



# CITY OF CAMBRIDGE

MASSACHUSETTS

WATER DEPARTMENT  
250 FRESH POND PARKWAY  
CAMBRIDGE, MASS. 02138

John J. Cusack, Jr.  
Superintendent

617-498-9070

To: Robert W. Healy, City Manager  
From: John J. Cusack, Jr., Superintendent  
Date: October 27, 1983  
Subject: TRIHALOMETHANES IN CAMBRIDGE DRINKING WATER

As a followup to our meeting on October 26th with Dr. Melvin Chalfen (Comm. of Health & Hospitals) and Everett Kennedy (Acting Comm. P.W.D.) the C.W.D. has prepared this brief fact sheet and status report on the issue of trihalomethanes:

## Definition of Trihalomethanes

- members of a group of organic chemicals that contain one carbon atom, one hydrogen atom, and three halogen atoms (typically chlorine)

## How are Trihalomethanes Formed?

- formation occurs during chlorination and can continue to occur as long as free chlorine is available to react with organic precursors, which typically consist of humic and fulvic acids produced by decaying vegetation.

## Chlorination

- this is the treatment process used at the Cambridge Water Treatment Plant for disinfection to destroy any disease-producing water-borne bacteria

## Federal Regulations

- in November 1979, the U.S.E.P.A. amended its Drinking Water Regulations to provide a Maximum Contaminant Level (M.C.L.) of 0.10 milligrams/liter (parts per million) or 100 micrograms/liter (parts per billion)

State Regulations

- as of May 1983, according to Section 22.07 of 310 C.M.R. 22.00 - Drinking Water Regulations, the M.C.L. for trihalomethanes shall be 0.10 milligrams per liter which is identical to the Federal standard
- section 22.07-(2c) also requires that "... analyses for trihalomethanes shall be performed at quarterly intervals on at least four water samples for each treatment plant..."

Potential Health Effect

- The U.S.E.P.A. believes that the four most common trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane and tribromomethane) are "potential carcinogens" because of laboratory test with rats and mice. This assumption is somewhat similar to the opinions of the U.S.D.A. about the artificial sweetener saccharin ( $C_7H_5O_3NS$ ), which is obtained from coal tar.

Synthetic Organics

- section 22.07 - (table 1) of 310 C.M.R. 22.00 - Drinking Water Regulations requires testing of water every three years for chlorinated hydrocarbons and chlorophenoxy pesticides. The last series of required tests for these six organic pesticides (endrin; lindane; methoxychlor; toxaphene; 2,4-D; and silvex) were conducted in November 1982, with all test results below the M.C.L. concentrations. (see attached Exhibit "A").
- since there are no significant concentrations of synthetic organics in the water, any current formation of trihalomethane compounds must be attributed to naturally occurring organic substances in the reservoir system.

Natural Organics

- the principal source of organic compounds in the three Cambridge reservoirs is decaying vegetation matter from deciduous trees; this situation is most acute at Fresh Pond where dense vegetation is actually situated within the perimeter fence of the terminal reservoir.

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Current Test Results

- The latest series of test samples (which initiated the 10-26-83 "Boston Globe" article) were collected by C.W.D. personnel on August 23rd and delivered to the Lawrence Experimental Station; the results of these tests are summarized below along with results from the two previous sets of samples:

Total THM Analytical Results - (micrograms/liter)

| <u>Location</u>              | <u>7/82</u> | <u>11/82</u> | <u>8/83</u> |
|------------------------------|-------------|--------------|-------------|
| City Hall                    | 69          | 56           | 103         |
| Payson Park                  | 67          | 49           | 104         |
| Plant Effluent               | 35          | 20           | 96          |
| Engine Co. #3 -(@ Lechmere)  | 77          | 48           | 109         |
| Engine Co. #7 -(Kendall Sq.) | <u>72</u>   | <u>n.a.</u>  | <u>263</u>  |
| Average TTHM per series:     | 64          | 43           | 135         |

Running Average of last fourteen tests: 83 micrograms/liter

Previous Testing

- the C.W.D. has been monitoring trihalomethane compounds for four years, starting in November 1979; a composite table is attached as Exhibit B.

