TESTING LOG

Appendix D - Jar & Pilot Study Logs Page 44 of 44

Date	Time	(S)tart (M)iddle (E)nd	Description of	Process Ste	p, Test Res	uita, Adjustments
7/4/2006				Time		
	8:30am					
The second second				5:00pm		
<u> </u>	Тор	NTU	1.67 Settled overnight	Bottom	NTU	3.48 Settled 1hr
material promoter and the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state		Control of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the last of the las	0.1 Through 1.2µl filter		NTU	0.1 Through 1.2µl filter
<u> </u>		The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon	0.02		Fe	0
W		The same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the sa	0.127		Mn	0.11
***			8 Through .45µl			0 Through .45µl
	Middle	NTU	2.8 Settled overnight			
			0.05 Through 1.2µl filter			
		Fe	0			
		Mn	0.11			
		Ptco	7 Through .45µl			
	Borrom	NTU	5.20 Settled Overnight			The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s
		NTU	0.06 Through 1.2µl filter			
		Fe	0			
		Mn	0.04			
			3 Through .45µl			
	Changed th	e mixer mo	or mount and ran it on slow	speed for 40r	nin it built m	ueium size floc and
	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s		r the water is clearer than it		THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s
	5:00pm					
	Тор	UTN	2.84 Settled 1hr			
		NTU	0.1 Through 1.2µl filter	T		
		Fe				
			D/R			10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm 10 mm
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	,	Ptco	u mough, appl	1	1	
	,	Ptco	0 Through .45µl			The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon
	Middle					
	Middle	NTU	1.44 Settled 1hr			
	Middle	NTU				
	Middle	NTU NTU	1.44 Settled 1hr 0.08 Through 1.2µl filter 0			
	Middle	NTU NTU Fe Mn	1.44 Settled 1hr 0.08 Through 1.2µl filter 0 D/R			
	Middle	NTU NTU Fe Mn	1.44 Settled 1hr 0.08 Through 1.2µl filter 0			
	Middle	NTU NTU Fe Mn	1.44 Settled 1hr 0.08 Through 1.2µl filter 0 D/R			
	Middle	NTU NTU Fe Mn	1.44 Settled 1hr 0.08 Through 1.2µl filter 0 D/R			

Tuluksak W-05-1 7-3-08 Pilot Testing Sheet

Page ____

Printed 7/5/2008

# Appendix E



### Laboratory Analysis Report

200 W. Potter Drive Anchorage, AK 99518-1605 Tel: (907) 562-2343 Fax: (907) 561-5301 Web: http://www.us.sgs.com

Paul Weisner Chuck Eggener Consulting Engr. P.O. Box 232946 Anchorage, AK 99523

Work Order:

1063863

Tuluksak

Client:

A D E C-Village Safewater

Report Date:

August 10, 2006

Released by:

Forest Taylor 2006.08.10

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08'00'

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by SGS. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request.

The laboratory certification numbers are AK971-05 (DW), UST-005 (CS) and AK00971 (Micro) for ADEC and 001543 for NELAP.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP, the National Environmental Laboratory Accreditation Program and, when applicable, other regulatory authorities.

If you have any questions regarding this report or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
<b>F</b>	Indicates value that is greater than or equal to the MDL.
J	The quantitation is an estimation.
ND	Indicates the analyte is not detected.
В	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
j	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
Е	The analyte result is above the calibrated range.

Note: Soil samples are reported on a dry weight basis unless otherwise specified.

### SGS

SGS Ref.#

1063863003

Client Name Project Name/# A D E C-Village Safewater

Tuluksak

Client Sample ID Matrix Treated Water Process 1
Water (Surface, Eff., Ground)

All Dates/Times are Alaska Standard Time

Printed Date/Time Collected Date/Time Received Date/Time

08/10/2006 11:20 07/11/2006 23:00 07/13/2006 10:05

Technical Director

Stephen C. Ede

#### Sample Remarks:

SM 5910B - %T = 92.4

TTHM Formation Potential was analyzed by Montgomery Watson Harza in Monrovia, CA.

HAA5 Formation Potential was analyzed by Montgomery Watson Harza in Monrovia, CA.

MBAS (Surfactants) by SM5440C was analyzed by Analytica International of Anchorage, AK.

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Nitrate-N	1.17	0.100	mg/L	EPA 353.2	С			07/13/06	ALR
Nitrite-N	ND	0.100	mg/L	EPA 353.2	С			07/13/06	ALR
Calcium	34.3	0.100	mg/L	EP200.7	Α		07/20/06	07/25/06	TK
Magnesium	3.54	0.100	mg/L	EP200.7	Α		07/20/06	07/25/06	TK
Calcium	68.5	0.0500	mg/L	SM20 2340B	Α		07/20/06	07/25/06	TK
Hardness as CaCO3	100	2.50	mg/L	SM20 2340B	Α		07/20/06	07/25/06	TK
Magnesium	7.09	0.0500	mg/L	SM20 2340B	Α		07/20/06	07/25/06	TK
Metals by ICP/MS									
Aluminum	ND	20.0	ug/L	EP200.8	Α		07/20/06	07/25/06	МН
Calcium	35800	500	ug/L	EP200.8	Α		07/20/06	07/25/06	MH
Magnesium	3490	50.0	ug/L	EP200.8	Α		07/20/06	07/25/06	МН
Silver	ND	1.00	ug/L	EP200.8	٨		07/20/06	07/25/06	МН
Waters Department									
Bromide	ND	0.100	mg/L	EPA 300.0	C		07/14/06	07/14/06	DSH
Total Residual Chlorine	ND	0.200	mg/L	SM20 4500-C1 0	G G			07/13/06	DPT
Total Organic Carbon	1.94	0.500	mg/L	EPA 415.1	Н			07/17/06	TSN
(Total Organic Carbon, Dissolve)	(1.80)	0.500	mg/L	EPA 415.1	O			07/17/06	TSN
UV-254	0.0340	0.0200	cm-1	SM20 5910B	N			07/13/06	CAW
Inorganic Contaminants									
Antimony	ND	1.00	ug/L	EP200.8	Α	(<6)	07/20/06	07/25/06	МН
Arsenic	(ND)	5.00	ug/L	EP200.8		(<50)	07/20/06		MH
Barium	42.8	3.00	ug/L	EP200.8		(<2000)	07/20/06		МН

## SGS

SGS Ref.# Client Name 1063863003 A D E C-Village Safewater

Project Name/# Tuluksak

Client Sample ID Treated Water Process 1
Matrix Water (Surface, Eff., Ground)

All Dates/Times are Alaska Standard Time

Printed Date/Time
Collected Date/Time

08/10/2006 11:20 07/11/2006 23:00

Received Date/Time Technical Director 07/13/2006 10:05 Stephen C. Ede

Parameter	Results	PQL	Units	Method	Container II	Allowable  Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants									
Beryllium	ND	0.400	ug/L	EP200.8	Α	(<4)	07/20/06	07/25/06	МН
Cadmium	ND	0.500	ug/L	EP200.8	Α	(<5)		07/25/06	МН
Chromium	2.44	1.00	ug/L	EP200.8	Α	(<100)		07/25/06	MH
Cyanide	ND	0.0050	mg/L	SM20 4500-CN	C.E B	(<0.2)		07/19/06	XZ
Fluoride	ND	0.100	mg/L	EPA 300.0	С	(<2)		07/14/06	DSH
Mercury by Cold Vapor	ND	0.200	ug/L	EP245.1	Α	(<0.2)		07/20/06	
Nickel	2.37	2.00	ug/L	EP200.8	Α	(<100)		07/25/06	МН
Selenium	ND	5.00	ug/L	EP200.8	A	(<50)		07/25/06	МН
Thallium	ND	1.00	ug/L	EP200.8	Α	(<2)		07/25/06	МН
Secondary Contaminants Chloride	4.42	0.100	mg/L	EPA 300.0	С	(<250)	07/14/06	07/14/06	DSH
Color	ND)	5.00	PCU	SM20 2120B	D	(<15)	0771700	07/13/06	CRY
Copper	5.41	1.00	ug/L	EP200.8	Α	(<1300)	07/20/06	07/25/06	MH
Fluoride	ND	0.100	mg/L	EPA 300.0	С	(<2)		07/14/06	DSH
Langlier Index @ 40 degree F	-1.162		-	SM2330B	D	( -,	****	07/28/06	PLW
Alkalinity	98.0	20.0	mg/L	SM20 2320B	D			07/14/06	PLW
Langlier Index @ 140 degree F	-0.082		-	SM2330B	D				PLW
CO3 Alkalinity	ND	20.0	mg/L	SM20 2320B	D			07/14/06	PLW
(Iron	ND )	0.0200	mg/L	EP200.7	Α		07/20/06		TK
HCO3 Alkalinity	98.0	20.0	mg/L	SM20 2320B	D				PLW
OH Alkalinity	ND	20.0	mg/L	SM20 2320B	D				PLW
Manganese	193	* 1.00	ug/L	EP200.8	Α	(<50)	07/20/06	07/25/06	МН
Odor (TON)	ND	1.00	T.O.N.	SM20 2150B	E	(<3)		07/13/06	CRY-
рН	7.14	0.100	pH units	EPA 150.1	D	(6.5-8.5)		07/13/06	CRY
Sodium	2.90	1.00	mg/L	EP200.7	۸	•	07/20/06		TK
Sulfate	2.68	0.100	mg/L	EPA 300.0		(<250)	07/14/06	-	DSH
Total Dissolved Solids	133	10.0	mg/L	SM20 2540C		(<500)		07/14/06	KP
Zinc	91.6	5.00	ug/L	EP200.8	Α	(<5000)	07/20/06		МН



