CHEMICAL TREATMENT AND ANALYSIS:
TREATED WATER IN DISTRIBUTION SYSTEM - 1997

CHEMICAL TREATMENT - 1997

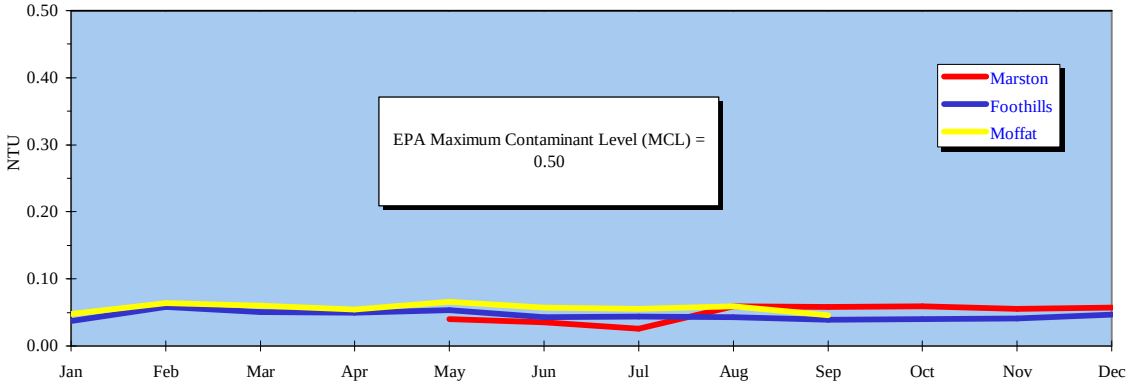
	Pounds of Chemicals Used				
	Foothills	Marston	Moffat	Total	Total Cost
Aluminum Sulfate (Liquid Alum)	19,645,545	3,683,005	9,045,711	32,374,261	$1,196,517
Ammonium Hydroxide (Aqua Ammonia)	594,391	114,210	155,102	863,703	57,259
Powdered Activated Carbon	-	-	-	-	-
Calcium Oxide (Lime - Bulk)	77,503	-	-	77,503	3,525
Calcium Hydroxide (Lime -Bulk)	-	-	1,293,690	1,293,690	93,477
Chlorine, Liquid	1,204,713	226,462	324,294	1,755,469	327,345
Caustic Soda	5,875,500	1,052,731	1,156,625	8,084,856	387,477
Polymer (Anionic)	-	-	-	-	-
Polymer (Cationic)	909,592	113,057	-	1,022,649	481,344
Polymer (Nonionic)	48,645	3,325	30,103	82,073	126,496
Potassium Permanganate	441	-	-	-	437
Soda Ash	-	-	199,240	199,240	11,866
Sodium Silicofluoride	282,715	42,300	131,978	456,993	117,136
Total Cost					$2,802,878

DISTRIBUTION SYSTEM & TREATMENT PLANT EFFLUENT TOTAL COLIFORM RESULTS - 1997

Month	Number of Samples	Number of Positives	% Positive
January	470	0	0.00%
February	427	1	0.23%
March	513	0	0.00%
April	495	0	0.00%
May	473	1	0.21%
June	548	2	0.36%
July	651	7	1.08%
August	508	1	0.20%
September	550	3	0.55%
October	584	0	0.00%
November	501	0	0.00%
December	599	1	0.17%
	6,319	16	0.25%

The total coliform group of bacteria is a microbiological indicator used to determine the safety of drinking water for human consumption. The EPA and the Colorado Department of Public Health and Environment require that Denver Water test a minimum of 300 treated water samples each month for total coliforms. The Maximum Contaminant Level (MCL) for total coliform specifies that no more than 5% of the samples taken each month may be positive. All positive samples were further analyzed to determine if *E. coli* bacteria were present, which would indicate possible contamination from a fecal source. There was one positive *E. coli* sample in 1997 and the repeat sample was negative.

TREATMENT PLANT EFFLUENT AVERAGE TURBIDITY - 1997



Turbidity is a measure of the clarity of the water. EPA has established 0.50 NTU as the MCL for turbidity.