Response of C.W.D. to Date

- Fall 1975 - C.W.D. initiated a tree cutting and clearing project at Fresh Pond to remove undesirable deciduous vegetation and dead trees adjacent to the reservoir to minimize organic matter entering the water. Project was stopped because of controversy about tree cutting.
- Fall 1979 - C.W.D. started to test for trihalomethanes to establish a data base.

- Summer 1981 - Pre-chlorination ahead of filtration was discontinued as a treatment process to reduce formation of THMS. Disinfection since then has been accomplished with post-chlorination only.
- Fall 1981 - Awarded a \$250,000 construction contract for improvements at Payson Park Reservoir. The scope of work consisted of cleaning the bottom of the basins, installation of new 36-inch inlet and outlet pipes, and erection of perimeter fence to improve security and act as a barricade to block out wind-borne leaf deposits. The objectives of this project were to improve hydraulic mixing and minimize organic matter, which would also minimize chlorine demand.
- Spring 1982 - The Water Board presented the Cambridge City Council with the "Fresh Pond Reservoir and Watershed Vegetative Maintenance Plan", No action was taken eventhough the plan was endorsed by the U.S.E.P.A. Drinking Water Branch.
- Summer 1982 - C.W.D. awarded a \$60,000 construction contract for improvements to the chemical pre-treatment facilities at the W.T.P. The work consisted of the installation of vertical rapid mixing units ahead of flocculation in the distribution boxes at the application point of the coagulant. The purpose of this project was to improve suspended solids removal efficiency ahead of filtration.

This project was subsequently expanded to include replacement chemical feed pumps, that would be suitable for use with the alternate coagulant of ferric chloride, that would be used when the corrosion control chemical is converted from caustic soda to lime. This project should be on-line in November 1983.

- Fall 1982 - C.W.D. had testing performed on water for synthetic organics. Test results were satisfactory, which substantiated that organic matter in reservoir was from natural sources.

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- Winter 1982 - The C.W.D. contracted for the design of improvements to the existing flocculation system. Plans and specifications for this construction project are now complete and ready for advertisement. Estimated project cost is \$500,000. This project will improve pre-treatment and filtration efficiency.
- Summer 1983 - C.W.D. met with D.E.Q.E. Division of Water Supply about State funding of Water Filtration Plant improvements under the Chapter 406 program.

JJC/mp

Attachments: Exhibit A - Test Data for Chlorinated Hydrocarbons & Chlorophenoxy  
Pesticides

Exhibit B - Historical Test Results of Total Trihalomethanes from  
November 1979 thru August 1983



environmental engineers, scientists,  
planners, & management consultants

CAMP DRESSER & McKEE INC.

One Center Plaza  
Boston, Massachusetts 02108  
617 742-5151

30 NOVEMBER 1982

LAB NO: 12113  
FILE NO: 9952-158-01

CERTIFICATE OF LABORATORY ANALYSIS

PROJECT: CAMBRIDGE, MA

REPORT TO: BRIAN BUCKLEY  
CDM/BOSTON  
RE: 139-98-CG-GEAD

DATE SAMPLE RECEIVED: 9 NOVEMBER 1982

DATE SAMPLE COLLECTED: 9 NOVEMBER 1982 BY GERARD SCHULTZ/CWD

ANALYTICAL METHODS: THE SAMPLE WAS ANALYZED ACCORDING TO PROCEDURES  
OUTLINED IN STANDARD METHODS FOR THE EXAMINATION  
OF WATER AND WASTEWATER, 15TH ED., 1980.