SGS Ref.# Client Name Project Name/# Client Sample ID Matrix 1063863003 A D E C-Village Safewater Tuluksak Treated Water Process 1 Water (Surface, Eff., Ground) All Dates/Times are Alaska Standard Time
Printed Date/Time 08/10/2006 11:20
Collected Date/Time 07/11/2006 23:00
Received Date/Time 07/13/2006 10:05
Technical Director Stephen C. Ede

### SGS

SGS Ref.#

1063863004

Client Name Project Name/# A D E C-Village Safewater

Tuluksak

Client Sample ID Treatment Process 2

Matrix

Water (Surface, Eff., Ground)

All Dates/Times are Alaska Standard Time

Printed Date/Time Collected Date/Time 08/10/2006 11:20 07/11/2006 22:00

Received Date/Time

07/13/2006 7:55

Technical Director

Stephen C. Ede

#### Sample Remarks:

SM 5910B - %T = 94.2

TTHM Formation Potential was analyzed by Montgomery Watson Harza in Monrovia, CA.

HAA5 Formation Potential was analyzed by Montgomery Watson Harza in Monrovia, CA.

MBAS (Surfactants) by SM5440C was analyzed by Analytica International of Anchorage, AK.

Nitrate-N         0.205         0.100         mg/L         EPA 353.2         A           Nitrite-N         ND         0.100         mg/L         EPA 353.2         A           Calcium         34.6         0.100         mg/L         EP200.7         A           Magnesium         3.55         0.100         mg/L         EP200.7         A	07/20/06 07/20/06	07/13/06 07/13/06 07/25/06 07/25/06	ALR TK
Calcium 34.6 0.100 mg/L EP200.7 A	07/20/06 07/20/06	07/25/06	TK
	07/20/06 07/20/06		
Magnesium 3.55 0.100 mg/L EP200.7 A	07/20/06	07/25/06	77.1
			TK
Calcium 69.2 0.0500 mg/L SM20 2340B A		07/25/06	TK
Hardness as CaCO3 101 2.50 mg/L SM20 2340B A	07/20/06	07/25/06	TK
Magnesium 7.10 0.0500 mg/L SM20 2340B A	07/20/06	07/25/06	TK
Metals by ICP/MS			
Aluminum ND 20.0 ug/L EP200.8 A	07/20/06	07/25/06	МН
Calcium 35200 500 ug/L EP200.8 A	07/20/06	07/25/06	MH
Magnesium 3480 50.0 ug/L EP200.8 A	07/20/06	07/25/06	МН
Silver ND 1.00 ug/L EP200.8 A	07/20/06	07/25/06	МН
Waters Department			
Bromide ND 0.100 mg/L EPA 300.0 C	07/17/06	07/17/06	DSH
Total Residual Chlorine ND 0.200 mg/L SM20 4500-Cl G G		07/13/06	DPT
(Total Organic Carbon, Dissolved 1.82) 0.500 mg/L EPA 415.1 O		07/17/06	TSN
UV-254 0.0260 0.0200 cm-1 SM20 5910B N		07/13/06	CAW
Inorganic Contaminants			WIT
Antimony ND 1.00 ug/L EP200.8 A (<6)	07/20/06	07/25/06	МН
(Arsenic ND) 5.00 ug/L EP200.8 A (<50)	07/20/06	07/25/06	МН
Barium 71.0 3.00 ug/L EP200.8 A (<2000)	07/20/06	07/25/06	МН
Beryllium ND 0.400 ug/L EP200.8 A (<4)	07/20/06	07/25/06	МН

# SGS

SGS Ref.# Client Name 1063863004 A D E C-Village Safewater

Project Name/# Tuluksak

Client Sample ID Treatment Process 2

Matrix

Water (Surface, Eff., Ground)

All Dates/Times are Alaska Standard Time

Printed Date/Time Collected Date/Time 08/10/2006 11:20 07/11/2006 22:00

Received Date/Time

07/13/2006 7:55

Technical Director	Stephen C. Ede
	011711111111111111111111111111111111111

Parameter	Results		PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants										
Cadmium	ND		0.500	ug/L	EP200.8	Α	(<5)	07/20/06	07/25/06	МН
Chromium	2.29		1.00	ug/L	EP200.8	Α	(<100)	07/20/06	07/25/06	МН
Cyanide	ND		0.0050	mg/L	SM20 4500-C	N C,E	(<0.2)	07/17/06	07/19/06	XZ
Fluoride	ND		0.100	mg/L	EPA 300.0	С	(<2)	07/17/06	07/17/06	DSH
Mercury by Cold Vapor	ND		0.200	ug/L	EP245.1	Α	(<0.2)	07/20/06	07/20/06	HKG
Nickel	2.02		2.00	ug/L	EP200.8	Α	(<100)	07/20/06	07/25/06	MH
Selenium	ND		5.00	ug/L	EP200.8	Α	(<50)	07/20/06	07/25/06	МН
Thallium	ND		1.00	ug/L	EP200.8	Λ	(<2)	07/20/06	07/25/06	МН
Secondary Contaminants										
Chloride	3.51		0.100	mg/L	EPA 300.0	Α	(<250)	07/17/06	07/17/06	DSH
Color	ND		5.00	PCU	SM20 2120B	D	(<15)		07/13/06	CRY
Copper	4.21		1.00	ug/L	EP200.8	Α	(<1300)	07/20/06	07/25/06	MH
Fluoride	ND		0.100	mg/L	EPA 300.0	Α	(<2)	07/17/06	07/17/06	DSH
Langlier Index @ 40 degree F	-1.171				SM2330B	D			07/28/06	PLW
Alkalinity	96.0		20.0	mg/L	SM20 2320B	D			07/14/06	PLW
Iron	ND		0.0200	mg/L	EP200.7	Α		07/20/06	07/25/06	TK
Langlier Index @ 140 degree F	-0.091				SM2330B	D			07/28/06	PLW
CO3 Alkalinity	ND		20.0	mg/L	SM20 2320B	D			07/14/06	PLW
HCO3 Alkalinity	96.0		20.0	mg/L	SM20 2320B	D			07/14/06	PLW
OH Alkalinity	ND		20.0	mg/L	SM20 2320B	D			07/14/06	PLW
Manganese	252	*	1.00	ug/L	EP200.8	Λ	(<50)	07/20/06	07/25/06	МН
Odor (TON)	ND		1.00	T.O.N.	SM20 2150B	Е	(<3)		07/13/06	CRY
рН	7.14		0.100	pH units	EPA 150.1	D	(6.5-8.5)		07/13/06	CRY
Sodium	2.59		1.00	mg/L	EP200.7	Α		07/20/06	07/25/06	TK
Sulfate	2.81		0.100	mg/L	EPA 300.0	Α	(<250)	07/17/06	07/17/06	DSH
Zinc	34.9		5.00	ug/L	EP200.8	Α	(<5000)	07/20/06	07/25/06	МН
Total Dissolved Solids	129		10.0	mg/L	SM20 2540C	D	(<500)		07/14/06	KP



200 W Potter Drive Anchorage, AK 99518 907 562-2343 Fax: 907-561-5301

Client Sample ID:

Raw Water W-05-1

Client Project: Location:

Tuluksak

Sample Matrix:

Aqueous

COC#:

051996

PWS#:

Residual Chlorine:

Comments:

Analytica International, Inc. 5761 Silverado Way, Unit N Anchorage, AK 99518 Phone: 907-258-2155

