WATER QUALITY REPORT

ALLIANCE WATER TREATMENT FACILITY

ALLIANCE, OHIO

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By

Toni E. Middleton, Mayor

John B. Blaser, Director
Public Safety and Service

Dr. Dean A. Reynolds, Superintendent
Alliance Water Treatment Plant

Michael D. Dreger, Superintendent
Alliance Water and Sewer Distribution

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I. INTRODUCTION

The purpose of this report is to provide the reader with accurate information regarding the quality of water produced by the Alliance Water Treatment Plant (WTP). The report was requested by Councilman Lawrence Dordea. The City of Alliance Administration appreciates the opportunity to address misrepresentations over the past year regarding the quality of both raw and finished water. An example of this is a recent ordinance introduced in City Council which inferred that there should be concern with Alliance's drinking water due to the quality of the water in the City's reservoirs.

When advised of the ordinance, AmyJo Klei, Environmental Specialist with the Ohio EPA, wrote that she reviewed all of the data used for the Deer Creek Reservoir and concluded that the atrazine watch list determination was based on raw water samples collected six years ago. She goes on to say that atrazine levels in the raw water have been consistently low since 2004 and all of the finished water levels are near or below the detection limit. If the trend continues, she believes it is likely that the watch list designation could be removed in the 2012 Integrated Reporting cycle. She concludes with, ***"It is unfortunate that the results of the Integrated Report would be misused as a measure of the quality of the finished water."*** (A copy of the complete letter from Ms. Klei is included in the Appendix A.) **In fact, the Integrated Report states that Deer Creek Reservoir has no drinking water impairment whatsoever.** (Watershed Assessment Unit Summary for Deer Creek Reservoir taken from the Integrated Report is included in Appendix A.)

This report will address the water treatment plant, source water, regulatory compliance, aesthetics, and future concerns and solutions. Under Regulatory Compliance the report will clearly show that **the Alliance Water Treatment Plant is in full compliance with every regulation and has been for more than five years.** The Ohio EPA maintains records for immediate referral for a period of five years.

For many users there are issues that go beyond safe drinking water. There are aesthetic "qualities" for water, which can be important attributes to users, such as water hardness, discoloration, and taste and odor. There is no intention to minimize these concerns; in fact this report will deal with them in a very direct manner. At the same time, it is of paramount importance that a distinction be maintained between Safe Drinking Water Standards (SDWS) and aesthetic qualities. Just as it would be wrong for the City to infer that its stellar performance with to respect to SDWS somehow eliminates any taste and odor issues, **it would be far more irresponsible to suggest that a taste and odor issue reflects any concern over the safety of our water.**

And finally, the report will inform the reader of the City's plans for both water treatment and source water protection to meet the needs of the community and to continue to stay ahead of new regulations from the Ohio EPA.

II. WATER TREATMENT PLANT

The City of Alliance Water Treatment Department moved to the present facility at 12251 Rockhill Avenue N.E. in 1993. The facility was constructed between 1990 and 1993 with engineering and construction costs of approximately $14,200,000. The new facility which received the 1995 Ohio Outstanding Civil Engineering Achievement Award from the Ohio Council of the American Society of Engineers was needed to replace an outdated and aging treatment plant built in 1913. Additional funds were used for construction of the Clark Street Water Tower to add more distribution storage capacity, installation of a 30 inch supply line from the new plant location to the existing distribution system, installation of additional water lines in the city, and replacement of all customer water meters. The total expenditures included in the bonds were over $21,000,000.

The WTP has a peak daily design rating of 10 million gallons per day (MGD) with an average daily rating of 5.5 MGD. Currently, water demand of the system is approximately 3.1 MGD. The plant treatment processes include primary oxidation using chlorine dioxide; powdered activated carbon (PAC) for taste, odor and organics removal; alum coagulation in upflow clarifiers; dual media filtration which includes granulated activated carbon (GAC); pH adjustment using caustic soda; fluoridation; and free chlorine disinfection. Potassium permanganate, hydrochloric acid, and polymer feeds are also available but not currently used. The City's distribution system is divided into two pressure zones. Water storage includes two elevated towers, one 3-million gallon tank, and a half million gallon stand pipe for a total storage of 5 million gallons. A finished water clear well at the WTP adds another 1.6 million gallons of storage capacity to the system.

III. SOURCE WATER

Alliance's raw water source is surface water. Surface water supplies the majority of potable water in North America. Fifty two percent of the population in the United States is served by surface water sources (AWWA, 1995a). Most major cities in the U.S. receive their drinking water from surface water sources. In Canada, 88% of Canadians' receive their drinking water from a surface water source, 10% from groundwater wells, and 2% from wells that are termed under the direct influence of surface water, which means they are impacted by surface water sources and thus are treated as a surface water source (Statistics Canada, 2009).

All public water systems with surface water sources are required to report on their Consumer Confidence Report that they "are highly vulnerable to contamination". However, that does not mean that sources of water from wells are not subject to contamination, they are. In most cases, a contaminant spills into surface water, passes through quickly, is diluted, and moves down stream. This is not the case for contaminants in wells. Contamination of groundwater is slow to appear because of the enormous time required for water to pass from the earth's surface through earth and rock into the aquifer below. Contamination sources are often not identified until after the contaminant shows up at the treatment plant. Once groundwater is contaminated, removal is a slow process, if it can be removed at all. Whole well fields can be contaminated by a contaminant plume such as the recently exposed carbon tetrachloride cleaning fluid contamination of the water aquifer at Camp Lejune, South Carolina. Groundwater contamination is not uncommon and has occurred in Stark County.

To assume that ground water is always a safer source of drinking water is a common error in thinking. Researchers have reported higher levels of disease originating from groundwater than from surface water. According to the Center for Disease Control (CDC) surveillance reports for 2000 and 2001, approximately 50% of the waterborne disease outbreaks reported in the U.S. were the result of contaminated groundwater (Lee et al, 2002). A study of waterborne diseases in the 2003 through 2004 period showed over 87% of waterborne diseases were from groundwater and 12% from surface water (Liang et al, 2006). Because of the high incidence of waterborne disease coming from groundwater sources, the Federal EPA recently promulgated the Ground Water Rule to attempt to reduce the risk of exposure to consumers using groundwater from wells.

Alliance draws surface water from the lower of two contiguous reservoirs, Walborn and Deer Creek, with a total available capacity of 2.9 billion gallons. This source assures Alliance of sufficient quantity of water and capacity to expand our customer base in the future even during extreme drought conditions. Surrounding communities have had to severely curtail customer demand during times of drought. A second water source that serves as an emergency water supply, the Mahoning River, is available and capable of providing up to 30 million gallon per day (MGD) but has not been used since 2000. Water quality varies considerably between the two sources. Although we do not utilize the river source, it is routinely sampled and tested to better understand treatment requirements, if needed. A third source of water owned by the City is Westville Lake which flows to Alliance via the Mahoning River.

IV. <u>REGULATORY COMPLIANCE</u>

The Safe Drinking Water Act (SDWA) passed into law in 1974 is the principal federal law in the United States that ensures safe drinking water for the public. Pursuant to the act, the U. S. Environmental Protection Agency (USEPA) is required to set standards for drinking water quality and oversee all states, localities, and water suppliers who implement these standards. The SDWA requires the USEPA to establish *National Primary Drinking Water Regulations* (NPDWRs) for contaminants that may cause adverse public health effects.

The USEPA is responsible for determining and regulating any contaminants found in water sources. They set the maximum contaminant level (MCL) allowable for any water contaminant that they find. The MCL is based on sound science and has an imputed margin of safety. The major groupings of regulated water contaminants are inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, disinfectants and disinfectant byproducts, microbial contaminants, and radionuclide compounds. The total number of regulated compounds and organisms is in excess of 90.

There are currently more than 160,000 public water systems providing water to almost all Americans at some time in their lives. The SDWA applies to every one of those public water systems. Curiously, it does not apply to bottled water nor does it apply to private wells.

The state regulatory agency, the Ohio Environmental Protection Agency (OEPA), is the primacy agency in Ohio. It is responsible for ensuring public safety. Requirements for drinking water protection are contained in Chapter 3745 of the Ohio Revised Code. Ultimately, federal and state regulatory officials set, and enforce drinking water standards for all public water systems in Ohio.

The City of Alliance samples our raw and finished water for contaminants as specified by the Ohio Revised Code. **The City of Alliance Public Water System has had no violations of these regulations for over five years.** A recent public records request by local media for official sample analysis records and required Monthly Operating Reports for the last five years amounted to over 3,000 pages of information. **The media source publicly announced their findings that the Alliance Public Water System is, and has been for the past five years, in complete compliance with all OEPA regulations.** Questions concerning Alliance's record of compliance can be directed to the Northeast area Ohio EPA offices in Twinsburg, Ohio at (330) 425-9171 or the state offices in Columbus, Ohio at (614) 644-2752. Additionally, Appendix B presents the City's water performance for the last five years compared to the drinking water standards set by the EPA. **The Figures make it very apparent that the City's finished water far exceeds the federally established parameters for safe drinking water.**

Alliance recently completed two years of sampling for a federal EPA rule called the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2) which regulates a microbial contaminant known as Cryptosporidium, a common surface water protozoan parasite. Raw water from Deer Creek Reservoir was collected and tested for the presence of Cryptosporidium. During the two years of the study Cryptosporidium cysts were found only during one month. The results drawn from the two year study based on EPA regulations placed the Alliance treatment facility in BIN #1, which requires no additional disinfection. Currently, Cryptosporidium contamination of finished water is not a concern. A second round of Cryptosporidium sampling will begin in 2016. **Should Cryptosporidium ever become a concern, the proposed addition of Ultraviolet Light to the treatment process will position the Alliance WTP to counter the new threat.**

Another one year federally mandated study, the Stage 2 Disinfectants and Disinfection Byproducts Rule (DBPR2), was recently completed. It involved sampling and testing of selected locations in the distribution system. Similar studies have been completed in every water system in the U.S. that supplies water to populations of greater than 3000 consumers. The study detailed an Initial Distribution System Evaluation for a group of compounds called Total Trihalomethanes (TTHM) and a group of five Haloacetic Acids

(HAA5) commonly found in drinking water. The compounds are formed when free chlorine added for water disinfection combines with organic carbon which is found at varying concentrations in all water sources. Both sets of compounds are produced in all distribution systems whether the water comes from surface water or groundwater sources.

Results of the study determined where future compliance samples are to be taken, at the locations where the highest TTHM and HAA5 levels were observed. The calculation process for complying with the regulations will change in January 2013. Prior to January 2013 the compliance concentration is determined by averaging concentrations of the compounds at all sampled sites across the previous 12 months. Starting in 2013, the compliance concentration will be computed separately for each location averaged across the previous 12 months. Due to the change in calculating the actual concentration, compliance will be more difficult for some water systems to achieve.

In order to insure that the Alliance WTP remains in compliance, the City is requesting that our residual disinfectant be converted into chloramines. Chloramines are created by combining free chlorine with a small amount of ammonia in the finished water. Chloramines are longer lasting than free chlorine, do not produce the regulated disinfectant byproducts and will remove all the chlorine taste from the finished water. **Use of chloramines is fairly common in the Midwest, but not utilized much in Ohio. Dr. Reynolds' experience in this field will allow Alliance WTP to be one of the leaders in meeting new TTHM and HAA5 increased compliance requirements.**

The EPA is continually identifying new potential water contaminants. The Unregulated Contaminant Monitoring Rule periodically requires all systems in the U.S. to sample and test for a predetermined list of emerging contaminant compounds and microbes. National sampling results provide the EPA with prevalence of potential Contaminant Candidates which can then be regulated. To date none of the compounds investigated have been found in Alliance's finished water.

V. KNOWN EPA REGULATED CONTAMINANTS IN ALLIANCE WATER

The following is an explanation of various EPA regulated water contaminants that are found in Alliance's finished water. Contaminants that have been investigated in the past or are routinely tested in Alliance water but were not found are not included. It is important to note that although these regulated compounds are considered contaminates some are required to be added to the water, such as chlorine, chlorine dioxide, and fluoride. Copper and lead are contaminants that come primarily or totally from the internal plumbing system inside a residence or other structure. The contaminants are presented alphabetically.

ATRAZINE – Atrazine is a corn herbicide that was first used by farmers in the 1960's. Over 100 commercially available herbicides contain atrazine. The discovery of atrazine in surface and groundwater led the USEPA to significantly reduce application rates/acre when the herbicide was reregistered in the 1990's. Subsequently, less total pounds of atrazine are applied per acre but it is used in more products than in the past several decades. Atrazine reaches surface waters in soil runoff and groundwater through percolation. Levels of atrazine found in Walborn and Deer Creek Reservoirs have not exceeded EPA allowable levels in finished water since 2000 when the City installed granular activated carbon (GAC) to its treatment plant filters to protect the end user from contamination. Current sampling indicates that atrazine is below detectable limits in the City's water supply. **It is important to note that the OEPA has decreased the City's sampling requirement from 4 samples per year to 1 sample per year.** The maximum allowable limit in drinking water is 3 parts per billion (ppb). The level currently found in the City's finished water is below the minimum detectable limit of 0.3 µg/L or **more than 90% below the maximum allowable limit.** (Figure 1 in Appendix B illustrates the Treatment Plant's **significant level of compliance for the past 5 years.**)

BARIUM – Barium is discharged into surface waters from metal refineries, drilling waste, or erosion of natural deposits. The maximum allowable limit is 2 mg/L. The level currently found in the City's finished water is 0.02 mg/L or **99% below the maximum allowable limit.** (Figure 2 in Appendix B illustrates the Treatment Plant's **significant level of compliance for the past 5 years.**)

CHLORINE – Chlorine is required as a disinfectant to assure finished water contains no harmful human pathogen. The U.S. EPA and Ohio EPA require that every system using free chlorine as their disinfectant maintain a minimum level of chlorine at 0.2 mg/L throughout the distribution system. The maximum allowable limit is 4.0 mg/L. The chlorine level in the Alliance system is greatest near the treatment plant and decreases throughout the system as you move farther away from the plant. Alliance maintains a free chlorine level in the system so that we have sufficient chlorine in the extremities of the system but low enough to minimize taste and odor of chlorine for all residents. The future use of chloramines, another form of disinfectant, will eliminate the chlorine taste and odor and will insure more consistent disinfectant levels throughout the distribution system. (Figures 3, 4, and 5 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

CHLORINE DIOXIDE – Chlorine dioxide is manufactured in the treatment plant by combining sodium chlorite and gas chlorine together under vacuum. It is the primary oxidant and is used to convert iron and manganese to an oxidized state so it can be removed during the coagulation process. It is also used to destroy any human pathogens and other living organisms in the raw water prior to clarification. The maximum allowable concentration is 0.8 mg/L. Chlorine dioxide concentrations in Alliance water have never exceeded 0.2 mg/L in the last five years or **90% below the maximum allowable limit.** (Figures 6, 7, and 8 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

CHLORITE – Chlorite is a by-product of drinking water chlorination with chlorine dioxide. The maximum allowable limit is 1.0 mg/L. The level currently found in the City's finished water varies depending on treatment levels for chlorine dioxide but has always been below the maximum allowable limit. (Figures 9, 10, and 11 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

COPPER – Copper is caused by corrosion of household plumbing systems and erosion of natural deposits. It can be exacerbated by corrosive and unstable water. As will be indicated later in this report the hardness of the City's drinking water is continuously at or near optimum levels and in fact deposits a thin protective layer on the inside of water pipes. Copper does not have an MCL but instead has a level called the Action Level (AL). If the 90^{th} percentile sample taken from specified locations in the City's distribution system exceeds the AL, the City must undertake treatment process changes and begin a public education program to mitigate the copper level. The AL for copper is 1,300 μg/L. Since copper is only sampled and tested every three years the last sampling was in 2007 and will be repeated in 2010. The 90^{th} percentile level determined in the City's finished water in 2007 was 71 μg/L or **94.5% below the AL. Alliance has not exceeded the AL limit since EPA required copper testing began in the 1990's**

FLUORIDE – Fluoride is caused by discharge from fertilizers and aluminum factories or erosion of natural deposits. It is also added to water to promote dental health. The maximum allowable limit is 4 mg/L. The City is required to add fluoride so the finished water level is between 0.8 and 1.2 mg/L. The target level for the City's finished water is 1.0 mg/L. (Figures 12, 13, and 14 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

GROSS ALPHA – Gross alpha is a measure of naturally occurring radioactivity in soil and soil parent material that erodes into surface or ground water. The maximum allowable limit is 15 picocuries per liter (pCi/L). Gross alpha testing on finished water is conducted every five years. The level detected in 2007, the last time it was measured, was less that 3 pCi/L or **at least 80% below the maximum allowable limit.**

