

**Table Rock Lake, Branson, Missouri
July, 1994**

Results of Determining Trihalomethane Forming Potential

The following table summarizes the results of determining *trihalomethane forming potential* (TFP) on six samples of Table Rock Lake water which had been coagulated, flocculated and settled. *Chlorine* (nominally, 5 mg Cl/l) was added to the settled water following coagulation with 20 and 30 mg/l of alum; 12 and 18 mg/l of iron; 30 mg/l of alum; and 18 mg/l of iron, respectively. After 8 hours of contact with free chlorine, the last *two* samples were treated with ammonium chloride to convert the disinfectant residual to *chloramine*. Chloramine, being less reactive than 'free' chlorine, is known to produce less trihalomethane during distribution.

TRIHALOMETHANE FORMING POTENTIAL

Results of Adding 5 mg Cl/l to Coagulated and Settled Table Rock Lake Water (Cove, 20 meters depth) and Analyzing for Trihalomethanes after 7 Days

Coagulant/Treatment	CHCl ₃	CHBrCl ₂	CHBr ₂ Cl	CHBr ₃	TFP, $\mu\text{g/l}$ CHCl ₃
	$\mu\text{g/l}$ of indicated species				
20 mg alum/l; Chlorine	20.28	30.69	45.70	29.74	82.89
30 mg alum/l; Chlorine	21.91	37.84	47.05	24.74	88.15
12 mg iron/l; Chlorine	21.01	38.44	44.74	23.27	85.65
18 mg iron/l; Chlorine	18.41	33.07	46.74	17.08	77.36
30 mg alum/l; Chloramine	11.36	18.73	26.97	15.63	47.86
18 mg iron/l; Chloramine	10.03	16.20	22.64	13.63	41.25

Method: modified EPA 502.2 using FID Detector

The TFP results indicate that the Table Rock Lake cove water has sufficient dissolved organic matter remaining, after coagulation and sedimentation, to generate modest amounts of THM. Disinfection with 5 mg Cl/l at room temperature (22^o C) for 7 days yielded an average of 83.5 micrograms per liter THM. This amount of trihalomethane represents the 'ultimate' which might be expected after prolonged retention in the distribution system. The actual amount of THM observed in the distribution should be less than this 'ultimate' because:

1. This water will be filtered so that residual microfloc with entrained organic matter will be removed.
2. The average retention time in the Branson distribution system may be closer to one to two days.
3. Distributed water temperatures should be consistently lower than 22^o C so that the kinetics of THM formation will be slower.

CHLORAMINATION

In the event that THM levels approach 100 micrograms per liter in the future or should USEPA further restrict the allowable MCL, the City of Branson could readily reduce THM levels through the addition of ammonium ion (NH₄⁺) to the finished water prior to distribution.

The final two analyses for TFP indicate the degree of reduction in trihalomethane which may be expected when NH₄Cl is added 8 hours (in-plant retention time) following the addition of chlorine. The subsequent addition of ammonium ion reduced TFP formation to an average of 44.6 micrograms per liter; roughly half the amount formed in the presence of free chlorine. In this scenario, free chlorine is still the *primary* disinfectant enabling Branson to achieve the concentration times time (Cxt) requirement for disinfection.

DISINFECTION, DISINFECTION BY-PRODUCTS (DBP)

Based on these observations and results, it appears that Table Rock Lake will provide a water which can be satisfactorily disinfected with either chlorine or chloramine without creating excessive amounts of THM during distribution. More stringent THM regulation may require Branson to consider the addition of ammonium ion to maintain a less reactive chloramine residual. Most major utilities in Missouri currently employ chloramine residuals in the distribution system, particularly during periods of high water temperature when free chlorine residuals may be rapidly dissipated in transmission mains.

Seasonal approaches to disinfection may also be considered, with 'free chlorine' utilized in the winter and chloramine formed during the summer. This not only ensures good disinfection during the winter, but minimal chlorine usage (and loss) during the summer.