Fax: 907-258-6634

Report Date: Receipt Date:

7/31/2006 7/13/2006

Sample Date: Sample Time: 7/12/2006 7:00:00PM

Collected By:

Flag Definitions:

MRL = Method Reporting Limit MCL = Maximum Contaminant Limit B = Present also in Method Blank H = Exceeds Regulatory Limit

M = Matrix Interference J = Estimated Value

D = Lost to Dilution

** = RL higher than MCL; target not detected

Lab#: A0607165-01A

Analysis Method Prep Analysis Prep Parameter Result Units Flags MRL MCL Method Date Date Analyst 5540C (Aqueous) - Surfactants as MBAS Test was conducted by: Analytica - Anchorage MBAS Foaming Agents <MRL 0.10 7/13/2006 7/13/2006 AJ mg/L

Reported by: Krissy Plett, Laboratory Project Manager

K. Plett

Page 1 of 4



200 W Potter Drive Anchorage, AK 99518 907 562-2343 Fax: 907-561-5301

Client Sample ID: Raw Water W-05-2

Client Project:

Tuluksak

Location:

Sample Matrix: COC #:

Aqueous 051996

PWS#:

Residual Chlorine:

Comments:

Analytica International, Inc. 5761 Silverado Way, Unit N Anchorage, AK 99518

Phone: 907-258-2155 Fax: 907-258-6634

Report Date:

7/31/2006

Receipt Date:

7/13/2006

Sample Date:

7/12/2006

Sample Time:

7:20:00PM Collected By: FT

Flag Definitions:

MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit

B = Present also in Method Blank H = Exceeds Regulatory Limit

M = Matrix Interference

J = Estimated Value

D = Lost to Dilution

** = RL higher than MCL; target not detected

Lab#: A0607165-02A

Analysis Method						Prep	Prep	Analysi	S
Paramete <b>r</b>	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
5540C (Aqueous) - Surfactar	Test was	conducted b	y: Analyt	ica - Ancho	orage				
MBAS Foaming Agents	<mrl< td=""><td>mg/L</td><td></td><td>0.10</td><td></td><td></td><td>7/13/200</td><td>6 7/13/200</td><td>06 AJ</td></mrl<>	mg/L		0.10			7/13/200	6 7/13/200	06 AJ



200 W Potter Drive Anchorage, AK 99518 907 562-2343 Fax: 907-561-5301

Client Sample ID: Treated Water #1

Client Project:

Tuluksak

Location:

Sample Matrix: COC #:

Aqueous

051996

PWS#:

Residual Chlorine:

Comments:

Analytica International, Inc. 5761 Silverado Way, Unit N Anchorage, AK 99518

Phone: 907-258-2155 Fax: 907-258-6634

Report Date:

7/31/2006

Receipt Date:

7/13/2006

Sample Date:

7/11/2006

Sample Time:

11:00:00PM

Collected By:

FT

Flag Definitions:

MRL = Method Reporting Limit MCL = Maximum Contaminant Limit B = Present also in Method Blank H = Exceeds Regulatory Limit

M = Matrix Interference J = Estimated Value

D = Lost to Dilution

** = RL higher than MCL; target not detected

Lab#:

A0607165-03A

Analysis Method						Prep	Prep	Analysis	
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
5540C (Aqueous) - Surfactar	its as MBAS	}			Test was a	conducted b	y: Analyi	tica - Anchoi	rage
MBAS Foaming Agents	<mrl< td=""><td>mg/L</td><td></td><td>0.10</td><td></td><td></td><td>7/13/200</td><th>06 7/13/200</th><td>6 AJ</td></mrl<>	mg/L		0.10			7/13/200	06 7/13/200	6 AJ

Reported by: Krissy Plett,

Laboratory Project Manager

Page 3 of 4



200 W Potter Drive Anchorage, AK 99518 907 562-2343 Fax: 907-561-5301

Client Sample ID: Client Project:

**Treatment Process 2** 

Tuluksak

Location: Sample Matrix:

COC #:

Aqueous 051996

PWS#:

Residual Chlorine:

Comments:

Analytica International, Inc. 5761 Silverado Way, Unit N Anchorage, AK 99518

Phone: 907-258-2155 Fax: 907-258-6634

Report Date:

7/31/2006

Receipt Date:

7/13/2006

Sample Date: Sample Time: 10:00:00PM

7/11/2006

Collected By: FT

Flag Definitions:

MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit B = Present also in Method Blank

H = Exceeds Regulatory Limit

M = Matrix Interference

J = Estimated Value

D = Lost to Dilution

** = RL higher than MCL; target not detected

Lab#:

Α0607165-04Λ

Analysis Method			······································			Prep	Prep	Analysis	
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
5540C (Aqueous) - Surfactar	its as MBAS	1			Test was o	conducted b	y: Analyi	tica - Ancho	rage
MBAS Foaming Agents	<mrl< td=""><td>mg/L</td><td></td><td>0.10</td><td></td><td></td><td>7/13/200</td><td>6 7/13/200</td><td>6 AJ</td></mrl<>	mg/L		0.10			7/13/200	6 7/13/200	6 AJ

Reported by: Krissy Plett, Laboratory Project Manager

Page 4 of 4



750 Royal Oaks Drive, Sufe 100 Monrovia, Celiforna 91018-0629 Tel: 626 386 1100 Fax: 628 386 1101 1 600 566 LABS (1 80) 566 5227)

Laboratory Report

for

SGS Environmental Services Inc. 200 W. Potter Drive

Anchorage , AK 99518

Attention: Forest Taylor Fax: (907) 561-5301

DATE OF ISSUE

AUG 0 7 20067

YOM Yolanda Martin Project Manager

LABORATORIES

nelac 1

Report#: 179019 DRINKING

Laboratory certifies that the test results meet all NELAC requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Comments, QC Report, QC Summary, Data Report, Hits Report, totaling 32 page[s].



Laboratory Hits Report #179019

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750 Royal Oaks Driva, Sura 100 Morrova, Calhornia 91018-0629 Tel: 826 386 1100 Fax 626 386 1101 1 800 566 LABS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518 Samples Received 15-jul-2006 09:29:06

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2607150003	1063863001 RAW	WATER W-0	5-1		
	2607150004	1063863002 RAW.	WATER W-0	5-2		
	2607150005	1063863003 TREA	ATMENT PRO	CESS 1		
08/01/06 08/01/06 07/17/06 07/24/06 08/01/06 08/01/06 07/31/06 07/17/06 07/24/06 07/31/06 07/31/06 07/31/06	Dichloroacetic Trichloroacetic Bromodichloroacetic Chlorine Dose Chlorine Resid Chloroform Dibromochloroacetic	acetic acid dual tic Acids (HAA5) c acid ic acid methane	3.86 3.82 10 2.2 37.1 19.6 17.5 7.52 10 2.2 46.7 1.52	60	ug/l ug/l mg/l ug/l ug/l ug/l ug/l ug/l ug/l mg/l ug/l ug/l	1.0 1.0 0.1 1.0 1.0 1.0 0.5 1.0 0.1 0.5 0.5
	2607150006	1063863004 TREA	TMENT PRO	CESS 2	•	
08/01/06 08/01/06 07/17/06 07/24/06 08/01/06 08/01/06 08/01/06	Bromochloroace Bromodichloroace Chlorine Dose Chlorine Resid D/DBP Haloace Dichloroacetic Monochloroacet Trichloroacet	acetic acid dual cic Acids (HAA5) c acid cic acid	3.17 3.64 10 2.7 40.4 19.4 2.19 18.8	60	ug/l ug/l mg/l mg/l ug/l ug/l ug/l	1.0 1.0 1.0 0.1 1.0 2.0



Laboratory Hits Report #179019

750 Royal Oaks Orivi, Sure 100 Morrowin, Callertia 91016-0629 Tel 628 388 1100 Fax: 628 366 1101 1 800 566 LABS (1 800 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518 Samples Received 15-jul-2006 09:29:06

Analyzed	Sample#	Sample ID	Result	Federal MCL	UNITS	MRL
	2607150006	1063863004 TR	EATMENT PRO	CESS 2		
07/31/06 07/17/06 07/24/06 07/31/06 07/31/06 07/31/06	Chlorine Resi Chloroform Dibromochloro	dual	5.96 10 2.7 46.4 0.998 ne 53.4	< <b>6</b> 0	ug/l mg/l mg/l ug/l ug/l ug/l	0.5 1.0 0.1 0.5 0.5
	2607150007	1063863005 TR	IP BLANK			
07/20/06	Dichlorometha	ne	0.75	5	ug/l	0.5