HALOACETIC ACIDS – Haloacetic acids are a by-product of drinking water chlorination. The maximum allowable limit is determined by calculating a Running Annual Average using test results from predetermined sites collected quarterly. The Maximum allowable limit is 60μg/L. The level currently found in the City's finished water is 27.47 μg/L or **54% below the maximum allowable limit.** (Figure 15 in Appendix B illustrates the Treatment Plant's **significant level of compliance for the past 5 years.**)

LEAD – Lead is caused by corrosion of household plumbing systems and erosion of natural deposits. It can be exacerbated by corrosive and unstable water. As will be indicated later in this report the hardness of the City's drinking water is continuously at or near optimum levels and in fact deposits a thin protective layer on the inside of water pipes. Lead does not have an MCL but instead has a level called the Action Level (AL). If the 90^{th} percentile sample taken from specified locations in the cities distribution system exceeds the AL, the City must undertake treatment process changes and begin a public education program to mitigate the lead level. The AL for lead is 15 μg/L. Since lead is only sampled and tested every three years the last sampling was in 2007 and will be repeated in 2010. The 90^{th} percentile level found in the City's finished water in 2007 was 2.3 μg/L or **85% below the AL. Alliance has not exceeded the AL limit since EPA required lead testing began in the 1990's.**

NITRATE – Nitrate is used in fertilizers and reaches surface waters as soil runoff. It may also leach from septic tanks, sewage or erosion of natural deposits. The City is currently pursuing corrective measures against sewage polluters of Walborn and Deer Creek Reservoirs through the OEPA, Stark Soil and Water Conservation District, the Stark County Department of Health, the Stark County Sanitary Engineer, and the Army Corps of Engineers. The maximum allowable limit is 10 μg/L. The level currently found in the City's finished water is 0.79 μg/L or **94% below the maximum allowable limit.** (Figure 16 in Appendix B illustrates the Treatment Plant's **significant level of compliance for the past 5 years.**)

RADIUM – Radium is a natural occurring element in soil and parent material that erodes into surface and groundwater. The maximum allowable limit is 5 pCi/L. Radium is only tested every five years and was last tested in 2007. The level found in the City's finished water 2007 was less than 1 pCi/L or **at least 80% below the maximum allowable limit.**

TOTAL COLIFORM – Total coliform bacteria include both human non-pathogenic and pathogenic species of bacteria that can remain viable in water. Coliform bacteria are commonly found in surface water sources and can occur in groundwater when surface contamination of the well has occurred. These bacteria are the main reason that regulatory agencies require disinfection of drinking water with chlorine or chloramines. Over sixty locations at businesses throughout the city are routinely sampled to determine the chlorine residual and test for total coliform. Anytime a test for total coliform is found positive for the bacteria, further investigative sampling steps are required. Several samples are taken in the immediate area in the distribution system to determine the exact location of contamination. If the system is found to be compromised, further steps are then required and public notification is required. **Alliance has not had a positive Total coliform sample for over five years.**

TOTAL ORGANIC CARBON (TOC) – TOC is an organic carbon from natural organic material found in the environment. One important source of TOC in surface water comes from algal blooms. TOC is found at varying levels in all surface and groundwater sources. TOC in Alliance's raw water typically is around 6 to 7 mg/L. All surface water systems are required to reduce the TOC level according to very specific EPA regulations. Alliance uses enhanced coagulation, PAC, and GAC to reduce the TOC to acceptable levels in the finished water. (Figures 17 and 18 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

TOTAL TRIHALOMETHANE (TTHM) – TTHM is a by-product of drinking water chlorination. TTHM's include the compounds chloroform, bromoform, bromodichloro-methane, and dibromodichloromethane. The maximum allowable limit for TTHM is determined by calculating a Running Annual Average using test results from predetermined sites collected quarterly in the City's distribution system. The maximum allowable limit is 80 μg/L. The level currently found in the City's finished water is 68.67

μg/L or **14% below the maximum allowable limit**. This is the one EPA regulated contaminant of concern to the City because of the next round of OEPA regulations. As such, the City is moving to a treatment process called chloramination which was discussed previously in this report and will be mentioned again under Future Considerations. (Figure 19 in Appendix B illustrates the Treatment Plant's **level of compliance for the past 5 years.**)

TURBIDITY – Turbidity is a physical characteristic of water referring to the clarity of water and is expressed in units called nephelometric turbidity units (ntu). Higher turbidities are caused by suspended material in the water. Turbidity of finished water is used as a measure of the potential presence of harmful microorganisms in a distribution system. The maximum allowable turbidity is when two measurements recorded 15 minutes apart exceed 0.5 ntu. Once that happens there are specific regulations that must be followed to correct the high turbidity. Alliance has been in compliance with all regulations concerning turbidity for over five years. (Figures 20, 21, and 22 in Appendix B illustrate the Treatment Plant's **significant level of compliance for the past 5 years.**)

VI. AESTHETICS

The term aesthetics has been used to describe consumer concerns with water that relate to its desirability, rather than its safety. Aesthetic concerns with water are related to hardness, color, and taste and odor. Consumer expectations for the aesthetic quality of their water are very important, but it is equally important in a discussion of "water quality" to insure a distinction be maintained which recognizes that these attributes do not impact the safety of the water supply.

HARDNESS – Hardness is defined as a characteristic of water, caused primarily by the salts of calcium and magnesium. Hardness causes deposition of scale in boilers and home water heaters, can cause damage to some industrial processes, and sometimes causes objectionable taste. (AWWA, 1995b)

Water is a strong solvent and as it becomes softer, water contains less dissolved materials and has a greater propensity to dissolve the inside surface of pipes. Although soft water produces more soap suds which some people prefer, softer water can be very corrosive and adversely raise the level of copper and lead in water by dissolving the inside of plumbing.

The ideal range for water hardness is between 100 mg $CaCO_3$/L and 200 mg $CaCO_3$/L (Mechenich and Andrews, 2004). The ideal range is based on an upper level of hardness that causes problems as mentioned above and the lower level of hardness is based on the suspected health benefits of slightly harder water. The purported health benefits of harder water are being debated by the international scientific community (WHO, 2009). Based on multiple published research studies, hardness above 170 mg $CaCO_3$/L poses limited health benefits (Shaper, 1981). **Most reputable sources including the American Water Works Association (AWWA) recommend a finished**

water hardness of 150 mg $CaCO_3$/L (mg/L= ppm or parts per million) (Mechenich and Andrews, 2004). **The hardness of Alliance's finished water has averaged approximately 150 mg/L over the last 5 years.**

Hardness of water originating from Deer Creek Reservoir varies little throughout the year. The WTP does not treat for hardness because it is not necessary. However, water hardness from the Mahoning River can be twice as hard and can fluctuate widely. Varying hardness within a distribution system can create problems with excessive precipitate in the pipes. The commercial water treatment industry commonly refers to hardness using the unit "grains" of hardness. To convert hardness presented as mg $CaCO_3$/L to grains of hardness, divide the mg/L by 17.1. Grains will always be a smaller number. For example 150 mg $CaCO_3$ /L divided by 17.1 equals 8.8 grains of hardness.

Corrosivity of water in a pipe refers to the stability of the water. Water in the distribution system needs to be stable. Water stability is the balance between being corrosive and scale forming. Stability of water is calculated using measured values for calcium carbonate, temperature, pH and other physical parameters of water. The "Langelier Saturation Index" (LSI), is the most widely used calculation to represent stability. Because the LSI is affected by many factors including pH, the Alliance WTP monitors and closely maintains the stability of its water by adjusting the water pH. The adjustment of pH varies only slightly throughout the year. **The Alliance water LSI is maintained at a level so that a very thin protective coating, called an eggshell coating, is deposited on the inner surface of the distribution system piping. The coating protects the inside of the pipe from corrosion.**

DISCOLORATION – Discoloration in a public water supply is normally the result of iron and/or manganese in the water. Iron and manganese are naturally occurring minerals found in drinking water supplies. These minerals are not harmful to life, but are in fact, necessary for life to exist and are included in most multivitamins sold on the market.

Water with high iron or manganese can cause water to be off color. In high concentrations they may cause reddish-brown or black stains on clothes or household fixtures. Red or orange color indicates iron while black, green, and yellow indicates varying degrees of manganese. To eliminate iron and manganese problems in finished water, the levels must be reduced by using various treatments. Iron is best reduced to less than 0.3 mg/L and manganese to less than 0.05 mg/L.

These minerals will also precipitate out of water in piping systems and accumulate, even when they are maintained in low concentrations. These accumulations can be resuspended in the water of the distribution system when water flow increases or changes directions abruptly, as happens during a water main break or when large amounts of water are required to fight a fire. As a result, all water systems are subject to water discoloration when there is a disturbance to the system. As such, flushing should be employed to prevent or minimize problems from accumulations. In a distribution system this is accomplished by regular flushing of fire hydrants, and in a home system by draining and flushing the hot water tank.

Reducing water discoloration has been a significant success for the City of Alliance. Alliance was plagued with consumer problems resulting from discolored water throughout the 1980's, in large measure due to the lack of a sufficient treatment tool for removing the high level of manganese in its source water. Virtually any water main break, fire or other system disturbance, even minor ones, created a localized color problem, and it was not uncommon for color problems to occur absent a system disturbance.

The iron concentration in Alliance's water supply is consistently low, <0.04 mg/L so no treatment is needed to prevent problems from iron. However, manganese concentration of our raw water varies greatly throughout the year. A typical manganese concentration in the raw water is around 0.2 mg/L, but seasonal swings can reach 1.0 mg/L. Even more problematic from a treatment perspective, these changes in concentration can be very sudden in occurrence and dramatic in magnitude.

Treatment capabilities for the removal of manganese were part of the new treatment plant. At the same time the plant was placed into service the City began a regular hydrant flushing program to provide for the removal of manganese accumulations in the distribution mains. The results of the new treatment and flushing significantly decreased consumer problems with color. However, the plant was not able to consistently maintain manganese concentrations below 0.05 mg/L, and consumer expectations were not fully realized. As a result, two studies were performed during the 1990's by independent consultants hired by the City. The first, in 1995, looked at possible in plant treatment alternatives to reduce manganese. The second, in 1999, examined options to reduce the levels of manganese at Deer Creek Reservoir.

Neither study provided recommendations deemed suitable to adequately reduce manganese. The treatment plant utilized potassium permanganate for manganese removal between the years 1993 until 2000. In 2000, a decision was made to utilize the plant's chlorine dioxide generator for continuous manganese removal. Additionally, a more frequent testing schedule to determine manganese levels in the raw water was followed. With the use of chlorine dioxide and the development of a sufficient testing program, since 2000 the City has consistently been able to maintain finished water levels for manganese below 0.05 mg/L. In fact, the treatment goal for Alliance is to keep finished levels below 0.03 mg/L.

As mentioned above, even with good treatment, periodic flushing should be employed to minimize problems from accumulations. In a distribution system this is accomplished by regular flushing of fire hydrants. Alliance each year practices a whole system directional flush and has an abbreviated monthly flush schedule. Both are used to reduce precipitant loads in the City's distribution system. **Since 2000 the City has not experienced an incident of discolored water that was not related to a system disturbance; and today even with a system disturbance it is very rare for anyone to experience discolored water problems.** Manganese levels are greatly reduced at the WTP and much less precipitant enters the distribution system during the year.

TASTE AND ODOR – In beginning a discussion on taste and odor issues with respect to Alliance water, it is important to recognize that prior to WTP Supt. Dr. Reynolds' investigation of 2-methylisoborneol (MIB) and Geosmin levels in our raw and finished water, the City did not possess a way to quantify these problems. Secondly, this knowledge regarding MIB and Geosmin only allows quantification of taste and odor problems associated with these compounds. Consequently, whereas problems and solutions for hardness and color can be demonstrated, discussion of taste and odor events prior to the last year and a half are largely anecdotal in nature.

At one time, chlorination of raw water was employed throughout the water supply industry as a treatment technique for taste and odor control, and it was often partially effective. However, chlorine combines with organic material in water to form carcinogenic compounds, a fact which led to NPDWRs for disinfection byproducts. Compliance with these regulations effectively eliminated the use of chlorine for taste and odor control in Ohio by the 1980's.

In the 1980's and 1990's taste and odor problems occurred on a regular basis. As with discoloration, expectations were elevated with the advent of the new Water Treatment Plant in 1993. But by the late 1990's it was evident that the new plant could not always produce a water free of taste and odor using water from Deer Creek. When taste and odor problems occurred, the water source being used was quickly switched to the Mahoning River until that became untenable. The source was then switched back to the reservoir with the hopes that the problem had subsided.

The City was experiencing one of its worst taste and odor events in the winter of 1999 when Toni Middleton became Mayor. **One of his first decisions was to stop using the Mahoning River as a supply to avert taste and odor problems. The decision was based on maintaining a safe water supply. The Mayor correctly believed that safety of our water supply could best be guaranteed using Deer Creek Reservoir for supply based on compliance with the NPDWR.**

At the height of the taste and odor problems during the 1999-2000 event, user complaints were much greater than anything experienced in the more recent 2008-2009 event. A variety of treatment options were employed during the 1999-2000 event, which were successful in dramatically reducing the taste and odor problems. The City also consulted heavily with the Mahoning Valley Sanitary District (MVSD) which supplies water to Youngstown because they had experienced the same problems the year before. By April of 2000, the taste and odor problems in Alliance had subsided.

In 1999 the City had completed a pilot study on the use of granular activated carbon (GAC) in the water treatment plant's filters. The pilot study demonstrated effectiveness in removing total organic carbon and atrazine, and GAC was already being used in the water treatment industry for odor taste and odor removal. Early in 2000 the City received approval from OEPA for the installation of granular activated carbon (GAC). The plant's filters were capped with GAC in the summer of 2000. By the fall of 2000, convinced that the taste and odor problems were the result of an algal bloom in Deer Creek, the City followed the lead of the MVSD, and obtained the ability to treat its reservoir with copper sulfate to prevent future algal blooms.

From 2000 until the present, the City monitored algae levels in Deer Creek, and treated the reservoir when needed. Whenever a problem with taste and odor began to develop, the treatment techniques learned in 2000 were employed, and improved, and of course GAC was now always in use. From 2000 to 2009, the City had only two minor taste and odor problems which were quickly addressed by increasing the treatment options discussed above.

It was nine years between that taste and odor event which began in late 1999 and the one that began in late 2008. That much time between taste and odor events was previously unheard of in Alliance and, as such, the latest event came as a surprise. It was now obvious that while GAC had significant benefits, it would take something else to combat extreme occurrences.

With that knowledge treatment plant personnel spent 2009 doing extensive sampling of both Walborn and Deer Creek Reservoirs to identify point sources where MIB's were high and identifying an additional treatment process for taste and odor called Ultraviolet Light Oxidation. Both of these will be discussed further under future considerations.

MIB and Geosmin are the compounds which cause the most significant taste and odor problems in Alliance water. There does not seem to be a general dissatisfaction with the taste and odor of Alliance water when those compounds are below detectable levels. The one minor exception is with respect to chlorine taste in water. Chlorine is a familiar taste with almost all public water systems, is required by the OEPA, and is probably less pronounced in Alliance because the City tries very hard to minimize chlorine as much as possible, yet maintain the required concentrations in the system. **However, if the City is permitted to switch to chloramines as is being proposed to the Ohio EPA, chlorine taste in the water will be eliminated.**

VII. <u>FUTURE CONCERNS AND SOLUTIONS</u>

Drinking water standards represent conservative judgments of scientists and regulators and are based on all available information on the health effects of drinking water contaminants. They reflect sound scientific judgment and are based on all the knowledge that is available. As new knowledge is gained and testing methods are improved, water quality standards will evolve. Staying abreast of developments and anticipating future concerns and requirements is critical to maintaining Alliance's compliance capabilities.

ULTRAVIOLET LIGHT – UV light has been used for many years in both water and wastewater treatment processes to disinfect water. UV light destroys microbial organisms living in water. Since the enactment of the Long-Term 2 Enhanced Surface Water

Treatment Rule (LT2) regulation concerning Cryptosporidium, many more water treatment plants have been required to add UV disinfection as part of their treatment process. **Currently, the EPA does not require Alliance WTP to use UV disinfection because our existing treatment process is sufficient to remove all threats of microbial pathogens from our finished water.**

The biggest challenge in Alliance involves treatment of raw water from the two reservoirs to remove taste and odor caused by 2-methylisoborneol (MIB), a secondary metabolite produced by certain blue-green algae. The eutrophic state of our two reservoirs caused by nutrient contaminants such as phosphorus and nitrogen entering the watershed supports blue-green algae blooms. During and after the algae blooms MIB is released into the raw water.