TREATED WATER QUALITY SUMMARY:
TREATMENT PLANT EFFLUENT AVERAGES - 1997

Analysis	Maximum Contaminant Level (MCL)	Marston	Foothills	Moffat
General (mg/L)				
Alkalinity, Total as $CaCO_3$		65	66	26
Chlorine, Total		1.35	1.43	1.33
Color (PCU)		6	4	2
Hardness as $CaCO_3$		99	102	50
Monochloramine		1.12	1.26	1.28
PH (SU)		7.8	7.7	7.4
Specific Conductance (µS)		292	278	128
Temperature (°C)		15	10	13
Total Dissolved Solids		179	174	87
Turbidity (NTU)	0.50	0.05	0.05	0.06
Metals (mg/L)				
Aluminum, Total		0.05	0.03	0.01
Barium, Total	2	0.04	0.04	0.02
Calcium		26	25	14
Copper, Total	TT[1]	0.01	0.02	0.06
Iron, Total		0.05	0.03	0.02
Lithium		0.005	0.006	<0.005
Magnesium		8.0	8.0	2.3
Manganese, Total		0.016	0.007	0.002
Molybdenum, Total		0.010	0.009	0.007
Potassium		1.8	1.7	0.8
Sodium		22	21	8
Strontium		0.2	0.2	<0.1
Zinc, Total		0.005	0.002	0.009
Ions (mg/L)				
Chloride		24.7	24.1	3.7
Fluoride	4.0	0.90	0.90	0.83
Nitrate-Nitrogen	10	0.05	0.06	0.10
Phosphorus, Total		0.018	0.014	0.015
Silicon Dioxide		4.5	4.1	7.0
Sulfate		47.9	45.7	30.2

(Continued next page)

[1] TT indicates that the MCL involves treatment techniques.
[2] DS indicates that the MCL involves calculations based upon the entire distribution system.

TREATED WATER QUALITY SUMMARY:
TREATMENT PLANT EFFLUENT AVERAGES - 1997 (Continued)

Analysis	Maximum Contaminant Level (MCL)	Marston	Foothills	Moffat
Radiological (pCi/L)				
Beta, Total	5	3	2	<2
Radium-228		<1	<1	1
Uranium (mg/L)		0.0010	0.0011	0.0008
Microbiological				
m-Heterotrophic Plate Count (CFU/mL)		6	1	-
Plankton (Count/mL)		1	1	6
Disinfection By-Products (µg/L)				
1,1,1-Trichloropropanone		2.1	1.6	1.7
1,1-Dichloropropanone		0.6	0.7	0.7
Bromochloroacetic acid		2.5	2.9	1.2
Bromochloroacetonitrile		0.7	0.3	<0.2
Bromodichloroacetic acid		4	3	<1
Bromodichloromethane		10.2	6.3	2.3
Chloral hydrate		3.4	2.3	2.6
Chloroform		25.2	22.4	29.1
Cyanogen chloride		1.1	2.5	1.8
Dibromochloromethane		1.8	0.8	0.4
Dichloroacetic acid		9.2	13.0	21.1
Dichloroacetonitrile		3.0	2.3	2.2
Haloacetic Acids (5)		23	28	39
Haloacetic Acids (6)		25	31	41
Total Trihalomethanes	1	37	30	31
Trichloroacetic acid		13.2	14.3	17.3
Trichloroacetonitrile		0.1	0.1	<0.1
Nonspecific Organics				
Total Organic Carbon (mg/L)		2.4	1.9	1.7
Total Organic Halogen (µg/L)		163	144	114
UV Absorbance @ 254nm (AU)		0.032	0.034	0.031

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TREATED WATER QUALITY SUMMARY:
TREATMENT PLANT EFFLUENT AVERAGES - 1997

The following analyses were performed and each of these constituents was either not detected or the average result was less than the reporting limit. The Maximum Contaminant Level is listed after the analysis in parentheses, if applicable. The unit of measure is also listed if different than that listed for the subsection.