750 Royal Oaks Other, Suite 100 Montovia, Ceskerna 91018-3829 Tel 626 386 1100 Fax: 628 386 1101 1 800 566 LASS (1 600 566 5227)

SGS Environmental Services Inc. Forest Taylor 200 W. Potter Drive Anchorage , AK 99518 Samples Received 07/15/06

Prepared	Analyzed		QC Ref#	Kethod	Analyte	Resu	lt Units	MRL	Dilution
106386	63001	RAW	WATER	W-05-1	(2607150003)	Sampled on	07/12/06	19:00	
				Regula	ed VOCs plus Lis	sts 1&3			
	07/20/06	05:39	326177	( ML/EPA 5	4.2 ) 1,1,1,2-Tetrachloroe	thane ND	ug/1	0.5	1
	07/20/06	05:39	326177	( MG/EPA 52	4.2 ) 1,1,1-Trichloroethar	te ND	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,1,2,2-Tetrachloroe	thane ND	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,1,2-Trichloroethan	ne ND	υg/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2   1,1-Dichloroethane	CF3	ug/l	0.5	1
	07/20/06	05:29	326177	( ML/EPA 52	4.2 } 1,1-Dichloroethylene	dik D	ug/1	0.5	ı
	07/20/06	05:39	326177	( ML/BPA 52	4.2 ) 1,1-Dichloropropene	ОИ	ug/l	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,2,3-Trichlorobenze	ne 'ND	ug/l	q.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,2,3-Trichloropropa	ne ND	ug/l	0.5	1
	07/20/06	C5:39	326177	ML/EPA 52	4.2 ) 1,2,4-Trichlorobenze	ne no	ug/1	0.5	1
	07/20/06	05:39	326177	I ML/EPA 52	4.2 ) 1,2,4-Trimethylbenze	ne ND	ug/l	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,2-Dichloroethane	סא	ug/l	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,2-Dichlozopropane	מזא	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,3,5-Trimethylbenze	ne ND	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 1,3-Dichloropropane	DI	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) p-Dichlorobenzene (1	, 4 - DCB) เพื่อ	ug/l	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 2,2-Dichloropropane	CM	ug/l	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 2-Bucanone (MEK)	כא	ug/l	5.0	1
	07/20/06	G5:39	326177	( ML/EFA 52	4.2   o-Chlorotoluene	ND	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EFA 52	4.2 ) p-Chlorotoluene	סוא	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) 4-Nethyl-2-Pentanone	du (xaim)	ug/1	5.0	1.
	07/20/06	05:39	326177	( ML/BPA 52	4.2 ) Benzene	ак	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/SPA 52	4.2 ) Bromobenzene	ИD	ug/1	0.5	1
	07/20/06	05:39	326177	( ML/EPA 52	4.2 ) Bromomethane (Methyl	Bromide) ND	ug/1	0.5	1
	07/20/06	05:39	326177		4.2 ) Bromoethane	нД	ug/1	0.5	1
	07/20/06	05:39	326177	ML/EPA 52	4.2   cis-1,2-Dichloroethy	lene ND	ug/1	0.5	1
	07/20/06	05:39	326177		4.2 ) Chlorobenzene	ND	ug/1	0.5	1
	07/20/06	05:39	326177	( HL/EPA 52	4.2   Carbon Tetrachloride		ug/1	0.5	1
	07/20/06	05:39	326177		(.2 ) cis-1,1-Dichloroprop	• -	uq/1	0.5	1
	07/20/06	05:39	126177		1.2 ) Bromoform	ND	ug/l	0.5	1



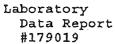
750 Poyal Cake Drive, Suke 100 Montovie, Caldornie 91018-3629 1el: 626 386 1100 Fex: 626 386 1101 1 801) 560 LABG (1 800 566 5227)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
106386	53001 RAW	WATER	W-05-1 (2	2607150003) (cont	inued)	Sample	ed on	07/12/0
	07/20/06 05:39	326177	( HL/EPA 524.2	) Chloroform (Trichloromethana)	מא	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Bromochloromethane	CH	ug/l	0.5	1
	07/20/06 05:39	326177	( ML/KPA 524.2	) Chlorosthans	ND	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Chloromethane (Mathyl Chloride)	סא	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/SPA 524.2	) Chlorodibromomethana	סע	ug/1	0.5	1
	07/20/06 05:39	.326177	( ML/SPA 524.2	) Dibromomethane	סדא	ug/1	0.5	1
	07/20/06 05:19	326177	( ML/BPA 524.2	) Bromodichloromathana	ND	ug/l	0.5	1
	07/20/06 05:39	326177	( ML/HPA 524.2	) Dichloromethune	DИ	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Di-isopropyl ether	ио	ug/1	3.0	1
	07/20/06 05:39	326177	( KL/EPA 524.2	) Ethyl benrene	MD	ug/1	0.5	1
	07/20/08 05:39	326177	( ML/RPA 524.2	) Dichlorodifluoromethane	CIN	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Fluorotrichloromathana-Praonl1	ND	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/BPA 524.2	) Hexachlorobutadiene	ФЖ	ng/1	0.5	1
2	07/20/06 05:39	326177	( ML/EPA 524.2	) Isopropylbenzene	жо	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/BPA 524.2	) m-Dichlorobenzene (1,3-DCB)	ND	ug/l	0.5	1
	07/20/06 05:39	326177	( ML/BPA 524.2	) m,p-Xylenes	аи	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Methyl Tert-butyl ather (MTBE)	מא	ag/l	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Naphthalene	ND	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) n-Butylbenzene	מא	ug/l	0.5	1
	07/20/06 05:39	326177	( HL/EPA 524.2	) n-Propylbenzena	מא	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) o-Kylene	ND	ug/l	0.5	1
	07/20/06 05:39	326177	( NL/EPA 524.2	) o-pichlorobenzene (1,2-DCB)	ND	ug/l	0.5	1
	07/20/06 05:39	326177	( HL/EPA 524.2	) Tatrachloroethylene (PCE)	ND	ug/1	0.5	1
	07/20/06 05:39	326177	( NL/EPA 524.2	) p-Isopropyltoluene	ND	ug/1	0.5	1
	07/20/06 05:39	325177	( ML/EPA 524.2	) sac-Butylbenzene	ND	ug/1	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) Styrene	מא	ug/1	0.5	1
	07/20/06 05:39	326177	( NL/EPA 524.2	) trans-1,2-Dichloroethylans	ND	ug/l	0.5	1
	07/20/06 05:39	326177	( ML/EPA 524.2	) tert-amyl Mathyl Ether	מא	ug/1	3.0	1
	07/20/06 05:39	326177	( NL/EPA 524.2	) tert-Butyl Ethyl Ether	ND	ug/1	3.0	1
	07/20/06 05.39	326177		l tert-Butylbenzene	ND	ug/1	0.5	1
	07/20/06 05:39	326177		) Trichlorosthylene (TCE)	ИД	ug/1	0.5	1
	07/20/06 05:39			) Trichlorotrifluoroethane(Freon	ND	ug/l	0.5	1
	07/20/06 05:39			) trans-1,3-Dichloropropene	KID.	ug/1	0.5	1
	07/20/06 05:39		( HL/EPA 524.2	• • •	מא	ug/1 ug/1	0.5	1



750 Royal Caks Drive, Suite 100 Monrove, California 91016-3629 Tel: 626 386 1100 Fax: 626 386 1101 1 800 506 LABS (1 800 566 5227)

Prepared Analyzed	QC Ref#	Method	Analyte	Result	Units MR	L Dilution
1063863001 RAW	WATER	W-05-1 (2	607150003)	(continued)	Sampled o	on 07/12/0
07/20/06 05:39	326177	( HL/EPA 524.2	) Total 1,3-Dichlorop	ropene ND	ug/1 0.	5 1
07/20/06 05:39	326177	( HL/EPA 524.2	) Total THN	מא	ug/l 0.	5 1
07/20/06 05:39	326177	( ML/EPA 524.2	) Total xylenes	מא	ug/1 0.	5 1
07/20/06 05:39	326177	( NL/BPA 524.2	) Vinyl chloride (VC)	מא	ug/1 0.	3 1
		( EPA 524.2	) Toluene-d8(70-130)	97	% Rec	•
		{ BPA 524.2	) 4-Bromofluorobanzen	e (70-130) 99	% Rec	
		( BPA 524.2	) 1.2-Dichloroethans-	14 (70-130) 105	* Rec	