Recently the water industry has developed a process known as UV Oxidation. Using the same UV technology that has been widely used throughout developed countries for disinfection, steps have been added to destroy organic contaminants in finished water. **UV Oxidation is being used to destroy well over one hundred contaminant compounds in water throughout the world. The taste and odor compounds that cause the aesthetically unpleasant taste in Alliance can be destroyed by the use of UV Oxidation.** The process utilizes hydrogen peroxide energized by UV light to form destructive hydroxyl ions that search and destroy the MIB and geosmin taste and odor compounds. Alliance has studied this exciting new technology and determined that it would be a more efficient and lower operating cost alternative to powder activated carbon (PAC). However, during times when MIB levels reach unusually high concentrations, as observed in 2009, PAC would also be required with UV Oxidation to reduce the MIB concentration to a negligible level. Operating costs to remove MIB concentration this past winter, January through March 2010, would have been more adequately and more cheaply removed by UV Oxidation than by the less efficient PAC.

In the future, if Alliance is dictated by changing state and federal regulations to add UV disinfection to the water treatment process, the UV system would already be in place and would only require adding an additional UV unit to meet the EPA's requirements for disinfection redundancy.

CHLORAMINATION – Another challenge for the future will come from the changing disinfectant byproduct regulations. Disinfectant byproducts (TTHM and HAA5 compounds) are formed when free chlorine added to water combines with organic carbon. Both are regulated by the EPA. EPA approval to change the secondary disinfectant from free chlorine to chloramines is being pursued by the City. The use of chloramines would allow the City to continue to meet the Disinfection By-Product requirements and possibly improve residual disinfectants in the system. Chloramines have been used as a disinfectant since 1916 in water systems throughout the U.S. and abroad (Cobban, 1996). An increasing number of water systems in the US have instituted chloramination as their secondary disinfectant because of the changes in the federal rules on disinfectant byproducts. **The benefits are reduced levels of disinfectant byproducts,**

longer lasting disinfectant residual in the distribution system, and elimination of chlorine taste in water.

SOURCE WATER PROTECTION EFFORTS AND ITS ROLE IN PREPAREDNESS – The Water Treatment Plant staff have been actively developing a Source Water Area Protection Plan since 2007. **The staff, in conjunction with representatives from the Ohio EPA has been instrumental in conducting important reservoir studies to better understand the environment of the source water watershed.** The OEPA conducted an in-depth analysis of Deer Creek Reservoir and additional sampling of Walborn Reservoir. In addition the Water Treatment staff has been sampling the watershed at 60 locations in tributaries flowing into the reservoirs and in the reservoirs themselves for sources of potential contamination. **As a result of initial testing Alliance is working with several governmental agencies to reduce the nutrient contaminants coming into the two reservoirs.** A Watershed Area Protection Plan is being developed for the Deer Creek and Walborn Reservoir watershed in conjunction with the Western Reserve Land Conservancy, the OEPA and other stake holders. The group currently has a **grant of $10,000 from the Greater Alliance Foundation** and anticipates more funding from other local foundations as the project matures.

Prevention alone is not adequate and the City is aggressively pursuing newer technologies for the treatment and removal of taste and odor in its water. Advanced treatment processes such as a UV Oxidation system to remove the taste and odor chemicals in the finished water is one of the technologies being considered by the City.

INVOLVEMENT IN AWWA – Because of his knowledge and experience, Dr. Dean Reynolds, the Alliance Water Treatment Superintendent is very active in district, state, and national water treatment professional organizations. He is a past member of the national American Water Works Association's (AWWA) Organic Contaminant Control Committee. He is currently the Chairman of the Northeast District of the Ohio Section of the AWWA where he has been active on the NE Board for 3 years since coming to the City of Alliance. He is an active member of the state AWWA for both the Research Committee and the Technology Committee. His involvement gives him invaluable and timely access to new water treatment technology, existing and proposed federal and state water regulations, and a very important network of the top water treatment professionals in the state and nation. He is also able to provide valuable input on new regulations that may affect Alliance Water Treatment operations.

EMERGING CONTAMINANTS, A GLIMPSE INTO WHERE THINGS MAY LEAD – Alliance is actively evaluating any new potential risks to our water supply. For example, recent interest in algal toxins by various non-governmental health organizations like the World Health Organization (WHO) and random sampling of water sources by federal and state agencies has suggested that algal toxins should be investigated. **Alliance WTP has developed a sampling plan to detect potential toxins. However, Alliance's current treatment processes are sufficient to remove those algal toxins, if present, from finished water.** It should also be noted here that **Dr. Reynolds is teaching a two day**

class at the Ohio State University's Stone Lab Research Center at Put-in-Bay on Lake Erie this summer on *Harmful Algal Blooms and Algal Toxins*.

Other groups of emerging contaminants have been discovered around the country. They include endocrine disruptors such as certain pesticides and pharmaceuticals; personal care products such as pain medications; and food additives. The Alliance water treatment plant staff is keeping aware of these emerging contaminants. As scientific inquiry learns more about these contaminants and whether they pose significant concerns to human health, the Alliance staff will evaluate the needs for additional treatment.

Currently, it is well known that the UV Oxidation system that Arcadis Engineering is designing for our treatment system can destroy most if not all of the recently found emerging contaminates. **Once again Alliance Water Treatment has a proactive position concerning future contaminants. With the UV Oxidation system and with the potential of adding a second UV unit for an EPA approved disinfection system, Alliance is set to handle any currently known microbiological or chemical contaminants.**

VIII. CONCLUSION

It has been shown under Regulatory Compliance that the **Alliance WTP is and has been in significant compliance with all Ohio EPA regulations**. The degree of that level of compliance is further demonstrated by the Figures in Appendix B. According to the last five years for which the Ohio EPA maintains active records, **the Alliance WTP has operated without a single violation**. Even the **Ohio EPA is troubled by the misuse by some individuals of information maintained by that agency**. The only area that could be a concern in the future is Total Trihalomethanes which will be eliminated by chloramination.

Under Aesthetics it was shown that the only issue the City needs to address is the ability to remove MIB's which will be **accomplished through UV Oxidation and source water protection.** For those who dislike the taste and odor of even low levels of chlorine, that issue will be addressed through chloramination.

Regarding Future Concerns and Solutions, it is apparent that the City has developed plans to address the few issues before us and is actively pursuing those plans. For those cynics who are not willing to accept the information provided herein, **we strongly urge you to contact Northeast Ohio EPA office in Twinsburg, Ohio at 330-425-9171 to obtain their professional opinion of the Alliance Water Treatment Plant.**

APPENDIX A

Ohio Environmental Protection Agency

Ted Strickland, Governor
Lee Fisher, Lt. Governor
Chris Korleski, Director

February 22, 2010

Dean Reynolds, Ph.D.
Superintendent, Department of Water Treatment
City of Alliance
12251 North Rockhill Avenue N.E..
Alliance, Ohio 44601

Dear Dr. Reynolds,

The following information is provided to you in response to our telephone conversation on 2/19/2010 regarding Ohio EPA's 2010 Integrated Water Quality Report. These two links will direct you to the 2010 Integrated Report webpage and specifically to the Public Drinking Water Supply (PDWS) beneficial use Section.
http://www.epa.ohio.gov/dsw/tmdl/2010IntReport/2010OhioIntegratedReport_draft.aspx
http://www.epa.ohio.gov/portals/35/tmdl/2010IntReport/Section%20H.pdf

The PDWS section describes how the assessments were completed for this beneficial use. I reviewed all of the data used for the Deer Creek Reservoir assessment and it appears the watch list determination was based on data collected in 2004 through the Syngenta Atrazine Monitoring Program. Our assessment methodology for the 2010 report states that we have to use data from the five year period from 2004 to 2008. I attached the Syngenta data in an excel file. Immunoassay (IA) results may be used but if GCMC or LCMS results were available they trumped the IA results. Due to elevated atrazine in the raw water the rolling quarterly average exceeded 3.0 ug/L for several months in 2004 and that triggered the "Watch List" designation.

Levels of atrazine in the raw water have been consistently low since 2004 and all of the finished water levels are near or below the detection limit. If current trends continue, it is likely that the watch list designation could be removed in the 2012 Integrated Reporting cycle. Keep in mind that the "Watch list" is a non-regulatory designation and only intended to help us prioritize future sampling and assessments. In this case, it is unfortunate that the results of the Integrated Report would be misused as a measure of the quality of finished water.

The assessment summary for unit 050301030201 that you referred to on the phone can also be found on our website via this link. http://wwwapp.epa.ohio.gov/dsw/ir2010/wau.php?hu=050301030201. After speaking with Paul Anderson (Ohio EPA, Division of Surface Water, NE District Office) on the phone today, I believe the attainment categories shown for this assessment unit apply to the watershed unit and not directly to Deer Creek Reservoir. As Paul mentioned in a previous email, Deer Creek Reservoir will be assessed later. Please contact Paul directly if you have any questions about aquatic life use impairments, causes of impairment or the lake assessment.

Please feel free to call me if you need further assistance.

Regards,
Amy

Amy Jo Klei (amyjo.klei@epa.state.oh.us)
Environmental Specialist
Ohio Environmental Protection Agency
Division of Drinking and Ground Waters, Water Quality Characterization and Protection Section
ph 614-644-2062 / fax 614-644-2909

50 West Town Street, Suite 700
P.O. Box 1049
Columbus, OH 43216-1049

614 | 644 3020
614 | 644 3184 (fax)
www.epa.ohio.gov

Ohio Environmental Protection Agency

Division of Surface Water

Inland Lakes Program Lake Snapshot

Deer Creek Reservoir

Stark County

www.epa.ohio.gov/dsw/inland_lakes/index.aspx

Lake Facts

Lake Area: 314 acres

Watershed Area:
37.1 square miles

Uses:
Drinking water supply and recreation

Designated Aquatic Life Use:
Warm Water Habitat

Main Impairments:
Public Water Supply: no impairments
Aquatic Life Use: nutrients, low dissolved oxygen, nuisance algae

Fun Fact:
Deer Creek Reservoir receives most of its water from Dale Walborn Reservoir. Stark Parks operates park facilities at both lakes www.starkparks.com.

This lake snapshot is only a summary. For more information about the quality of this lake, go to www.epa.ohio.gov/dsw/tmdl/MahoningRiverUpperTMDL.aspx or call (614) 644-2135.

Water Quality Summary

Support of Aquatic Life Uses:

- This lake experiences oxygen depletion in the summer, which limits the amount of available fish habitat.
- Nutrient enrichment from the watershed results in algae blooms.

Public Water Supply Use:

- The lake meets the standards for all chemical water quality criteria.
- Algae in the lake have caused taste and odor problems for the City of Alliance water system.

Recreational Contact

- Bacteria levels were well within the recreation standards.
- No restrictions for contact relating to boating and fishing.

Fish Consumption

- Ohio waters are under a state-wide fish consumption advisory for mercury.
- For more information about consuming fish from this lake, see the following web site:

http://www.epa.ohio.gov/dsw/ fishadvisory/index.aspx

March 2010

Love Your Lake – Keep it Clean and Healthy

Lake Impairments

Sampling by Ohio EPA found that all criteria for the Public Water Supply use are met in Deer Creek Reservoir. The following chart illustrates the major factors preventing this water body from supporting its designated use for aquatic life. The "result" indicates the value found in the water, while the "target" is the proposed standard for the lake water which Ohio EPA uses to determine whether the lake is considered impaired for that use.

Impairment	Result	Target
Chlorophyll a	31 parts per billion	14 parts per billion
Nitrogen	770 parts per billion	740 parts per billion
Dissolved Oxygen	35% of daily averages were less than 6 parts per million	Less than 10% of daily averages less than 6 parts per million

Pollution Sources and Cause for Concern

Impairments come from many sources and cause many problems. The following table lists major impairments, probable sources, and the problems they cause for the lake.

Impairment	Source	Problem
Low Dissolved Oxygen	• Nutrient enrichment • Decomposition of algae and organic matter (from leaves and runoff entering the lake) • Lack of water mixing	• May cause fish kills • May affect fish numbers and distribution. • Can contribute to algae blooms.
Nitrogen	• Untreated sewage • Agricultural runoff	• Contributes to algae blooms

For More Information

The Deer Creek watershed is included in the Upper Mahoning River watershed total maximum daily load study which is available online from the Web sites listed below.
Fishing information and a lake map can be accessed via the Ohio DNR web page:
http://www.dnr.state.oh.us/LinkClick.aspx?fileticket=8%2FQCvhnbPto%3D&tabid=20223
http://ohiodnr.com/tabid/4414/Default.aspx

How Can I Help?

Minimize nutrient laden runoff from lawns, farm fields and septic tanks. Local contacts:
Dr. Dean Reynolds, City of Alliance reynoldsda@allianceoh.gov (330) 829-2241
Darrin Petko, Stark Parks dpetko@starkparks.com (330) 477-3552

Related Web Sites

www.epa.ohio.gov/dsw/tmdl/monitoring_MahoningRiverUpper.aspx
www.epa.ohio.gov/dsw/tmdl/MahoningRiverUpperTMDL.aspx
www.epa.ohio.gov/dsw/nps/index.aspx
www.epa.ohio.gov/dsw/inland_lakes/index.aspx

Division of Surface Water Watershed Assessment Unit Summary

Overview Information

Click to view a glossary of terms

Assessment Unit Name: Deer Creek
Hydrologic Unit Code: 05030103 02 01
Assessment Unit Size: 37.6 square miles
Priority Points: 8
Monitoring Scheduled: 2022
TMDL Scheduled: 2010

Land Use Statistics:

Developed	Forest	Grass/Pasture	Row Crops	Other
7.5%	31.1%	26.8%	32.8%	1.9%

Aquatic Life Use Assessment

Map data ©2010 Google -

Reporting Category: 5
Aquatic Life Uses: WWH
Sampling Years: 2006
Watershed Score: 0.0

Assessment Details:

Headwater Sites <20 sq. mi.	Wading Sites >20 & <50 sq. mi.	Principal Sites >50 & <500 sq. mi.
Sites Assessed: 0	Sites Assessed: 2	Sites Assessed: 0
Sites Attaining: 0	Sites Attaining: 0	Sites Attaining: 0

Most Recent Data:

Year Assessed	Station Name	River Mile	Drainage Area	Aquatic Life Use	Attainment Status
2006	DEER CK @ MCCALLUM RD	4.48	27.9	WWH	Partial
2006	DEER CK @ ATWATER RD	2.90	30.1	WWH	Partial

Causes of Impairment:

- nutrient/eutrophication biological indicators
- other flow regime alterations

Sources of Impairment:

- upstream impoundment

Comments: None

Recreation Use Assessment

Reporting Category: 5
Assessment Unit Score: 67

Assessment Details:

Geometric Mean of *E. Coli* Samples (colony forming units/100ml)

Station ID	Station Name	Rec. Use Class	2004	2005	2006	2007	2008
300025	DEER CK @ ATWATER RD	B			485		
N01K10	DEER CK @ MCCALLUM RD	B			61		
N01K12	DEER CK @ WATERLOO RD	B			506		

Public Drinking Water Supply Assessment

Reporting Category: 1
Cause of Impairment: None
Nitrate Watch List: No
Pesticide Watch List: Yes

Fish Tissue Assessment

Reporting Category: 5
Causes of Impairment: PCBs
PCB Concentration: 54 ppb

Division of Surface Water Glossary for 2010 Integrated Report Assessments

General Information

HUC12: The U.S. Geological Survey designated 12-digit hydrologic unit code for Ohio's 1,538 watershed assessment units (WAUs).

WAU/LRAU/Lake Erie AU Description: A geographic description of the watershed, large river, or Lake Erie assessment units.

WAU/LRAU Size: The watershed drainage area of the assessment unit in square miles.

Integrated Report Assessment Category: One of five categories assigned to indicate the status of designated uses. The categories and their definitions are as follows.

Category[1]		Subcategory	
0	No waters currently utilized for water supply		
1	Use attaining	h	Historical data
		x	Retained from 2008 IR
2	Not applicable in new (2010) Ohio system		
3	Use attainment unknown	h	Historical data
		i	Insufficient data
		x	Retained from 2008 IR
4	Impaired; TMDL not needed	A	TMDL complete
		B	Other required control measures will result in attainment of use
		C	Not a pollutant
		h	Historical data
		n	Natural causes and sources
		x	Retained from 2008 IR
5	Impaired; TMDL needed	M	Mercury
		h	Historical data
		x	Retained from 2008 IR

[1]Shading indicates categories defined by U.S. EPA; additional categories and subcategories are defined by Ohio EPA.

Priority Points: A number between 1 and 20, calculated if any of the use assessment categories is 5 (or the assessment unit is not impaired but is on the nitrate and/or pesticide watch lists for public drinking water supply). Otherwise, blank. See Section J2 for an explanation of how the points are determined.

Next Scheduled Monitoring: The year in which Ohio EPA expects to revisit the assessment unit for comprehensive monitoring.