General
Asbestos (7)
Chlorine, Free
Metals (mg/L)
Aluminum, Available
Antimony, Total (0.006)
Arsenic, Total (0.05)
Boron
Beryllium, Total (0.004)
Cadmium, Total (0.005)
Chromium, Total (0.1)
Lead, Total (TT[1])
Mercury, Total (0.002)
Nickel, Total (0.1)
Selenium, Total (0.05)
Silver, Total
Thallium, Total (0.002)
Vanadium
Ions (mg/L)
Ammonia-Nitrogen
Bromide
Cyanide (0.2)
Nitrite-Nitrogen (1)
Radiological (pCi/L)
Alpha, Total (15)
Plutonium 239 + 240
Radium-226
Radon
Strontium 89 + 90
Microbiological
Cryptosporidium
Total Coliform (DS)
Giardia (TT[1])
Volatile Organic Compounds(µg/L)
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane (200)
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane (5)
1,1-Dichloroethane
1,1-Dichloroethene (7)
1,1-Dichloropropene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,3-Trimethylbenzene
1,2,4-Trichlorobenzene (70)
1,2,4-Trimethylbenzene
1,2-Dichloroethane (5)
1,2-Dichloropropane (5)
1,3-dichloropropene
1,3,5-Trimethylbenzene
1,3-Dichloropropane
1-Chlorobutane
2,2-Dichloropropane
2-Butanone
2-Hexanone
2-Nitropropane
4-Methyl-2-Pentanone
Acetone
Acrylonitrile
Allyl chloride
Benzene (5)
Bromobenzene
Bromochloromethane
Bromomethane
Carbon disulfide
Chloroacetonitrile
Chlorobenzene (100)
Chloroethane
Chloromethane
cis-1,2-Dichloroethene (70)
cis-1,3-Dichloropropene
Dibromomethane
Dichlorodifluoromethane
Dichloromethane (5)
Diethyl ether
Ethyl Benzene (700)
Ethyl methacrylate
Hexachlorobutadiene
Hexachloroethane
Iodomethane
Isopropyl Benzene
m-Dichlorobenzene
Methacrylonitrile
Methyl tert-butylether
Methylacrylate
Methylmethacrylate
Naphthalene
n-Butyl Benzene
Nitrobenzene
n-Propyl Benzene
o-Chlorotoluene
o-Dichlorobenzene (600)
p-Chlorotoluene
p-Dichlorobenzene (78.5)
Pentachloroethane
p-Isopropyl Toluene
Propionitrile
sec-Butyl Benzene
Styrene (100)
tert-Butyl Benzene
Tetrachloroethene (5)
Tetrahydrofuran
Toluene (1000)
trans-1,2-Dichloroethene (100)
trans-1,3-Dichloropropene
trans-1,4-Dichloro-2-butene
Trichloroethylene (5)
Trichlorofluoromethane
Vinyl acetate
Vinyl Chloride (2)
Xylenes (10000)
Disinfection By-Products(µg/L)
Bromoform
Carbon tetrachloride (5)
Chlorodibromoacetic Acid
Chloropicrin
Dibromoacetic acid
Dibromoacetonitrile
Monobromoacetic Acid
Monochloroacetic Acid
Pesticides (µg/L)
1,2-Dibromo-3-chloropropane (0.2)
2,4,5-T
2,4-D (70)
2,4-DB
2,4'-DDD
3,5-Dichlorobenzoic acid
3-Hydroxycarbofuran
4,4'-DDD
4,4'-DDE
4,4'-DDT
4-Nitrophenol
♋-BHC
Acifluourfen
Alachlor (2)
Aldicarb
Aldicarb sulfone
Aldicarb sulfoxide
Aldrin
Ametryn
Atraton
Atrazine (3)
♌-BHC
Bentazon
Bromacil
Butachlor
Carbaryl
Carbofuran (40)
Chlordane (2)
Chlorneb
Chlorobenzilate
Chlorothalonil
Chlorpropham
Cyanazine
Cycloate
Dacthal
Dalapon (200)
♎-BHC
Dicamba
Dichlorprop
Dichlorvos
Dieldrin
Dinoseb (7)
Diphenamid
Diquat (100)
Dursban
Endosulfan sulfate
Endosulfan-A
Endosulfan-B
Endothall (100)
Endrin (2)
Endrin Aldehyde
EPTC
Ethoprop
Ethylene dibromide (0.05)
Etridiazole
Glyphosate (700)
Heptachlor (0.4)
Heptachlor Epoxide (0.2)
Hexachlorocyclopentadiene (50)
Hexazinone
Lindane (0.2)
Malathion
Methiocarb
Methomyl
Methoxychlor (40)
Metolachlor
Metribuzin
Mevinphos
MGK-264
Mirex
Molinate
Napropamide
Oxamyl (200)
Paraquat
Pebulate
Picloram (500)
Prometon
Prometryn
Pronamide
Propachlor
Propazine
Propoxur
Silvex (50)
Simazine (4)
Simetryn
Stirofos
Terbacil
Terbutryn
Terbutylazin
Toxaphene (3)
Triademefon
Trifluralin
Vernolate
Synthetic Organic Compounds(µg/L)
1,2,4,5-Tetrachlorobenzene
2,4-Dinitrotoluene
2-Chlorobiphenyl
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene (0.2)
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Bis(2-ethylhexyl)adipate (400)
Butyl benzyl phthalate
Chrysene
Dibenzo(a,h)anthracene
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobenzene (1)
Indeno(1,2,3-cd)pyrene
Isophorone
Pentachlorobenzene
Pentachlorophenol (1)
Phenanthrene
Polychlorinated Biphenyls (0.5)
Pyrene