750 Royal Oaks Drive, State 100 Monrovia, Celdoma 91018-9629 Tet: 626 386 1100 Fax: 628 386 1101 1 800 568 LABS (1 800 566 5227)

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Prepared	Analyzed		QC Ref#	Method	Analyce		Result	Units	MRL	Dilution
10638	63002	RAW	WATER	W-05-2	(2607150004)	Sampled	on	07/12/06	19:20	
				Regulat	ed VOCs plus Li	ata 1£3				
	07/20/06	06:00	326177	-	4.2 ) 1,1,1,2-Tetrachloro		ир	ug/l	0.5	1
	07/20/06			•	4.2 ) 1,1,1-Trichloroetha		ND D	ug/1	0.5	1
	07/20/06				4.2 ) 1.1.2,2-Tetrachloro		ND	ug/1	0.5	1
	07/20/06				4.2 ) 1,1,2-Trichloroetha		מזא	ug/1	0.5	1
	07/20/06	06:00	326177		4.2 ) 1,1-Dichloroethane	-	KD	ug/1	0.5	1
	07/20/06	06:00	326177		4.2 ) 1,1-Dichlorcethylen	2	ND.	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 1,1-Dichloropropene		פא	ug/1	0.5	1
	07/20/06	05:00	326177	( ML/EPA 52	4.2 } 1,2,3-Trichlorobenze	ine	ND	ug/l	C.5	1
	07/20/06	06100	326177	( ML/EPA 52	4.2 ) 1,2,3-Trichloroprope	ne	100	ug/1	9.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2   1,2,4-Trichlorobenze	ene	ND	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2   I.2,4-Trimethylbenze	ne	ND	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/BPA 52	4.2 ) 1,2-Dichlorpethane		IID	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 1,2-Dichloropropane		ND	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 1,3,5-Trimethylbenze	ine.	ND	υg/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 1,3-Dichloropropane		ND	ug/l	0.5	1
	07/20/06	06:00	326177	I ML/EPA 52	4.2 ) p-Dichlorobenzene (1	.,4-003)	ND	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 2,2-Dichloropropane		ND	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 2-Butanone (MEK)		ND	na\1	5.0	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) o-Chicrotoluene		tiD	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) p-Chlorotoluene		ND	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	4.2 ) 4-Methyl-2-Pentanone	(MIBK)	ир	ug/1	5.0	1
	07/20/06	06:00	326177	( ML/EPA S2	1.2 ) Benzene		ND	ug/l	0.5	1
	07/20/05	06:00	326177	( ML/EPA 52	1.2 ) Bromobenzene		ND	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52-	(.2 ) Bromomethane (Methyl	Bromide)	ND	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52-	1.2   Bromoethane		ND	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	1.2   cis-1,2-Dichloroethy	lene	ND	ug/l	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	1.2 ) Chlorobenzene		ND	ug/1	C.5	ì
	07/20/06	06:00	326177	( ML/EPA 52	1.2 ) Carbon Tetrachloride		מא	ug/1	0.5	1
	07/20/06	06:00	326177	( ML/EPA 52	1.2 ) cis-1,3-Dichloroprop	ene	ND	ug/I	0.5	1
	07/20/06	06:00	326177	( ML/SPA 524	1.2 ) Bromoform		КD	ug/1	0,5	1
	97/20/06	06:00	326177	( HL/EPA 52	1.2 ) Chloroform (Trichlor	omethanel	ND	ug/1	0.5	1



750 Poyal Oaks Drive, Suff 100 Monrovia, Californa 91018-3629 Tat 628 386 1100 Fax 628 385 1101 1 800 508 LABS (1 800 566 5227)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
10638	63002 RAW	WATER	W-05-2 (	2607150004)	(continued)	Sample	ed on	07/12/0
	07/20/06 06:00	326177	( ML/BPA 524.2	) Bromochloromethane	כזא	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Chlorosthane	ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/RPA 524.2	) Chloromathane (Hethyl C	hloride) ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Chlorodibromomethane	ND	ug/l	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Dibromomethans	מא	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Eromodichloromethane	ИD	ug/1	0.5	1 .
	07/20/06 06:00	326177	( ML/EPA 524.2	) Dichloromethane	מא	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Di-isopropyl ether	DИ	ug/1	3.0	1
	07/20/06 06:00	326177	( ML/HPA 524.2	) Ethyl benzana	ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Dichlorodifluoromethan	a HD	ug/l	0.5	1
	07/20/06 06:00	325177	( ML/EPA 524.2	) Pluorotrichloromethane	-Preon11 ND	ug/l	0.5	1
	07/20/06 06:00	326177	( HL/EPA 524.2	) Hexachlorobutadiene	מא	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) Isopropylbanzena	ND	ug/1	0.5	1
	07/20/06 06:00	326177	( NL/BPA 524.2	) m-Dichlorobenzene (1,3	-DCB) ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ИЬ/ВРА 524.2	) m,p-Xylenes	ND	ug/1	0.5	1
	07/20/06 06:00		( ML/EPA 524.2	) Methyl Tert-butyl athe	r (MTBE) ND	ug/1	0.5	1
	07/20/06 06:00	326177	( HL/KPA 524.2	) Naphthalene	מא	ug/1	0.5	1
	07/20/06 06:00		( HL/BPA 524.2	) n-Butylbenzene	מא	ug/l	0.5	1
	07/20/06 06:00		( NL/EPA 524.2	) n-Propylbenzene	DM	ug/l	0.5	1
	07/20/06 06:00		{ ML/BPA 524.2	) o-Xylene	מא	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/RPA 524.2	) o-Dichlorobenzene (1,2	-DCB) ND	ug/l	0.5	1
	07/20/06 06:00	326177	( HL/EPA 524.2	) Tetrachloroathylene (P	CE) ND	ug/l	0.5	1
	07/20/06 06:00	326177	( ML/BPA 524.2	) p-Isopropyltoluene	CM	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) sec-Butylbenzens	ип	vg/1	0.5	1
	07/20/06 06:00	326177	( ML/SPA 524.2	) Styrene	מא	ug/l	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) trans-1,2-Dichloroethy	lene ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/BPA 524.2	) tert-amyl Methyl Bther	ממ	ug/1	3.0	1
	07/20/06 06:00	326177	( HL/BPA 524.2	) tert-Butyl Etbyl Ether	аж	ug/1	3.0	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) tert-Butylbenzene	ND	ug/l	0.5	1
	07/20/06 06:00	326177	{ ML/EPA 524.2	) Trichlorosthylene (TCB	OH D	ug/l	0.5	3
	07/20/06 06:00	326177	( ML/EPA 524.2	) Trichlorotrifluoroethan	ne(Freon ND	ug/1	0.5	1
	07/20/06 06:00	326177	( ML/EPA 524.2	) trans-1,3-Dichloroprop	cne ene	ug/l	0.5	1
	07/20/06 06:00	326177	( ML/BPA 524.2	) Toluene	מא	ug/1	0.5	1
	07/20/06 06:00	326177	( HL/BPA 524.2	) Total 1.3-Dichloroprope	מא את	ug/1	0.5	1



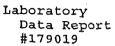
750 Poyal Cake Drive, Suite 100 Nonrovie, California 91016-0623 Tet 626 386 1100 Fax: 626 385 1101 I 600 586 LA93 [1 800 566 5227]

Prepared Analyzed	QC Ref#	Method	Analyte		Result	Units	MRL	Dilution
1063863002 RAW	WATER	W-05-2 (	2607150004)	(contin	ued)	Sample	d on	07/12/0
07/20/06 06:00	326177	( ML/RPA 524.	2 ) Total TRM		MD	ug/1	0.5	1
07/20/06 06:00	326177	( ML/EPA 524.	2 ) Total xylenes		ďИ	ug/1	0.5	1
07/20/06 06:00	326177	( ML/EPA 524.	2 ) Vinyl chloride (VC)		ND	ug/1	0.3	1
		( BPA 524.2	) 1.2-Dichloroethane-	14(70-130)	99	% Rec		
		( EPA 524.2	) 4-Bromofluorobenzene	(70-130)	104	♣ Rec		
		( EPA 524.2	) Toluene-d8(70-130)		97	* Rec		



750 Royal Ossis Drive, Suite 100 Monrove, California \$1016-3629 Tel: 626 386 1100 Fax: 626 386 1101 1 500 506 LABS [1 800 566 5227)