Aquatic Life Use (ALU) Assessment

See Section G for a detailed explanation of the assessment process

Subcategories of ALU: The designated aquatic life uses as codified in the Ohio Water Quality Standards - EWH (Exceptional Warmwater Habitat), WWH (Warmwater Habitat), CWH (Coldwater Habitat), MWH-C (Modified Warmwater Habitat-Channelized), MWH-MD (Modified Warmwater Habitat-Mine Drainage), MWH-I (Modified Warmwater Habitat-Impounded), LRW/LRW-S (Limited Resource Water), LWH/WWH-L (Limited Warmwater Habitat), SSH (Seasonal Salmonid Habitat).

Sampling Years: Years with data available for specific streams and rivers within the assessment unit that were used to assess status of the designated aquatic life use(s).

Impairment: Yes (Reporting Categories 4 or 5), No (Reporting Category 1), or Unknown (Reporting Category 3) depending on the assessment of the available sampling locations and their designated aquatic life use.

Data Assessment Summary (WAUs): Available site data from the assessment unit are grouped according to 3 stream size categories (headwater, wading, and principal) based on drainage area in square miles at the sampling location. The Watershed Score is generated based on the proportion of sampling locations which are in full attainment of the designated aquatic life use in each size category. The full attainment proportions of the headwater and wading categories are averaged to compute an intermediate WAU score. This number is then averaged with the principal full attainment proportion to derive the overall Watershed Score. This weighting method is used to impart more significance to sites in the largest drainage class (principal streams).

Data Assessment Summary (LRAUs and Lake Erie AUs): Attainment statistics (Miles in Full, Partial, or Non-Attainment) were generated based on a linear extrapolation of full, partial, or non-attaining miles to the total number of monitored river miles (for LRAUs) or the proportion of shoreline sampling sites in full, partial, or non-attainment for the Lake Erie AUs. The Assessment Unit Score is the proportion of monitored miles (LRAUs) or sites (Lake Erie AUs) in full attainment of the designated aquatic life use.

Causes of Impairment: The listing of the most prominent "agents" deemed responsible for the observed aquatic life use impairment in the assessment unit if in Reporting Category 4 or 5 and which will be the initial focus of restoration activities or TMDL development within the watershed. None Listed if the assessment unit is unassessed (Reporting Category 3 or the aquatic life uses are unimpaired (Reporting Category 1).

Sources of Impairment: The listing of the most prominent origins of the "agents" (causes of impairment) deemed responsible for the observed aquatic life use impairment.

Recreation Use Assessment (WAUs and LRAUs)

See Section F for a detailed explanation of the assessment process

Subcategories of Recreation Use: "Primary Contact" refers to waters that are suitable for full-body contact recreation, such as swimming, canoeing and diving during the recreation season. There are three classes of primary contact recreation ranging from Class A, which support frequent recreation, Class B, which support occasional recreation activity, to Class C, which support infrequent recreation activity. "Secondary Contact" are those waters that are rarely used for recreation because of limited access and generally having physical limitations that would limit water ingestion potential associated with recreation.

Impairment: Yes, No, or Unknown depending on the assessment of the available data from sampling locations within the assessment unit.

Geometric Mean: The geometric mean of all available E. coli bacteria data collected from a specific location and collected within the same recreation season, computed as the arithmetic mean of the log-transformed data.

Public Drinking Water Supply (PDWS) Use Assessment

See Section H for a detailed explanation of the assessment process

PDWS Use Designations and PWS: The Public Drinking Water Supply (PDWS) beneficial use only applies within 500 yards of active drinking water intakes, all publicly owned lakes, all privately owned lakes and reservoirs used as a source of public drinking water, and all surface waters used as emergency water supplied. All current PDWS use zones were described and the associated public water systems identified as [PWS Name]. Only waters with active PWS intakes were assessed at this time.

Overall PDWS Use Support: This determination (Yes/No/Unknown) was based on all assessment results from all PDWS zones in the AU. In order to be considered in overall Full Support (Yes), sufficient data were required for assessment of at least the nitrate indicator at all PDWS zones in the AU. In order for each indicator status to be considered "Full Support," sufficient data were required for all PDWS zones within the AU. Pesticide information was included when sufficient data were available. If any zones were identified as "Impaired" for any indicator, it would trigger an overall status of "Not Support."

Watch list: In addition to assessment of impairment status, water quality data were evaluated at each zone to identify waters in need of additional monitoring. These trigger points are more conservative than the water quality criteria used for the impairment determinations. Waters with at least one nitrate detection > 8 mg/L or pesticide levels > 3X the WQC (instantaneous) or quarterly pesticide average > annual average criteria were identified on the watch list.

Human Health (Fish Tissue) Use Assessment

See Section E for a detailed explanation of the assessment process

Results of comparing fish tissue contaminant data to the single route exposure human health water quality criteria in Ohio's Water Quality Standards.

Reporting Category: See "Integrated Report Assessment Category" table at the beginning of this document for an explanation of reporting categories used in the human health/fish tissue use assessment.

Causes of Impairment: Mean fish tissue concentrations of PCBs, mercury, DDT, hexachlorobenzene, chlordane, and mirex were evaluated for each assessment unit where data were available. If any of the listed contaminants exceeded the mean concentration in fish tissue on which the single route exposure human health water quality criterion is based, that assessment unit was considered impaired for that contaminant.

Contaminant Concentration: Mean concentration in fish tissue of the contaminant(s) for which the assessment unit is impaired. Impairment concentration thresholds for each contaminant are listed in Table x.x of this document.

APPENDIX B

FIGURE 1: Atrazine concentration in Alliance's finished water for the years 2005 through 2009. All samples collected since 9/13/06 have tested below the minimum detectable limit of 0.3 µg/L. The MCL is 3 µg/L.

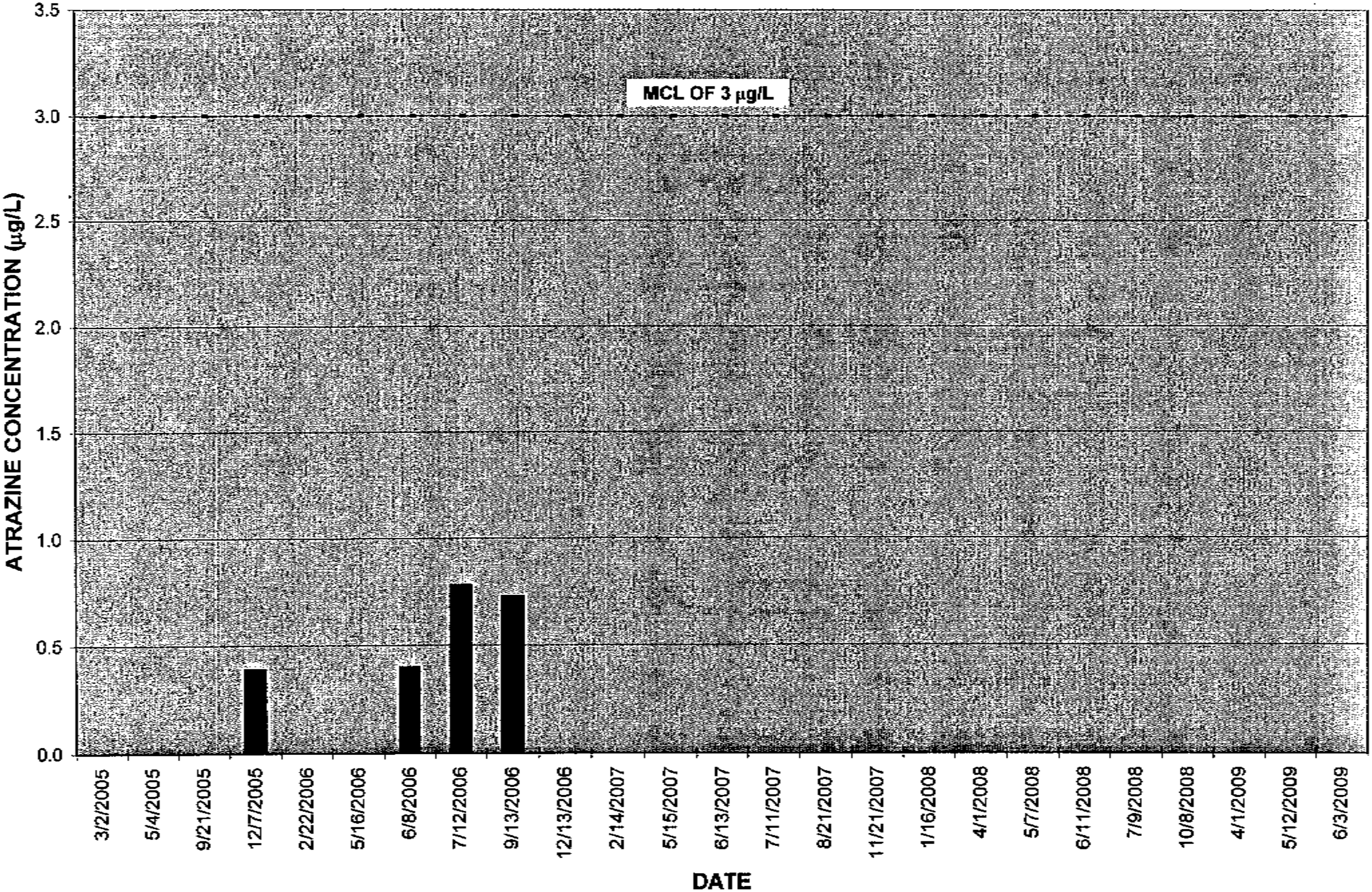


FIGURE 2: Barium concentration in Alliance's finished water for the years 2005 through 2009. Barium is included in the inorganic contaminants analyses and is sampled once per year. The MCL is 2.0 mg/L.

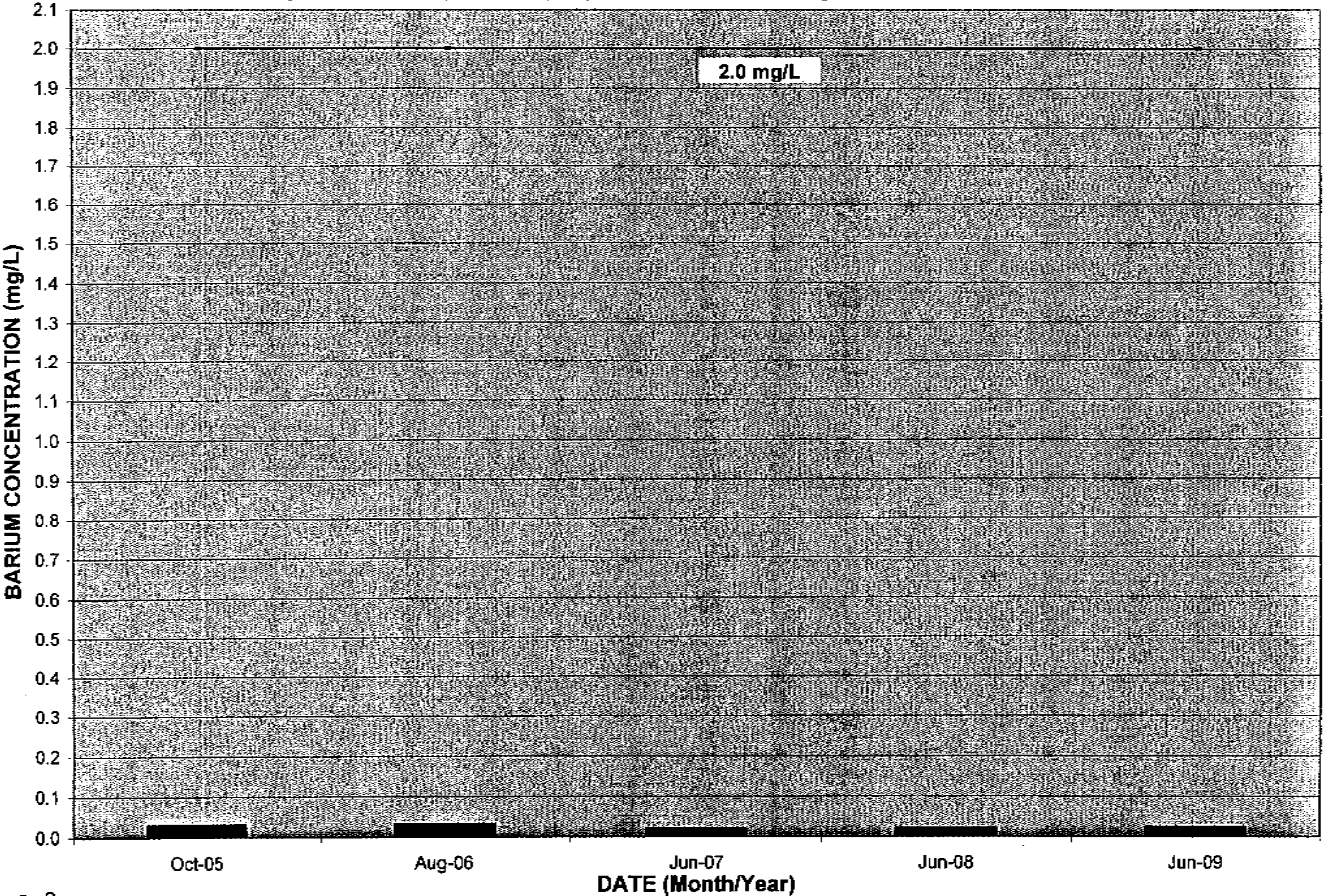


FIGURE 3: Average monthly chlorine concentration in Alliance's finished water for the years 2005 through 2009. The minimum allowable chlorine concentration is 0.2 mg/L at any place in the distribution system. The MCL is 4.0 mg/L.

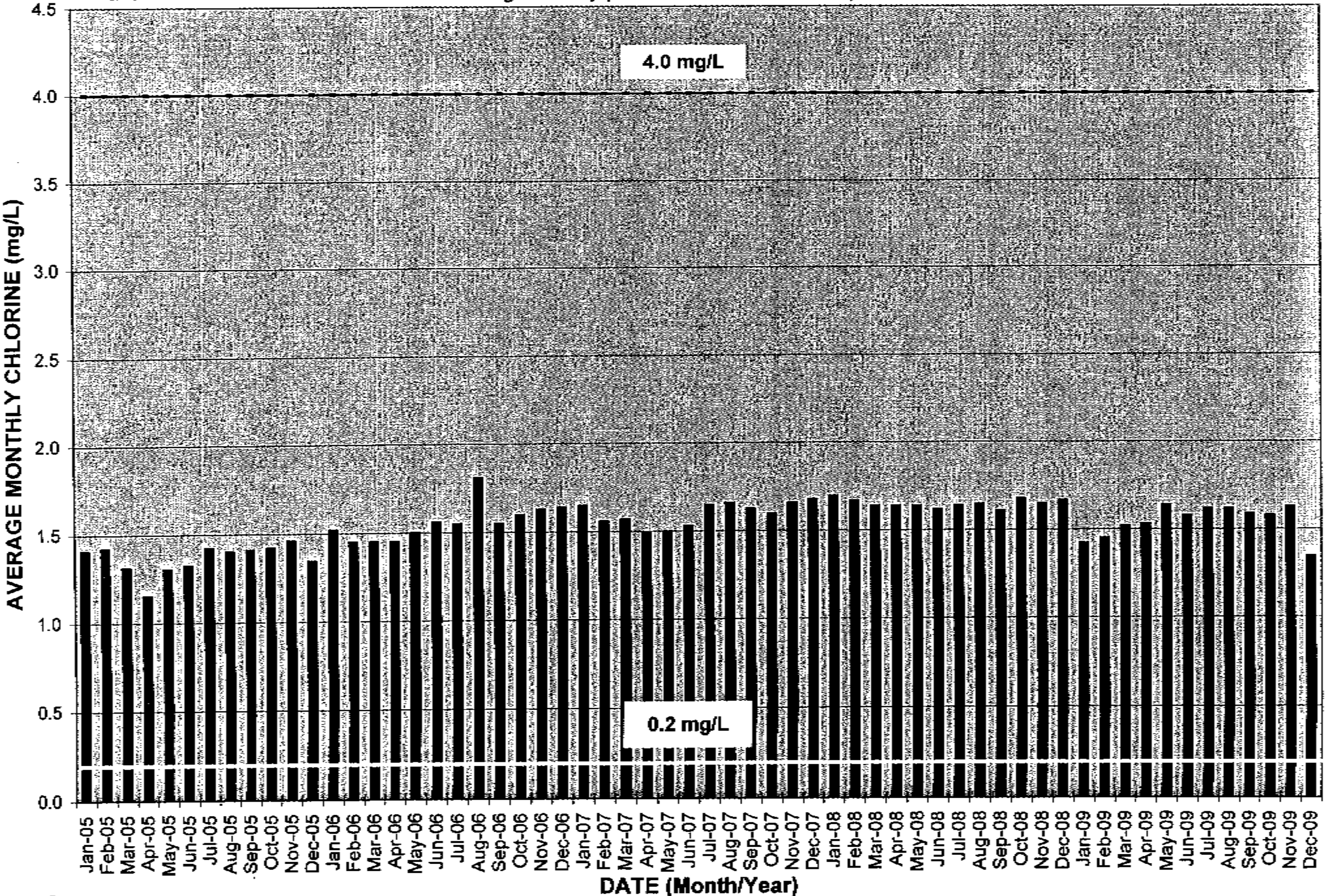


FIGURE 4: Minimum monthly chlorine concentration in Alliance's finished water for the years 2005 through 2009. The minimum allowable chlorine concentration is 0.2 mg/L at any place in the distribution system. The MCL is 4.0 mg/L.