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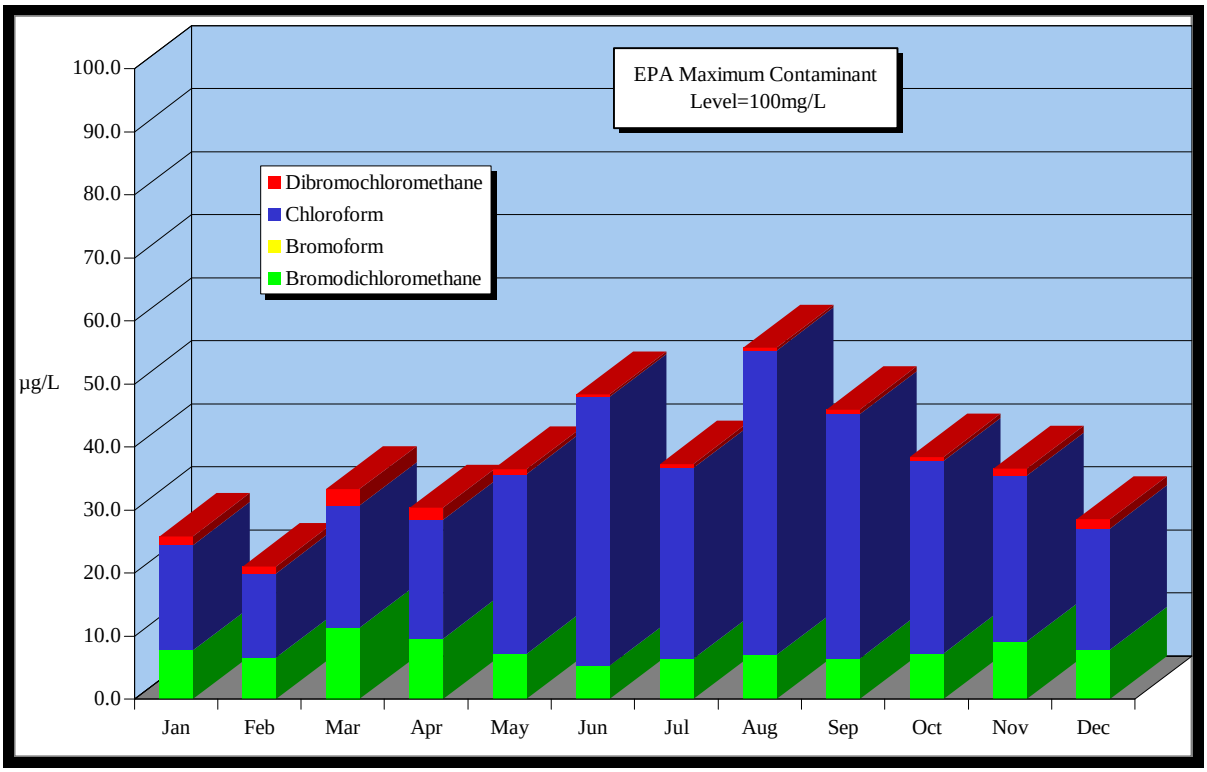
[2] DS indicates that the MCL involves calculations based upon the entire distribution system.

DISTRIBUTION SYSTEM AVERAGE TRIHALOMETHANES - 1997



Trihalomethanes (THMs) are organic compounds formed when chlorine disinfectant is added to the water. Th of chlorine and other chlorine-based disinfectant compounds is mandated by health regulatory agencies to elim microbiological contaminants from drinking water. The creation of THMs is a consequence of this necessary practice. THMs are comprised of four individual compounds. EPA has established 100 µg/L as the MCL for T Trihalomethanes (the sum of the four individual compounds). The amounts present in the Denver distribution system are well below the 100 µg/L level.

WATER QUALITY SAMPLE COLLECTION AND ANALYTICAL PROCEDURES - 1997

Samples Collected:	
Watershed	176
Treatment plant	615
Distribution system	5,889
Other	3,165
	9,845

Analyses Performed:	
Microbiological	9,789
Chemical	42,915
	52,704