Prepared	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
106386	53003 TR	EATMENT	PROCESS 1	(2607150005)	Sampled on	07/11/0	06 23:	00
			Tot Pot T	rihalomethanes 571	.0В			
07/28/06	67/31/06 00:	CO 327662	( ML/EPA 551.1	) Bromoform	מא	ug/l	0.5	1
07/28/06	07/31/06 00:	00 327662	( ML/EPA 551.1	) Chloroform	46.7	ug/l	0.5	1
07/28/06	07/17/06 00:	00 327662	( SM2350	) Chlorine Dose	10	mg/1	1.0	1
7/28/06	07/24/06 00:	00 327662	( ML/S 4500CL-G	) Chlorine Residual	2.2	mg/l	0.1	1
7/28/06	07/31/06 00:	00 327662	( ML/EPA 551.1	) Dibromochloromethane	1.52	ug/l	0.5	1
7/28/06	07/31/06 00:	00 327662	( ML/EPA SS1.1	) Bromodichloromethane	7.52	ug/l	0.5	1
07/28/06	07/31/06 00:	00 327662	( ML/EPA 551.1	) Total Potential Tribalometh	ane 55.7	ug/1	0.5	1
			( ML/SM 5710	1,2-Dibromopropane(70-130)	115	1 Rec		
		•	Total Pote	ential Haloacetic				
7/28/06	07/17/06 00:	00 327929	( ML/SM 5710B	) Chicrine Dose	10	mg/1	1.0	1
07/28/06	08/01/06 00:	00 327929	( ML/SM 6251B	) Bromochloroacetic acid	3.86	ug/l	1.0	1
7/28/06	08/01/06 00:	00 327929	( ML/SM 6251B	) Bromodichloroacetic acid	3.82	ug/l	1.0	1
7/28/06	08/01/06 00:0	30 327929	ML/SM 6251B	) Chlorodibromomacetic acid	מא	ug/l	2.0	1
7/28/06	07/24/06 00:0	10 327929	( ML/SM 5710B	) Chlorine Residual	2.2	mg/l	0.1	1
7/28/06	08/01/05 00:0	0 327929	( ML/SM 6251B	) Dibromoacetic acid	מא	ug/1	1.0	1
7/28/06	08/01/06 00:0	10 327929	ML/SM 6251B	Dichloroacetic acid	19.6	ug/l	1.0	1
7/28/06	08/01/06 00:0	0 327929	( ML/SM 6251B	) Monobromoacetic acid	מא	ug/l	1.0	1
7/28/06	08/01/06 00:0	0 327929	( ML/SM 6251B	Monochloroacetic acid	מע	ug/l	2.0	1
7/28/06	08/01/06 00:0	0 327929	( ML/SM 6251B	) Tribromoacetic acid	ND	ug/l	4.0	1
7/28/06	08/01/06 00:0	0 327929	( ML/SM 6251B	) Trichloroacetic acid	17.5	ug/l	1.0	1
7/28/06	08/01/06 00:0	0 327929	( ML/S6251B	) D/DBP Halcacetic Acids (HAA:	5) 37.1	ug/l	1.0	1
			( SM5710 6251B	) 2,3-Dibrom Acid(70-130)	106	1 Rec		
			( SM5710 6251B	) 1,2,3-TCP(80-120)	102	* Rec		





750 Poyal Oaks Crive, Suite 100 Montova, California 91016-0829 Ter: 626 386 1100 Fax 628 386 1101 1 800 366 LABS (1 800 366 5277)

Prepared	Analyzed	QC Ref#	Mechod	Analyte	Result	Units	MRL	Dilution
10638	63004 TRE	ATMENT	PROCESS :	2 (2607150006)	Sampled on	07/11/0	6 22:0	00
			Tot Pot :	Trihalomethanes 57	710B			
07/28/06	07/31/06 00:00	327662	( ML/EPA 351.1	) Bromoform	Си	ug/l	0.5	1
07/28/06	07/31/06 00:00	327662	( ML/EPA 551.1	1 Chloroform	46.4	ug/1	0.5	1
07/28/06	07/17/06 00:00	327662	( SM2350	) Chlorine Dose	10	mg/l	1.0	1
07/28/06	07/24/06 00:00	327662	( ML/S 4500CL-	3 ) Chlorine Residual	2.7	mg/l	0.1	1
07/28/06	07/31/06 00:00	327662	( ML/EPA 551.1	) Dibromochloromethane	0.998	ug/1	0.5	1
07/28/06	07/31/06 00:00	327662	( ML/EPA 551.1	) Bromodichloromethane	5.96	ug/l	0.5	1
07/28/06	07/31/06 00:00	327662	( ML/EPA 551.1	) Total Potential Trihalome	ethane (53.4) (8	) _{ug/1}	0.5	1
			( ML/SM 5710	) 1,2-Dibromopropane (70-130	117	Rec		
			Total Dat	ential Haloacetio				
07/28/06	07/17/06 00:00	327929	( ML/SM 5710B	.ENCIAL MAIOACECTO	-			
07/28/06	08/01/06 00:00		( ML/SM 5251B	,	10	mg/l	1.0	1
07/28/06	08/01/06 00:00		( ML/SM 6251B	) Bromochloroacetic acid	3.17	ug/l	1.0	1
7/28/06	08/01/06 00:00			) Bromodichloroacetic acid	3.64	ug/l	1.0	1
7/28/06	07/24/06 00:00		( ML/SM 6251B	) Chlorodibromomacetic acid		ug/1	2.0	1
7/28/06	08/01/06 00:00		( ML/SM 57108	Chlorine Residual	2.7	mg/l	0.1	1
7/28/06	08/01/06 00:00		( ML/SM 6251B	) Dibromoacetic acid	ND	nā\1	1.0	1
7/28/06	• • • • •		I ML/SM 6251B	) Dichloroacetic acid	19.4	ug/1	1.0	1
	03/01/06 00:00		( ML/SM 6251B	) Monobromoacetic acid	ND	ug/l	1.0	1
7/28/06	08/01/06 00:00		( ML/SM 6251B	) Monochloroacetic acid	2.19	ug/l	2.0	1
7/23/06	08/01/06 00:00		( ML/SM 6251B	) Tribromoaceric acid	ND	ug/1	4.0	1
7/28/06	08/01/06 00:00		ML/SM 6251B	) Trichloroscetic acid	18.8	ug/l	1.0	1
17/28/06	09/01/06 00:00	327929	( ML/S6251B	) D/DBP Haloacetic Acids (H	AAS) (40.4) (60	) ug/1	1.0	1
			( SM5710 6251B	1 2,3-Dibrom Acid(70-130)	107	* Rec		
		,	( EM5710 6251B	) 1,2,3-TCP(80-120)	101	1 Rec		



750 Poyal Oaks Drivin, Suda 100 Monrovia, Calibrinia 91016-3629 Tel. 628 386 1100 Fax: 628 386 1101 I 800 566 LABS [1 800 366 5227]

Prepared	Analyzed	<u>.</u>	QC Ref#	Method	Analyt	: <b>e</b>	Result	Units	MRL	Dilution
10638	63005	TRIP	BLANK	(2607	150007)	Sampled on	07/12/06	19:00		
				Ramila	enov bed	plus Lists 1&3				
	07/20/06	. 03 · 41		_		2-Tetrachloroethane	150			_
	07/20/06					Trichlorocthane	ND ND	ug/1	0.5	1
	07/20/06					2-Tetrachloroethane	טא כוא	ug/1	0.5	1
	07/20/06					Trichloroethane	מא	ug/l	0.5	1
	07/20/06				24.2 } 1,1-Di		ND	ug/1	0.5	1
	07/20/06					chlorosthylens		ug/l	0.5	1
	07/20/06				24.2   1,1-Di	-	מא מא	ug/1	0.5	1
	07/20/06					Trichlorobenzene	סא	ug/1	0.5	1
	07/20/06					Trichloropropane	ND	ug/1	0.5	1
	07/20/06					Trichlorobenzene	ND ND	ug/l	C.5	1
	07/20/06					Trimethylbenzene		ug/1	0.5	1
	07/20/06				14.2 ) 1,2-Di	- ·	ND	ug/l	0.5	1
	07/20/06				4.2 ) 1,2-Di		ND	ug/1	0.5	1
	07/20/06					Trimethylbenzene	ND ND	ug/l	0.5	1
	07/20/06				14.2 ) 1,3-Di	-		ug/1	0.5	1
	07/20/06					lorobenzene (1,4-DCB)	מא	ug/1	0.5	1
	07/20/06				4.3 ) 2,2-Di		מא	ug/1	0.5	1
	07/20/06				4.2 ) 2-Buta		סא	ug/1	0.5	1
	07/20/06				4.2   0-Chlo	• •	MD	ug/1	5.0	1
	07/20/06				4.2 ) p-Chlo		КD	ug/1	0.5	1
	07/20/06		· · · · · ·	•	· -	yl-2-Pentanone (MIBK)	ND	ug/1	0.5	1
	07/20/06				4.2 ) Benzen		סא	ug/l	5.0	7
	07/20/06				4.2 ) Bromobe		ОМ	ug/l	0.5	1
	07/20/06				-		GN	ug/1	0.5	1
	07/20/05		,			ethane (Methyl Bromide)	סא	υg/1	0.5	1
	07/20/06			-	4.2 ) Bromoet		ИД	ug/l	0.5	1
	07/20/06					1-Dichioroethylene	СИ	υ <b>g/l</b>	0.5	1
				• •	4.2 ) Chlorol		DИ	ug/l	0.5	1
	07/20/06		· · · · · ·			Tetrachloride	מא	ug/l	0.5	1
	07/20/06					-Dichloropropene	ND	ug/l	0.5	1
	07/20/06				4.2 ) Bromofo		ND	na\1	0.5	1
	07/20/06	03:41	326175 (	ML/EPA 52	4.2 ) Chlorof	orm (Trichloromethane)	ND	ug/l	0.5	1