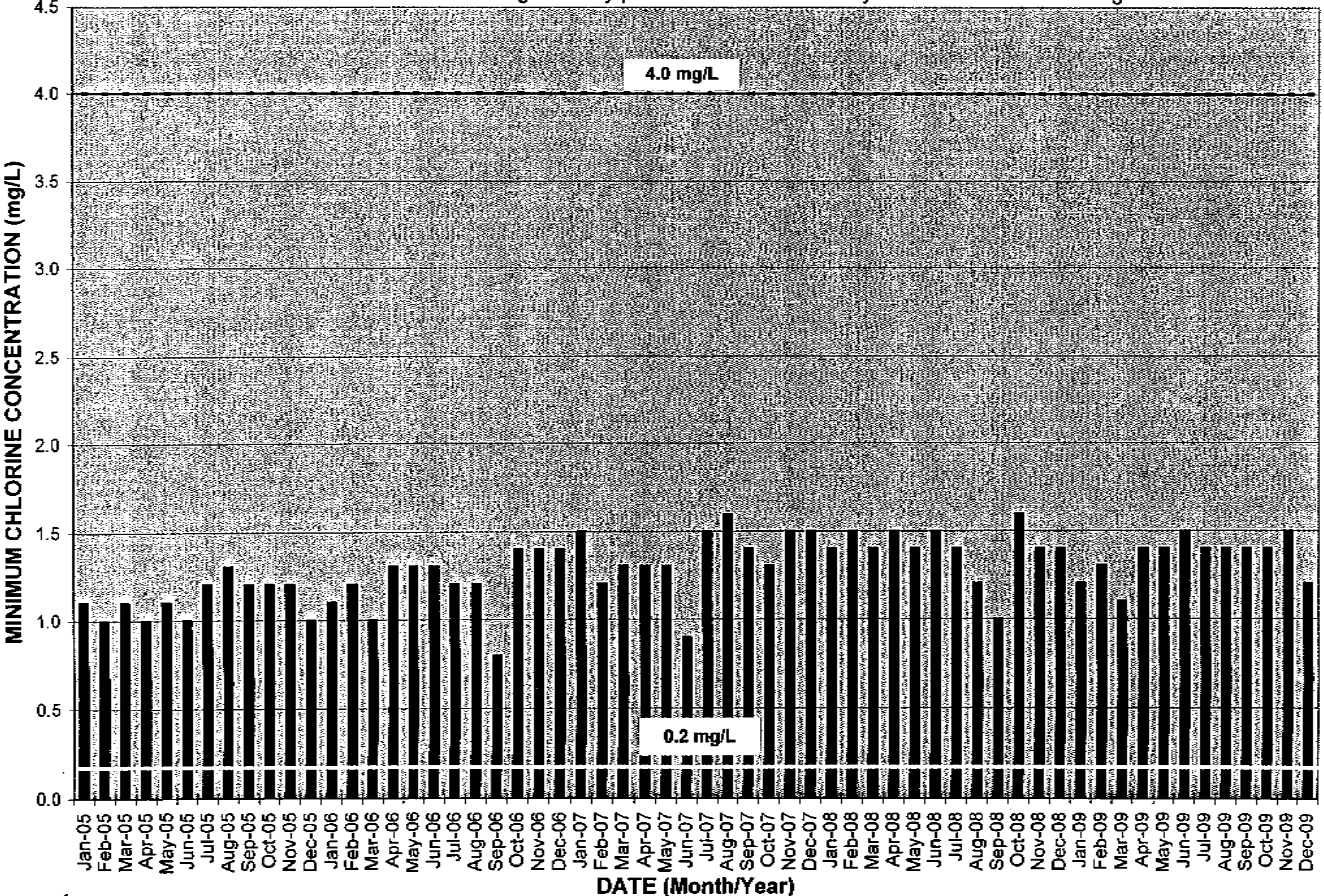


FIGURE 5: Maximum monthly chlorine concentration in Alliance's finished water for the years 2005 through 2009. The minimum allowable chlorine concentration is 0.2 mg/L at any place in the distribution system. The MCL is 4.0 mg/L.

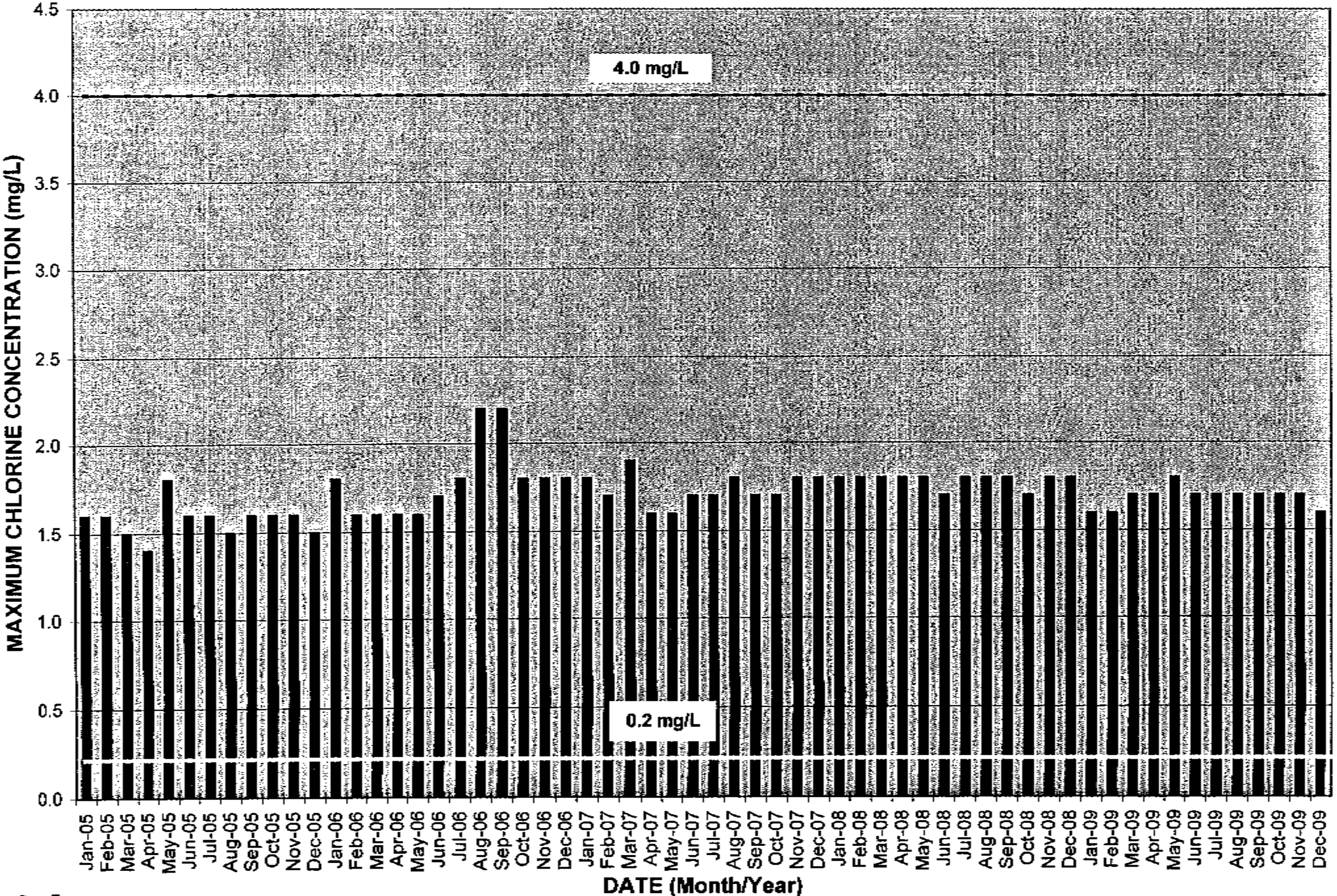


FIGURE 6: Average monthly chlorine dioxide concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 0.8 mg/L.

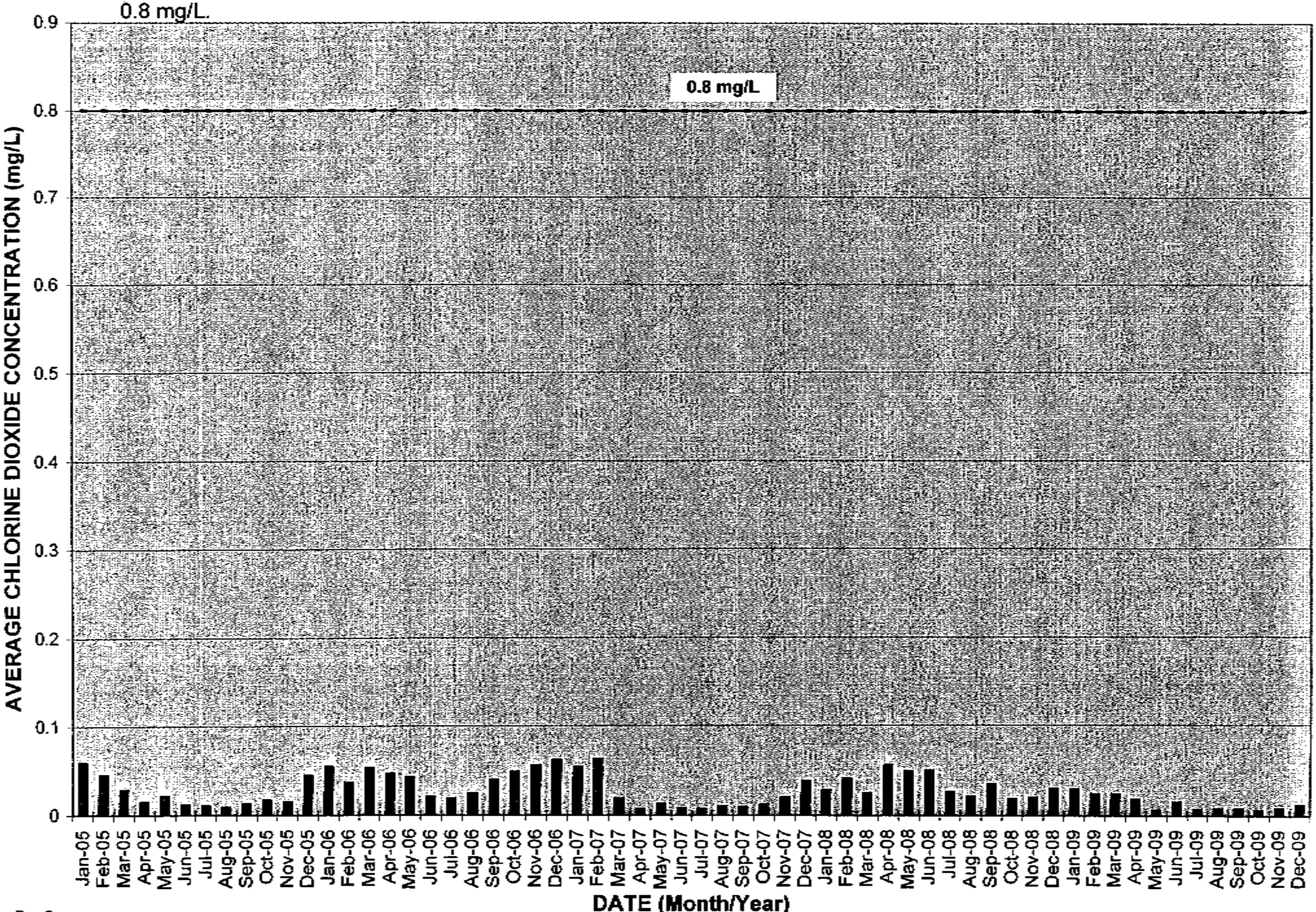


FIGURE 7: Maximum monthly chlorine dioxide concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 0.8 mg/L.

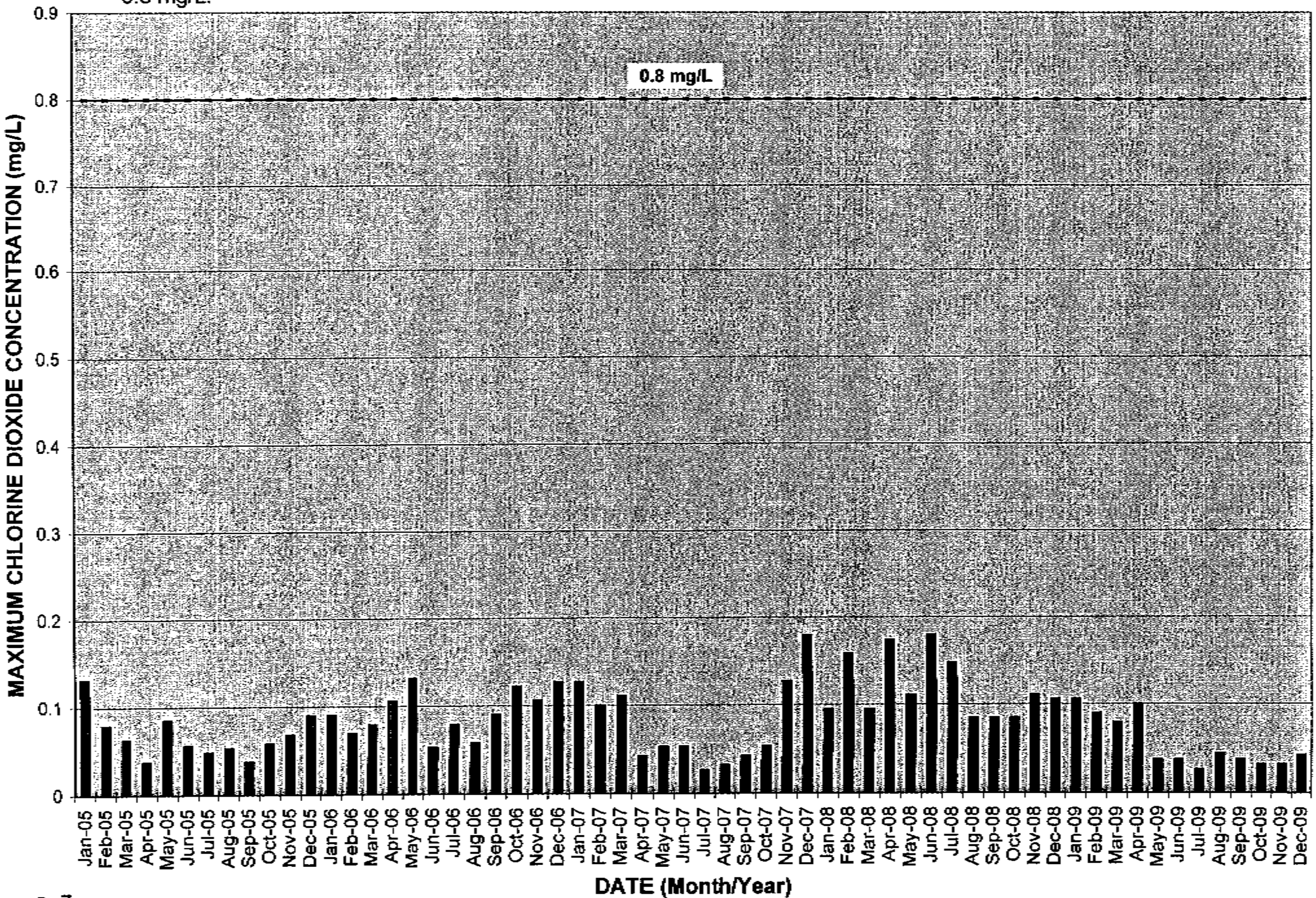


FIGURE 8: Minimum monthly chlorine dioxide concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 0.8 mg/L.