ANALYTICAL RESULTS:

CDM LAB NO: 12113 SAMPLE DESCRIPTION: PLANT EFFLUENT

| <u>CONTAMINANT</u> | <u>CONCENTRATION, MG/L</u> | <u>MAXIMUM CONTAMINANT<br/>LEVELS (DRINKING WATER), MG/L</u> |
|--------------------|----------------------------|--------------------------------------------------------------|
| ENDRIN             | <0.0002                    | 0.0002                                                       |
| LINDANE            | <0.004                     | 0.004                                                        |
| METHOXYCHLOR       | <0.1                       | 0.1                                                          |
| TOXAPHENE          | <0.005                     | 0.005                                                        |
| 2,4-D              | <0.1                       | 0.1                                                          |
| 2,4,5-TP (SILVEX)  | <0.01                      | 0.01                                                         |

Donald G. Muldoon 11/30/82  
DONALD G. MULDOON DATE  
LABORATORY MANAGER

A.W. Schulteis 11/30/82  
ALEXANDER W. SCHULTHEIS DATE  
PROJECT CHEMIST

DGM,AWS/EK

CC: J.C. THOMPSON

EXHIBIT "A"

SUMMARY OF ANALYTICAL RESULTS - TOTAL TRIHALOMETHANES - (micrograms per liter)

| <div> <div>ERCc</div> <div>CNM</div> <div>10/27</div> <div>10/26</div> </div> |              | 08/83 | 11/82 | 07/82 | 04/82 | 10/81 | 09/81 | 08/81 | 11/80 | 07/80 | 04/80 | 11/79 |
|-------------------------------------------------------------------------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Location/Date                                                                 | (month/year) |       |       |       |       |       |       |       |       |       |       |       |
| Plant Effluent                                                                | 58.1 38.3    | 96    | 20    | 35    | 31    | 11    | 51    | 78    | --    | 70    | 44    | 30    |
| Payson Park Reservoir                                                         | 51.8 72.4    | 104   | 49    | 67    | 38    | --    | 106   | --    | 61    | 80    | 66    | 64    |
| City Hall                                                                     | 59.6 74.8    | 103   | 56    | 69    | --    | 20    | 72    | 153   | 75    | 105   | 65    | 82    |
| Eng. Co. #3 - (Lechmere)                                                      | 71.1 76.5    | 109   | 48    | 77    | 48    | 35    | 78    | 151   | 74    | 160   | 87    | --    |
| Eng. Co. #4 - (Porter Sq.)                                                    |              | --    | --    | --    | --    | --    | --    | --    | 84    | 110   | 70    | --    |
| Eng. Co. #7 - (Kendall Sq.)                                                   | 59.0 78.8    | 263   | --    | 72    | 45    | 47    | 65    | 138   | 61    | --    | --    | --    |
| Eng. Co. #9 - (Lexington Ave.)                                                |              | --    | --    | --    | --    | --    | --    | --    | 100   | 180   | 83    | --    |
| Average TTHM per period                                                       | 59.92 68.16  | 135   | 43    | 64    | 41    | 28    | 74    | 130   | 76    | 130   | 69    | 59    |

Notes: a) Test results for sample series 08/83 determined by Lawrence Experimental Station; all other test data from Camp Dresser & McKee laboratory, which is certified by D.E.Q.E.

b) Pre-chlorination eliminated immediately after test results from 08/81 sample series

EXHIBIT "B"  
(10/27/83)



## CITY OF CAMBRIDGE

CAMBRIDGE, MASSACHUSETTS 02139

Tel. 498-9011

EXECUTIVE DEPARTMENT

ROBERT W. HEALY

City Manager

October 31, 1983

To the Honorable, the City Council:

Enclosed is a copy of a report from John Cusack, Water Superintendent, for Friday morning's Committee on the Environment meeting.

This report discusses in detail the issue of Trihalomethanes in drinking water.

Additionally, I have added the independent test results done last week which indicate THM averages well within the safe level. The average of the Camp Dresser & McKee samples on October 26 was 68.1. The ERCO average done on October 27 was 59.9.

Also, the Superintendent and Water Board have submitted a long-range capital improvement program, which I am currently reviewing for improvements and financial impact. I hope this report alleviates concern about the safety of Cambridge water.

Very truly yours,

Robert W. Healy  
City Manager

RWH/mbf  
Enc.

Agenda Item Number Five

S-606

Re: transmitting a copy of a report from  
John Cusack, Water Superintendent on the  
issue of Trihalomethanes in drinking water.

In City Council,

October 31, 1983

10/31/83

Placed  
on  
F. 12