750 Poyal Oeks Drive, Suite 100 Montovis, Cadifornia (91016-3629 Tet 626 386 1100 Fac: 626 385 1101 1 800 556 LABS (1 800 566 5227)

Prepared	Analyzed		QC Ref#	He	thad			Analyte	Result	Units	MRL	Di	ilution
10638	3005	TRIP	BLANE	κ (	260	7150	0	07) (continued)	Samp	led on	07/12	/06	19:0
	07/20/06			( X	L/EPA	524.2	)	Bromochloromethane	מא	ug/1	0.5	. 1	
	07/20/06	03:41	326175	( X	L/EPA	524.2	)	Chloroethans	ND	ug/1	0.5	1	
	07/20/06	03:41	326175	( x	L/EPA	524.2	)	Chloromethane (Methyl Chloride)	р	ug/1	0.5	1	
	07/20/06	03:41	326175	( K	L/SPA	524.2	)	Chlorodibromomethane	ND	ug/1	0.5	1	
	07/20/06			( K	L/BPA	524.2	)	Dibromomerhane	KD	ug/1	0.5	1	
	07/20/06	03:41	326175	( )K	K48\1	524.2	)	Bromodichloromethane	жъ	ug/1	0.5	1	
	07/20/06	03:41	326175	( K	L/EDA	524.2	)	Dichloromethane	0.75	ug/1	0.5	1	
	07/20/06	03,41	326175	( M	L/BPA	524.2	3	Di-isopropyl ether	ND	ug/1	3.0	1	
	07/20/06	03:41	326175	( M	L/SPA	524.2	)	Ethyl benzene	ИД	ug/1	0.5	1	
	07/20/06	03:41	326175	( )0	L/EPA	524.2	)	Dichlorodifluoromethane	ND	ug/1	0.5	1	
	07/20/06	03:41	326175	( )(	L/EPA	524.2	)	Fluorotrichloromethane-Freon11	ND	ug/l	0.5	1	
	07/20/06	03:41	326175	( M	L/EPA	324.2	)	Hexachlorobutadiene	HD	ug/1	0.3	1	
	07/20/06	03:41	326175	( 30	L/RPA	524.2	)	Isopropylbenzena	מא	ug/1	0.5	1	
	07/20/06	03:41	326175	( MI	L/EPA	524.2	}	m-Dichlorobenzena (1,3-DCB)	ND .	ug/l	0.5	1	
	07/20/06	03:41	326175	( )(1	L/BPA	524.2	)	m.p-Xylenes	ND	ug/1	0.5	1	
	07/20/06	03:41	326175	( MI	L/EPA	524.2	)	Mothyl Tert-butyl ather (MTBE)	ND	ug/1	0.5	1	
	07/20/06	03:41	326175	( MI	L/EPA	524.2	>	Naphthalene	מא	ug/1	0.5	1	
	07/20/06 (	03:41	326175	( HT	L/BPA	524.2	)	n-Butylbenzene	MD	ug/1	0.5	1	
	07/20/06 (	03:41	326175	( HE	/EPA	524.2	>	n-Propylbenzene	ND	ug/l	0.5	1	
	07/20/06 (	03,41	326175	( HI	/BPX	524.2	)	o-Xylana .	ИD	ug/1	0.5	1	
	07/20/06 (	33:41	326175	i hi	Z/BPA .	524.3	)	o-Dichlorobenzana (1,2-DCB)	מא	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( ML	/BPA :	524.2	1	Tetrachlorosthylene (PCE)	ан	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( 100	/EPA	524.2	)	p-Isopropyltoluene	жo	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( ML	/BPA !	524.2	)	sec-Butylbenzene	ND	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( HE	/BPA S	524.2	)	Styrana	ND	υg/1	0.5	1	
	07/20/06 0	3:41	326175	( NE	/EPA S	524.2	)	trans-1,2-Dichloroethylene	мъ	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( NIL	/EPA !	524.2	)	tert-amyl Methyl Ether	ND	ug/l	3.0	1	
	07/20/06 0	3:41	326175	( HL	/EPA 5	24.2	,	tert-Butyl Ethyl Ether	CM	ug/1	3.0	1	
	07/20/06 0	3:41	326175	( ML	/EPA S	24.2	)	tert-Butylbenzene	mp	ug/l	0.5	1	
	07/20/06 0	3:41	326175	( NL	/BPA 5	24.2	}	Trichloroethylene (TCE)	מא	ug/1	0.5	ı	
	07/20/06 0	3:41	326175	( KL	/EPA 5	24.2	,	rrichlorotrifluoroathana (Freon	KD	ng/l	0.5	1	
	07/20/06 0	3:41						trans-1,3-Dichloropropens	ND	ug/l	0.5	1	
	07/20/06 0	3:41						Coluene	ND	ug/1			
	07/20/06 0	3:41	326175	( MIL	/EPA 5	24.2	, ,	Total 1.3-Dichloropropene	מא	ug/1 ug/1	0.5 0.5	1	



750 Royal Oaks Drive, Suce 100 Monrovia, California 91016-3629 Tel 526 386 1100 Fax: 626 386 1101 1 800 566 LABS (1 800 566 5227)

Prepared Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
1063863005 T	RIP BLAN	K (260715	0007) (continued)	Samp:	led on	07/12	/06 19:0
07/20/06 0	141 326175	( HL/BPA 524.	2 ) Total THM	аи	vg/1	0.5	1
07/20/06 0	:41 326175	( ML/EPA 524.	2 ) Total xylenes	MD	ug/1	0.5	1
07/20/06 0	:41 326175	( ML/EPA 524.	) Vinyl chloride (VC)	סוא	ug/1	0.3	1
		( EPA 524.2	) Toluene-d8(70-130)	104	% Rec		
	•	( EPA 524.2	) 1.2-Dicbloroethane-d4(70-130)	118	% Rec		
		( RPA 524.2	) 4-Bromofluorobenzena (70-130)	109	<b>♦ Rec</b>		



#### CHAIN OF CUSTO! SGS Environmental



#### Locations Nationwide

- AlaskaLouisiana
- HawaiiMaryland
- New Jersey
- · North Carolina

West Virginia

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### CHAIN OF CUSTODY RECORD SGS Environmental Services Inc.

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### CHAIN OF CUSTODY RECORD SGS Environmental Services Inc.