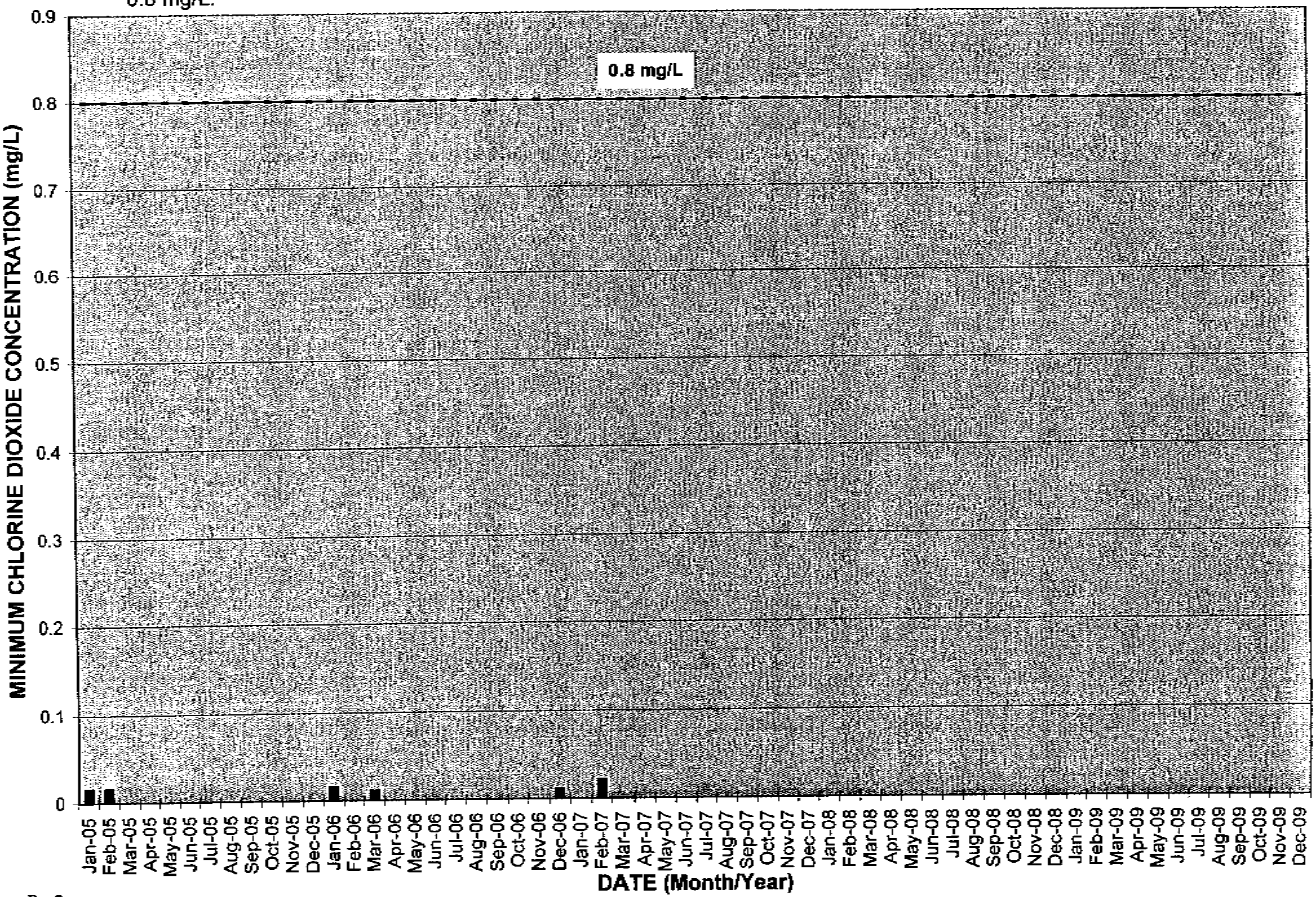


FIGURE 9 : Average monthly chlorite concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 1.0 mg/L.

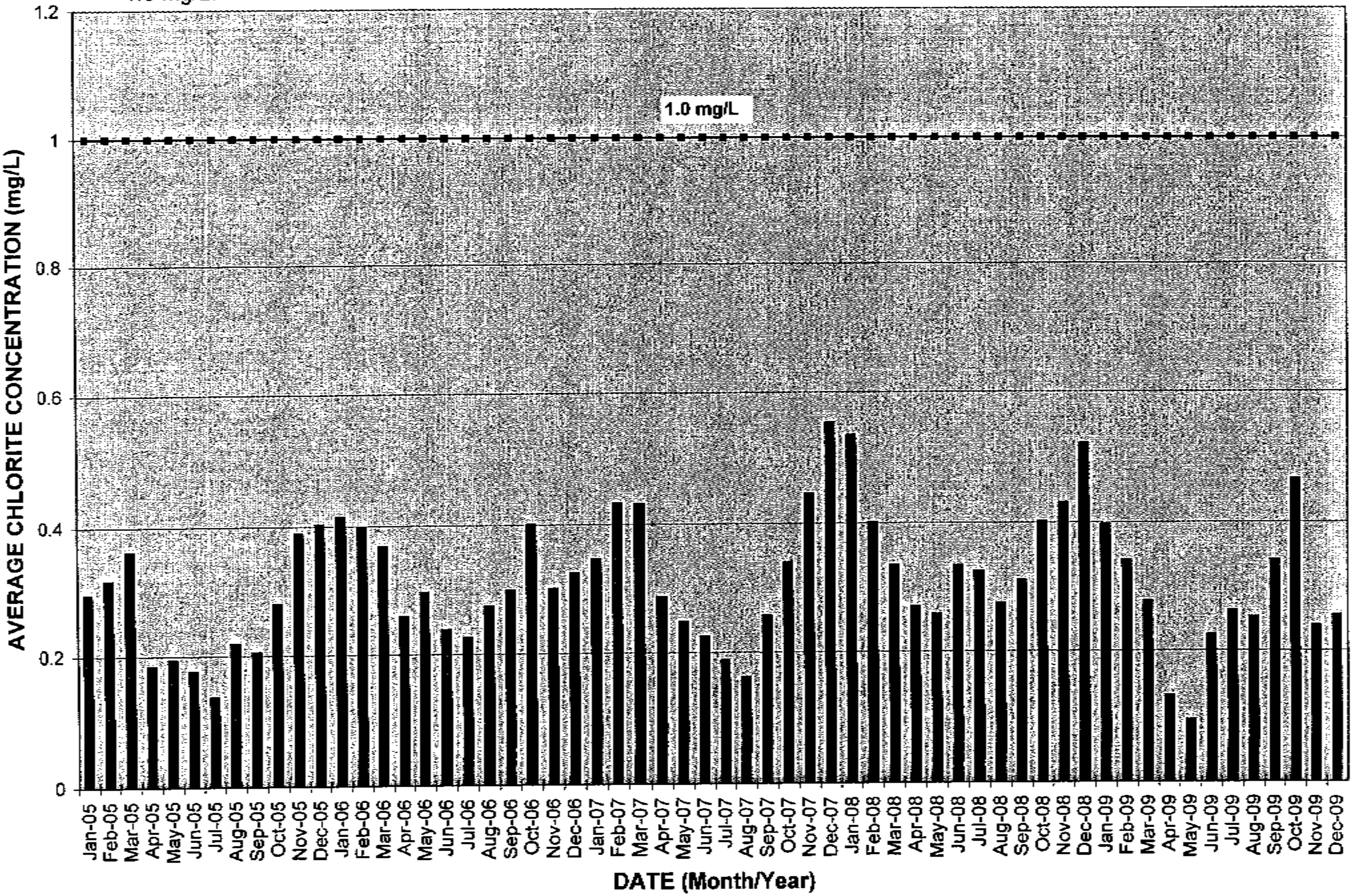


FIGURE: 10: Minimum monthly chlorite concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 1.0 mg/L.

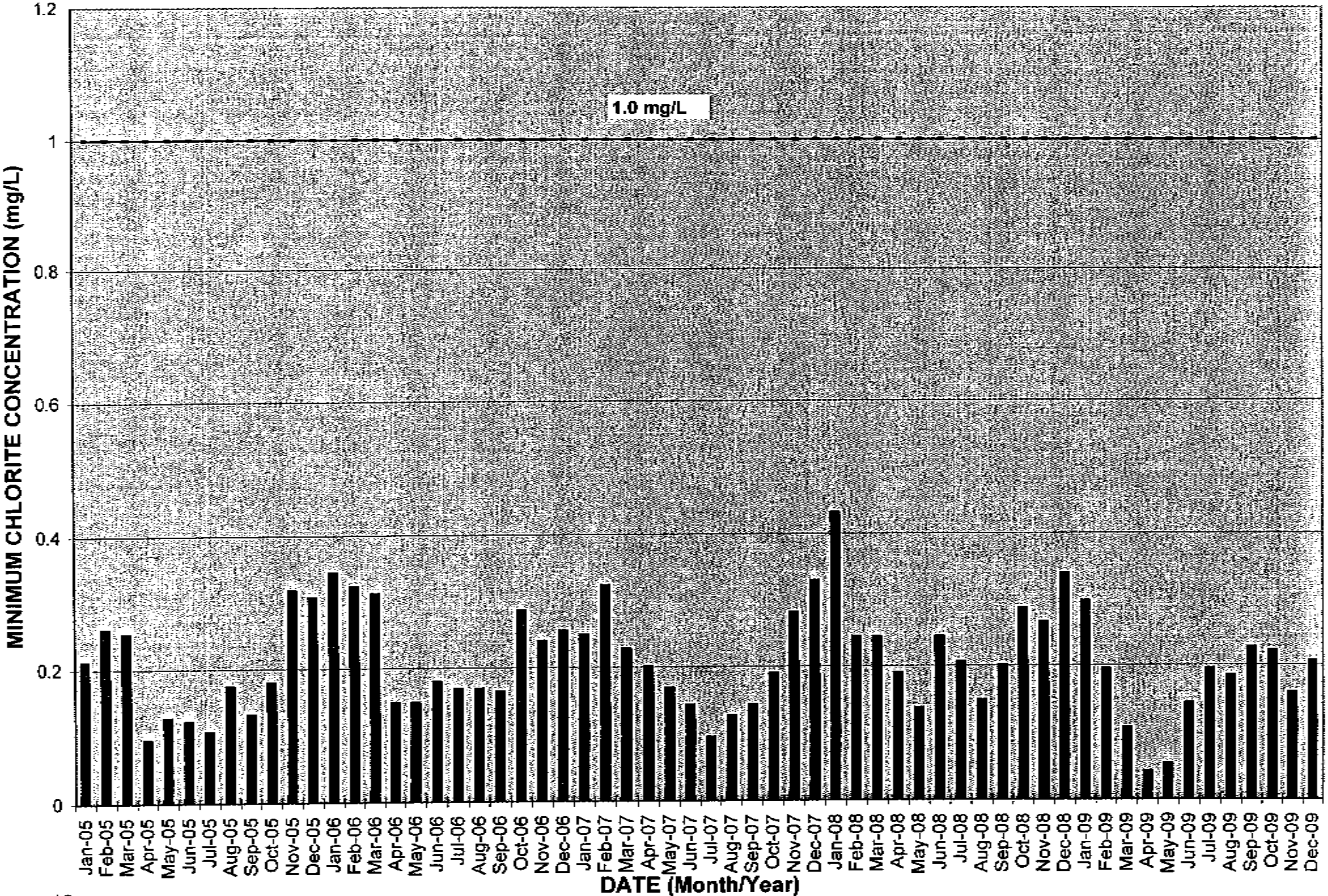


FIGURE 11: Maximum monthly chlorite concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 1.0 mg/L.

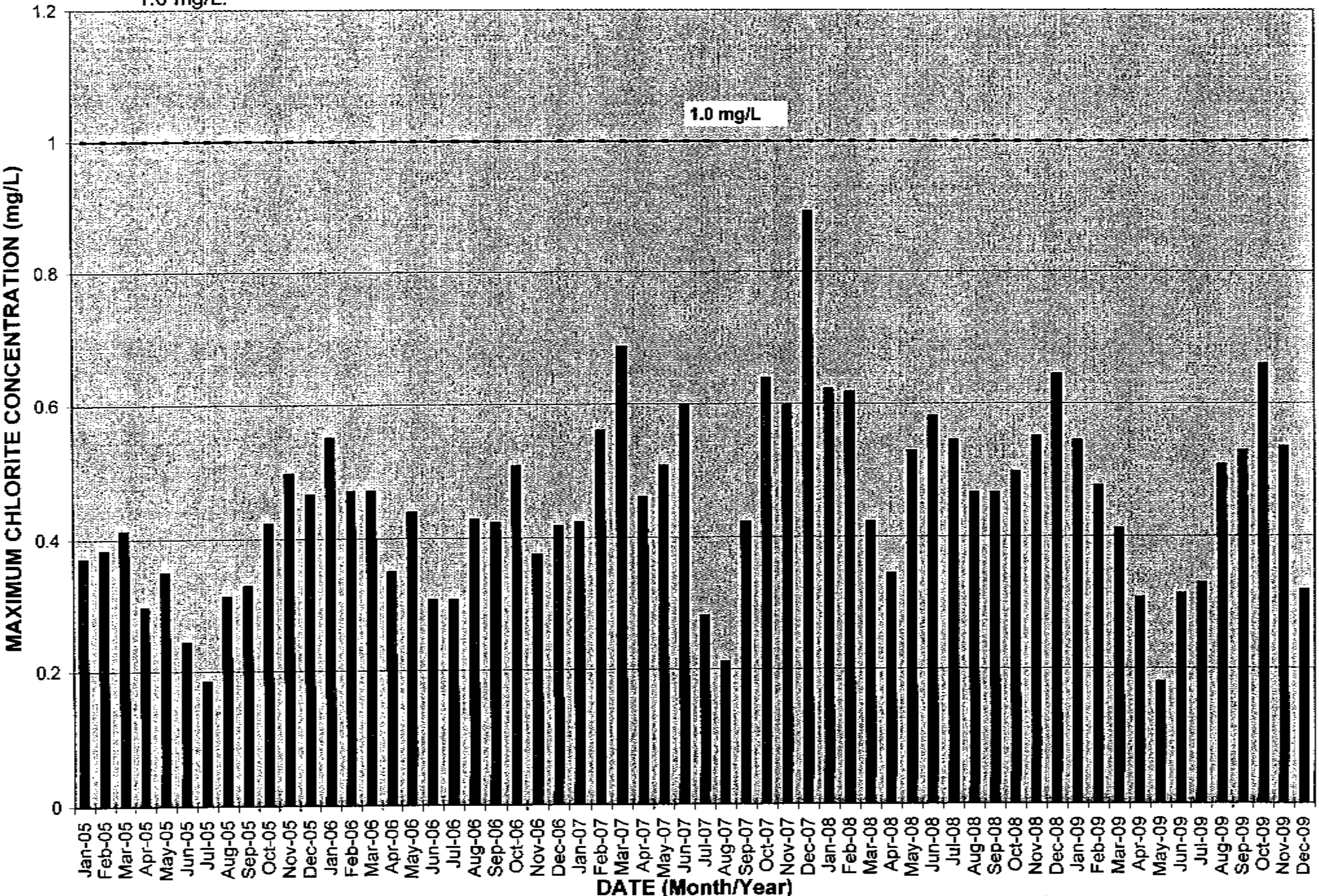


FIGURE 12: Average monthly fluoride concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 4.0 mg/L.

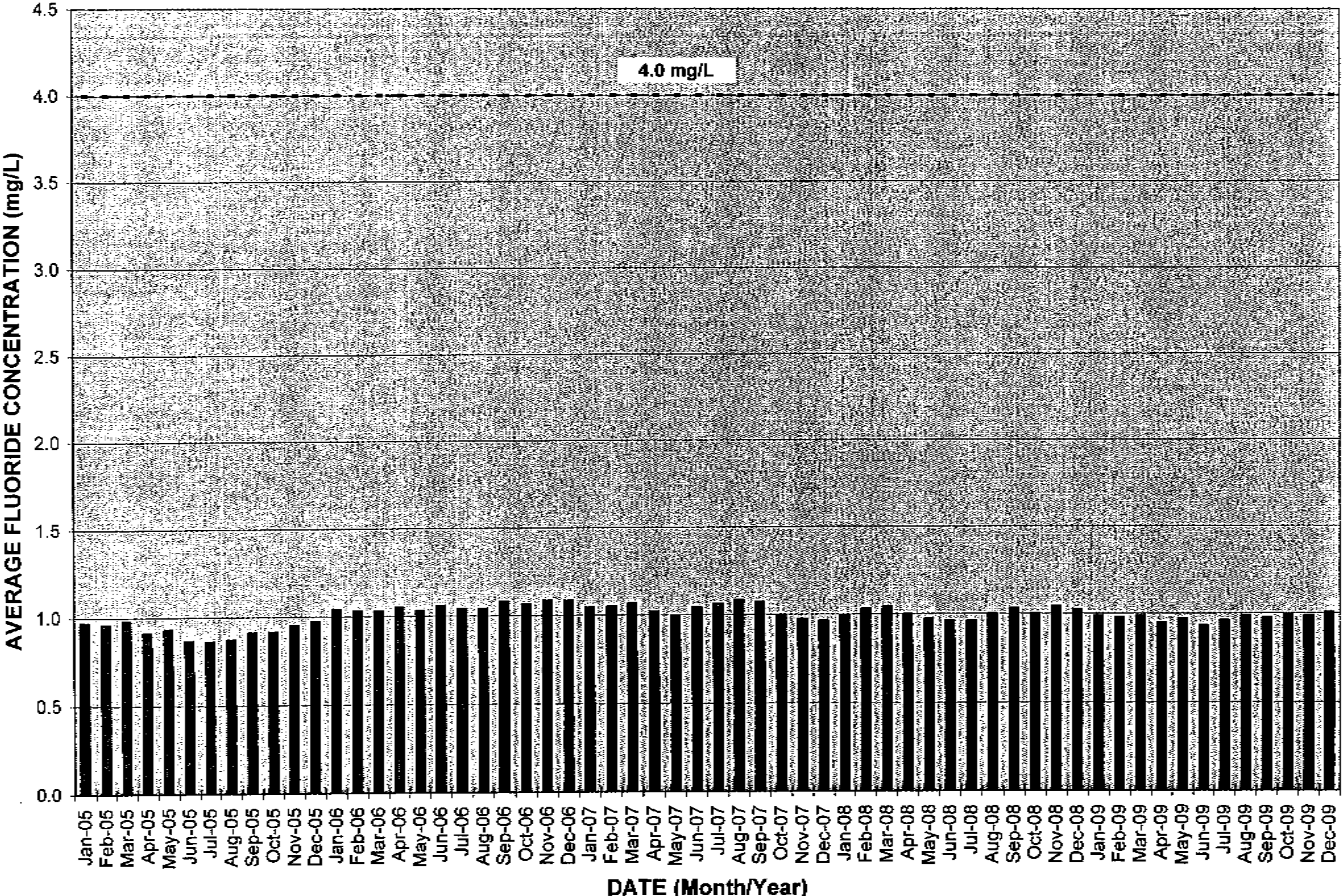


FIGURE 13: Minimum monthly fluoride concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 4.0 mg/L.

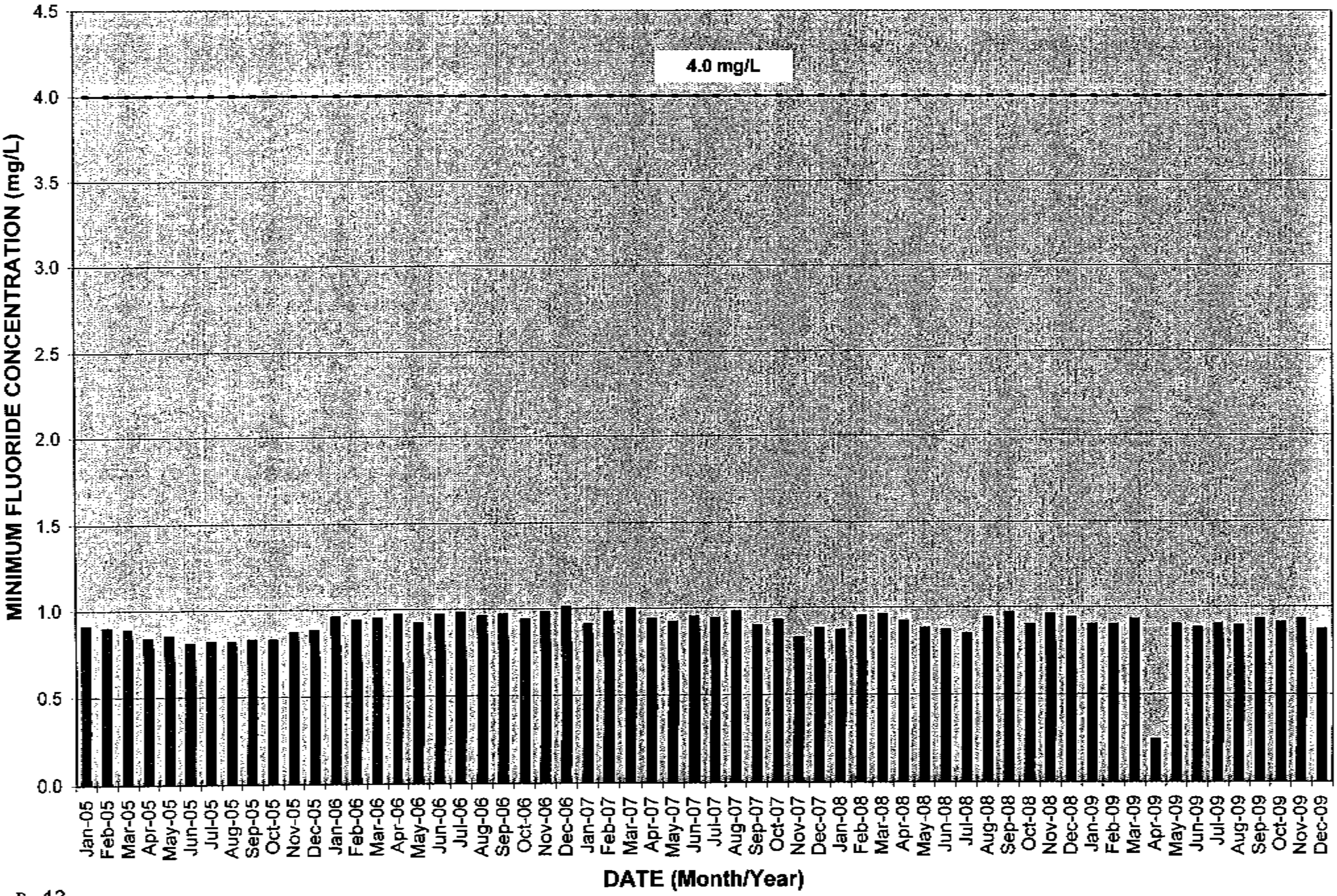


FIGURE 14: Maximum monthly fluoride concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 4.0 mg/L.

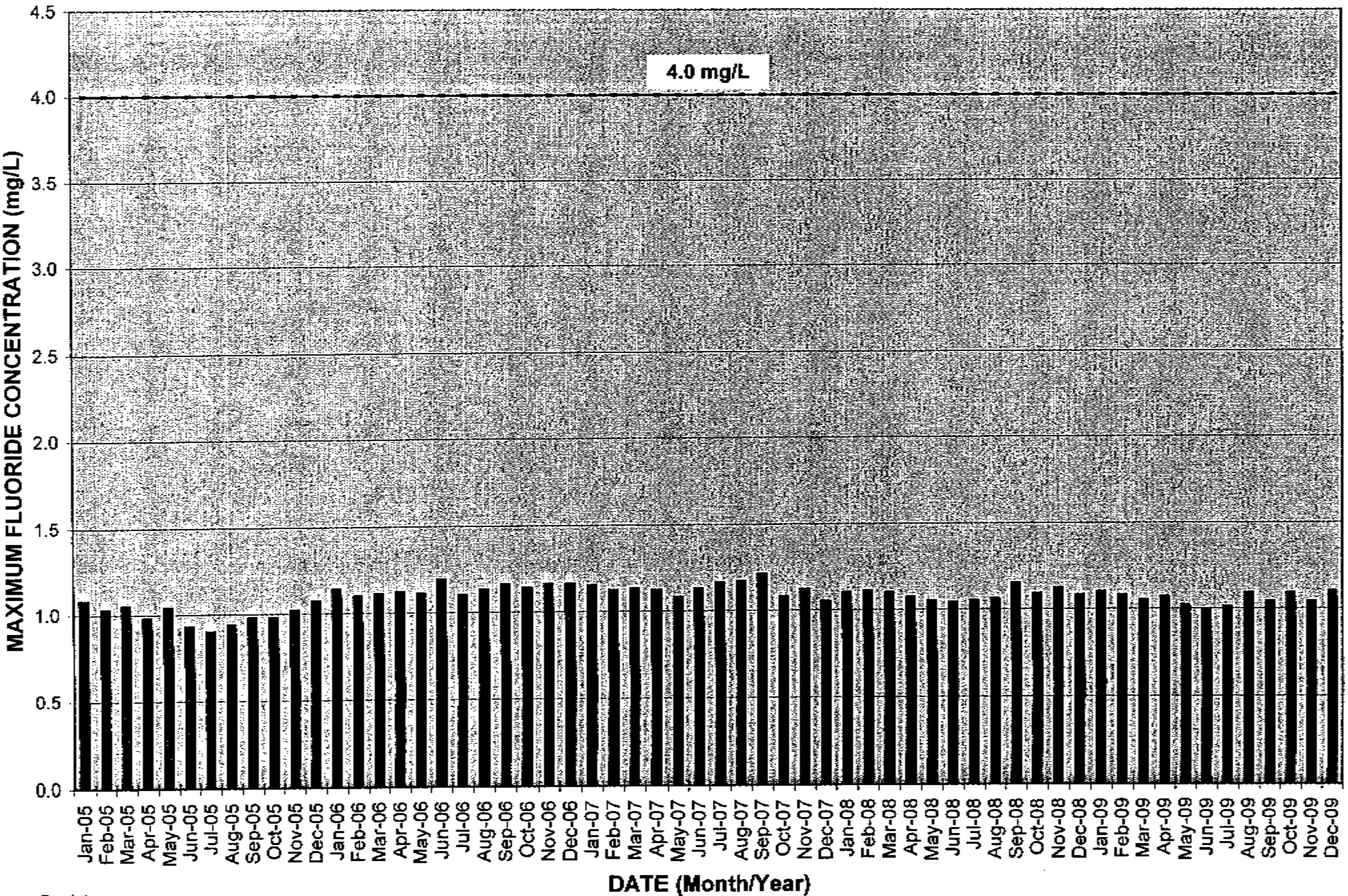


FIGURE 15: Total haloacetic acid (HAA5) concentration in Alliance's finished water 2005 through 2009. Samples are collected once per quarter. The MCL is 60 µg/L.

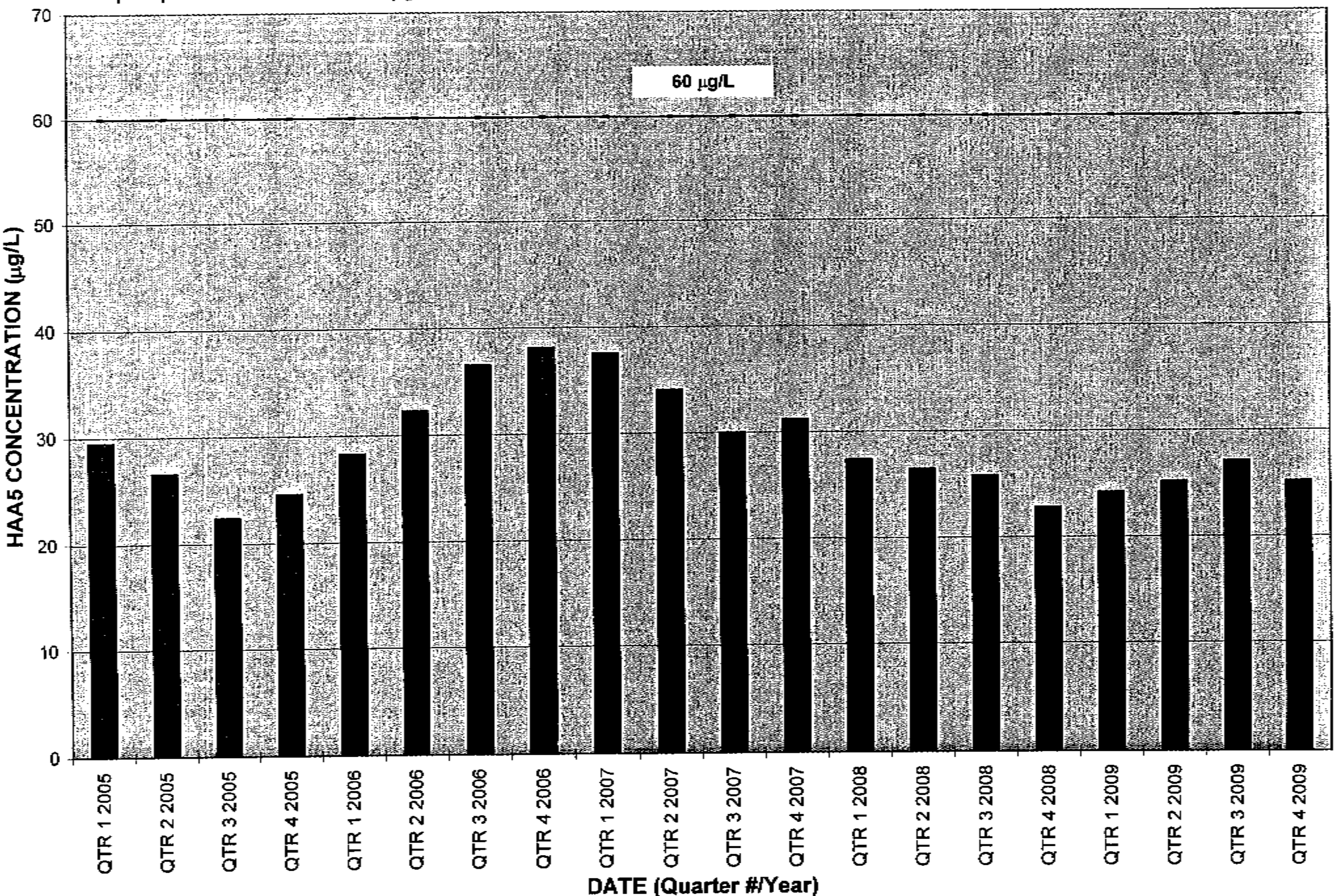


FIGURE 16: Nitrate concentration in Alliance's finished water for the years 2005 through 2009. The MCL is 10.0 mg/L.

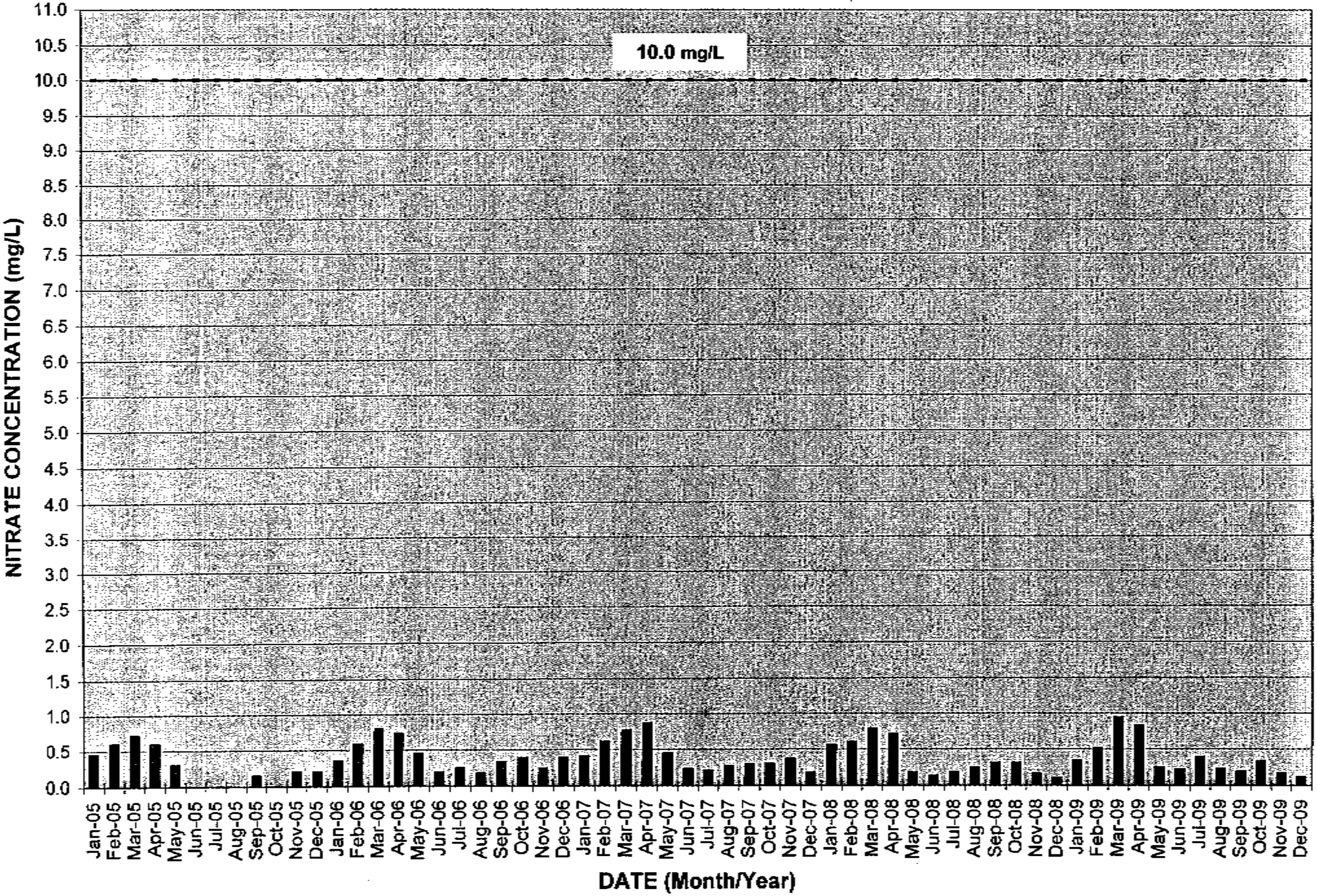


FIGURE 17: Comparison of total organic carbon (TOC) removal, actual percent removed versus percent removal required, in Alliance's finished water for the years 2005 through 2009.