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CONTACT:	Fa B. C. WELL	PHONE N	0:(401) 2	401-1211	2											PA	GE	OF		
PROJECT:	ET RNGINERA IVKCAK VSV	4 SITE/PWS	in#: -	19-70/6		Йo	SAMPLE TYPE	Preservat Used	nes ô.	20,4						Kr)		\ (		
REPORTS TO:	IVKSAK V5V	$\nu$	TRKA	MAD I NOT	1455 1	С	TYPE	Analysis Required	1	15	/-	/	—	<del>/-</del>	7	<del>/k</del>	++	<del>-}-}</del>		
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INVOICE TO:	EISNER	FAX NO.:(	9011349	1-1015		T A	G¤ GRAB	3/	/		_v/	W			"k;\	/	/ /_ /	/ <i>\</i> /	/	
	•					l	GRAB			TA.	الأد	Z/	2	7			12/	/\\$/	!	
3 CEZ	EN 6 INGKOR	S P.O. NUM	BER TUC	VKSAK		E R		/		¥ 3	/ 3		Ĭ :	N K	$A^{\vee}$			33		
LAB NO.	SAMPLE IDENTIFIC		DATE	TIME	MATRIX	S		/ 1	7		1 3	/ \		7 1	y r	1	1/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2	REMAR	RKS	
3) A - M	TREATED WAS	er	7-11-06	41.00/10	0	14	G	1	1	7	7	71	1	1	ŀ	1	22	7	•	
5/4 7/17/01	PROCESS #	1				,						1						<u>'</u>		
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5																				
Collected/Relin	quished By:(1)	Date	Time	Received 8	Yi.	Vigens and American American		Shi	oping C	arrier:				Sam	ples Re	ceive	d Cold? (C	ircle)/YE	S)NO	
Relinguished B	Burl	7-22						Shi	pping T	icket N	lo:			Tem	oeratur	e (C:	c=3.8	, -	TB=2.	.2
Relinguished B	y: (2)	Date	Time	Received B	y:			Spe	cial De	liverab	le Requ	ireme	nts:				Seal: (Cl			
	1													(NTA	$\searrow$	2	BROKEN		400	
Relinquished B	ν <del>ή</del> (3)	Date	Time	Received B	y;/			Re	questec	Tuma	round 1	îme a	nd Spe		structio	ns:	BROKE	1	ABS	ENI
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Relinquished B	y: (4)	Date	Time	Received B	γ <del>.</del> Λ					•										
		7/13/06	0755		inte	. ه														
					$ \bigcirc$															



#### SGS Environmental Services Inc.

200 W. Potter Dr., Anchorage, AK 99518

P: 907-562-2343, F: 907-561-5301

3180 Peger Rd., Fairbanks, AK 99701

P: 907-474-8656, F: 907-474-9685 255 Sand Island Rd. Unit1B, Honolulu, HI 96819 P: 808-224-6217, F: 808-845-2287

### Sample Kit Request

	Ordered By: Phone/Fax: roject Name:	CEZ ENG	,	-	□ Shi	Taken by: Prepared by: Checked by:		Date: Date:	Hudao
INDs Statepiles	, de la com-	Ann dean	Borde Kapa	Route Val	Pres	Rec	Cold C	nge.	iorj Botis
2	0	10 \$ 20 1 mose			·				
		METAS+A, A,C	WE 250 HODE		H1000		leveos		7
		CN	250 HOPE		North		140000		2
		Animes +Br	LEO NIMENE		7		ABHOS		2
		WATERS	950 400E				401105		2
	•	0002	950 Ameros		-		184125		2
		MBAS	520 Augus			•	ABKRS		2
		T/P.CHURLAGE	Leo Many de		-		481125	. 1	2
		TOC	250 Augus		KU		1400045		2
		DOC	250 Amore				18HIZS		2
		TOTHING FLP	28990 Amper				7045		4
		HARS FIP	24950 Amore		_		7 DAY(5		4
		W 254	125 Augr				HOMS		2
							1 194:11		
Foreign Soi Total # Cor Total # Cor Temperatur Tip Temperatur	its?  Intainers includes Intainers includes Re Blank: 125 r Blank (circle ma	extra bottles for QC s bottles for Percent Solids and / 500 mL (circle one) strix): soil / water  CT&E COCs Custody Seals Coolers	<u>-</u>	Sampling In  1. Do <u>not</u> rinse  2. Fill container  3. Label the cor  4. Fill in the Ch  5. Add frozen g  If you have	structions: container before to top, but do re ntainer with you ain of Custoday el packs or ice to	oot overfill (exce r sample/site ID r o your cooler & s concerning	ware of any aci pt volatiles whi , as well as the o pack to preven this sample	d preservative in ich should be hea late & time of co t breakage.	dspace free).

_SGS_

SAMPLE RECEIPT FORM SGS WO#:

1	0	60	38	6	3
				II.	

Yes No NA		
<u> </u>	Are samples RUSH, priority, or Win 72 hrs. of hold time?	Due Date: 7/26/06
	If yes have you done e-mail notification?	Received Date: 7/13/06
. V	Are samples within 24 brs. of hold time or due date?	Received Time: # Su 1005
	If yes, have you spoken with Supervisor?	Is date/time conversion necessary?
	Archiving bottles - if req., are they properly marked?	# of hours to AK Local Time:
	Are there any problems? PM Notified?	Thermometer ID: 7D
	Were samples preserved correctly and pH verified?	Cooler ID Temp Blank Cooler Temp
		2.3 °C 4.4 °C
		2 2.2°C 3.8°C
/	*	3 19°C 22°C
	If this is for PWS, provide PWSID	°C °C
$ \rightarrow$ $-$	Will courier charges apply?	
	Method of payment?	
<b>√</b>	Data package required? (Level: 1 / 2 / 3 / 4)	Temperature readings include thermometer correction factor.  Delivery method (circle all that apply): Client /
	Notes:	Alert Courier / UPS / FedEx / USPS /
V	Is this a DoD project? (USACE, Navy, AFCEE)	AA-Goldstreak/ NAC / ERA / PenAir / Carlile
	to this a bab project; (Go/tot, Mavy, M ott)	Lynden / SGS / Other:
This pastion	word to filled and for DaD and and MIGACE Name AECED	
Yes No	must be filled out for DoD projects (USACE, Navy, AFCEE)	Additional Sample Remarks: (d. Sample Remarks)
100	Is received temperature 4 ± 2°C7	Additional Sample Remarks: (\(\sigma\) if applicable)
	Exceptions: Samples/Analyses Affected:	Extra Sample Volume?Limited Sample Volume?
	Exceptions. Sumples/finityses filected.	
		Field preserved for volatiles?
		Field-filtered for dissolved?
	Rad Screen performed? Result:	Lab-filtered for dissolved? DoC (3)
	Was there an airbill? (Note # above in the right hand column)	Ref Lab required? MBAS 157
	Was cooler sealed with custody seals?	Foreign Soll?
	#/where:	This section must be filled if problems are found.
·	Were seal(s) intact upon arrival?	Yes No
	Was there a COC with cooler?	Was client notified of problems?
	Was COC sealed in plastic bag & taped inside lid of cooler?	
	Was the COC filled out properly?	Individual contacted: Parce
	Did the COC indicate COE / AFCEE / Navy project?	Via: Phone / Fax / Email (circle one)
	Did the COC and samples correspond?	Date Time: 713 de 1200
	Were all sample packed to prevent breakage?	Reason for contact: COC IMPICATES
	Packing material:	CHLORINE DEMAND, CLIENT
	Were all samples unbroken and clearly labeled?	WHITS PREE CHLORINE
	Were all samples sealed in separate plastic bags?	- HIX 04 1415
<del></del>	Were all VOCs free of headspace and/or MeOH preserved?	
	Were correct container / sample sizes submitted?	
<del></del>	Is sample condition good?	Change Order Required? No.
	Was copy of CoC, SRF, and custody seals given to PM to fax?	SGS Contact: GT
	•	
() a		
votes: (1) ( wo	OTTIME DEMANDED AS FREE CHLORINE	
(2) #3	\$#4: BOO As A Ca Me TO METERS AND	non Brown F Di Aucones.
(3) bub	ble > 6mm in vial (OC frip blank)	not on COC
(1 #3 t		
(4) TTH	MEHANS ME FORMATION DOTENTIAL (5	# ( # 2 : CALLEL CHLERINES DEMA
Completed by (si	an): ( ) Lin tel (print): F(in)	1 o D
	(bring): Comp	はて
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SGS_

SAMPLE RECEIPT FORM (page 2)

1063863

SGS WO#:

Other	X X AG	HOPE		ner Ty		Other	None	X HCI	HNO,	WeOH HO	Na ₂ S ₂ O ₃	e NaOH	Other
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40z (125	X		Nalg	5.			×		白	Me	Na ₂ S	Nac	
402 (	X	X			X		X X	X			Z		
4	X	X			X		X X	X					
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Bottle Totals	144	8	2	4	\$	2×?

9 gm = 13|06

Completed by: Wir Il

Date: 7/13/06



SGS Environmental	CUSTODY SEAL
Signature:	Date/Time:
Signature:	CUSTODY SEAL Date/Time:
Signature:	CUSTODY SEAL
SGS Environmental	CUSTODY SEAL
Signature:	Date/Time:
SGS Environmental	CUSTODY SEAL  Date/Time:
	CUSTODY SEAL
Signature:	Date/Time:

了这种人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们也没有一个人,我们也没有一个人,我们就是一个人,他 第一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就是一个人,我们就

## Appendix F