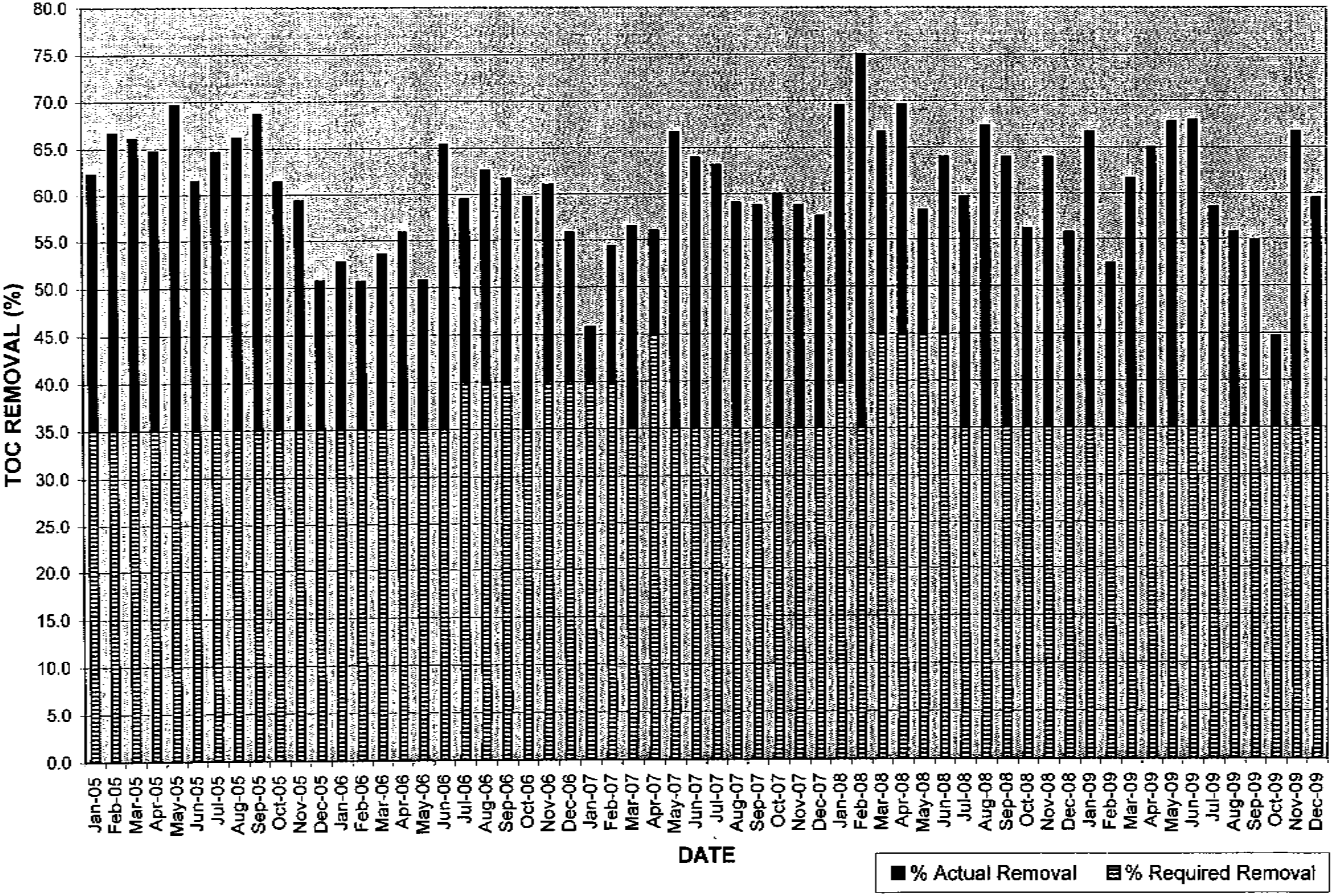


FIGURE 18: Total organic carbon (TOC) in Alliance's finished water for the years 2005 through 2009 measured in mg/L.

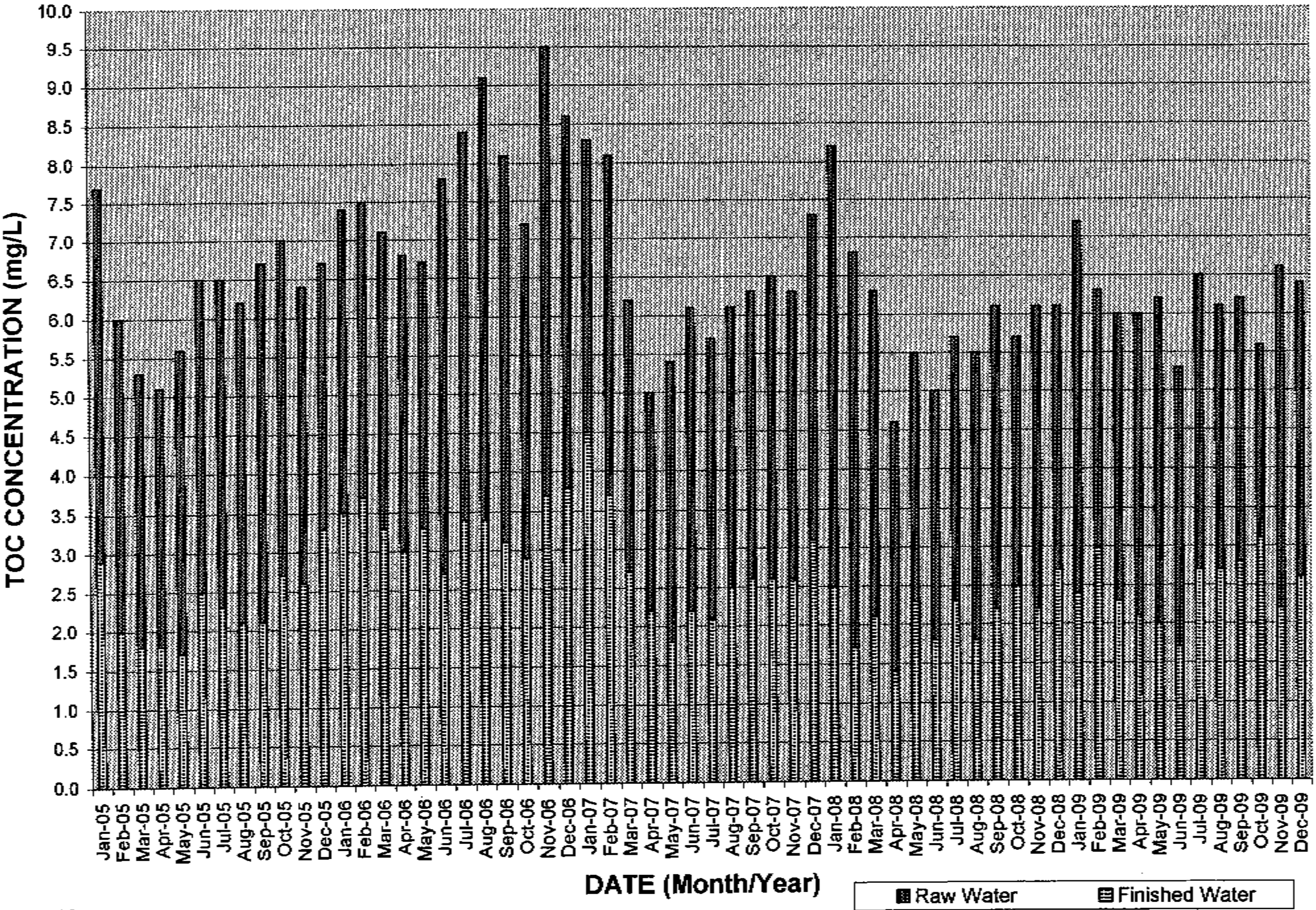


FIGURE 19: Total trihalomethane concentration (TTHM) in Alliance's finished water for the years 2005 through 2009. Samples are collected once per quarter. The MCL is 80 μg/L.

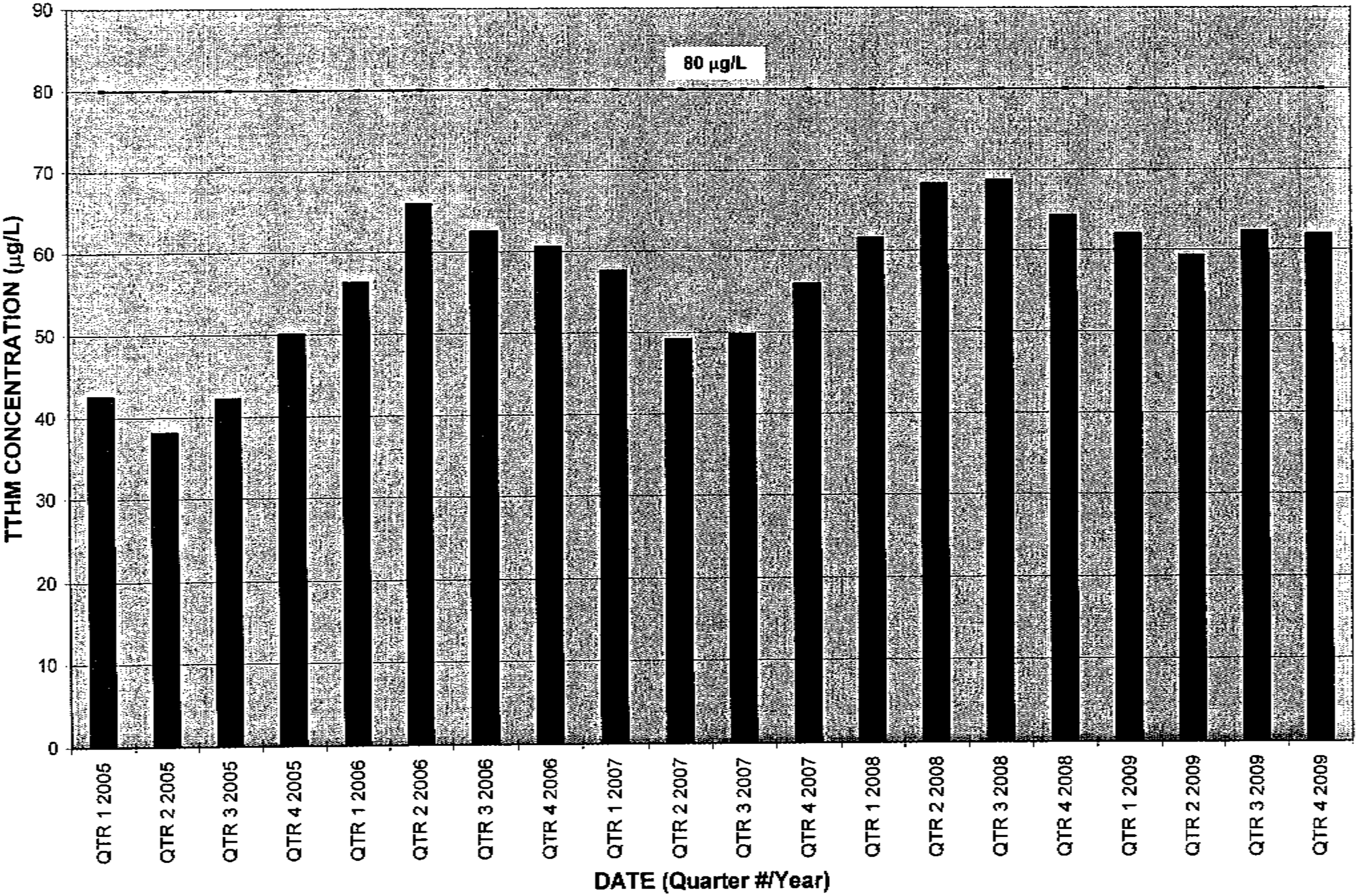


FIGURE 20: Average monthly turbidity in Alliance's finished water for the years 2005 through 2009. The MCL for turbidity is 0.5 NTU, in 2 consecutive readings, taken 15 minutes apart.

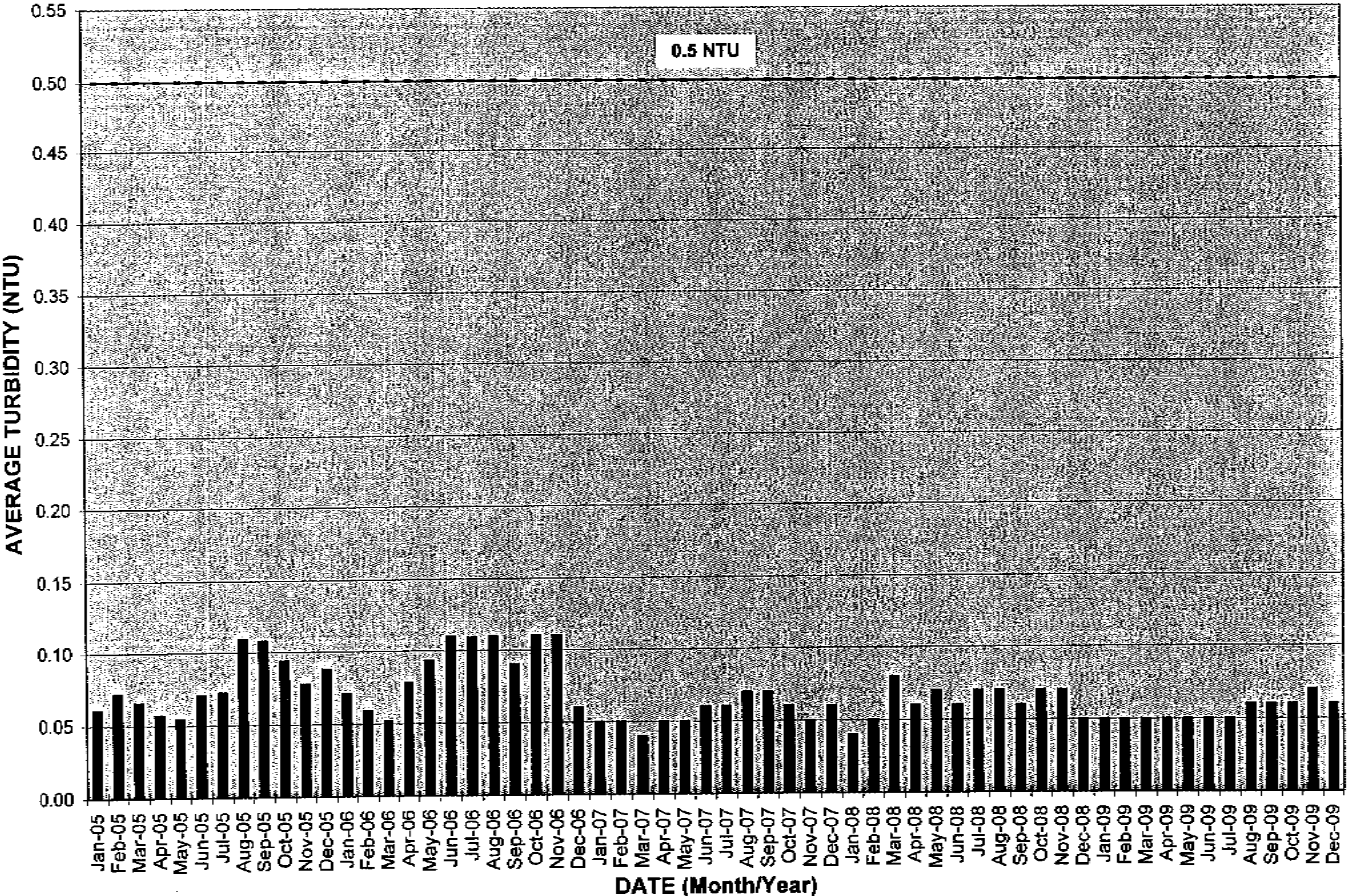


FIGURE 21: Minimum monthly turbidity in Alliance's finished water for the years 2005 through 2009. The MCL for turbidity is 0.5 NTU, in 2 consecutive readings, taken 15 minutes apart.

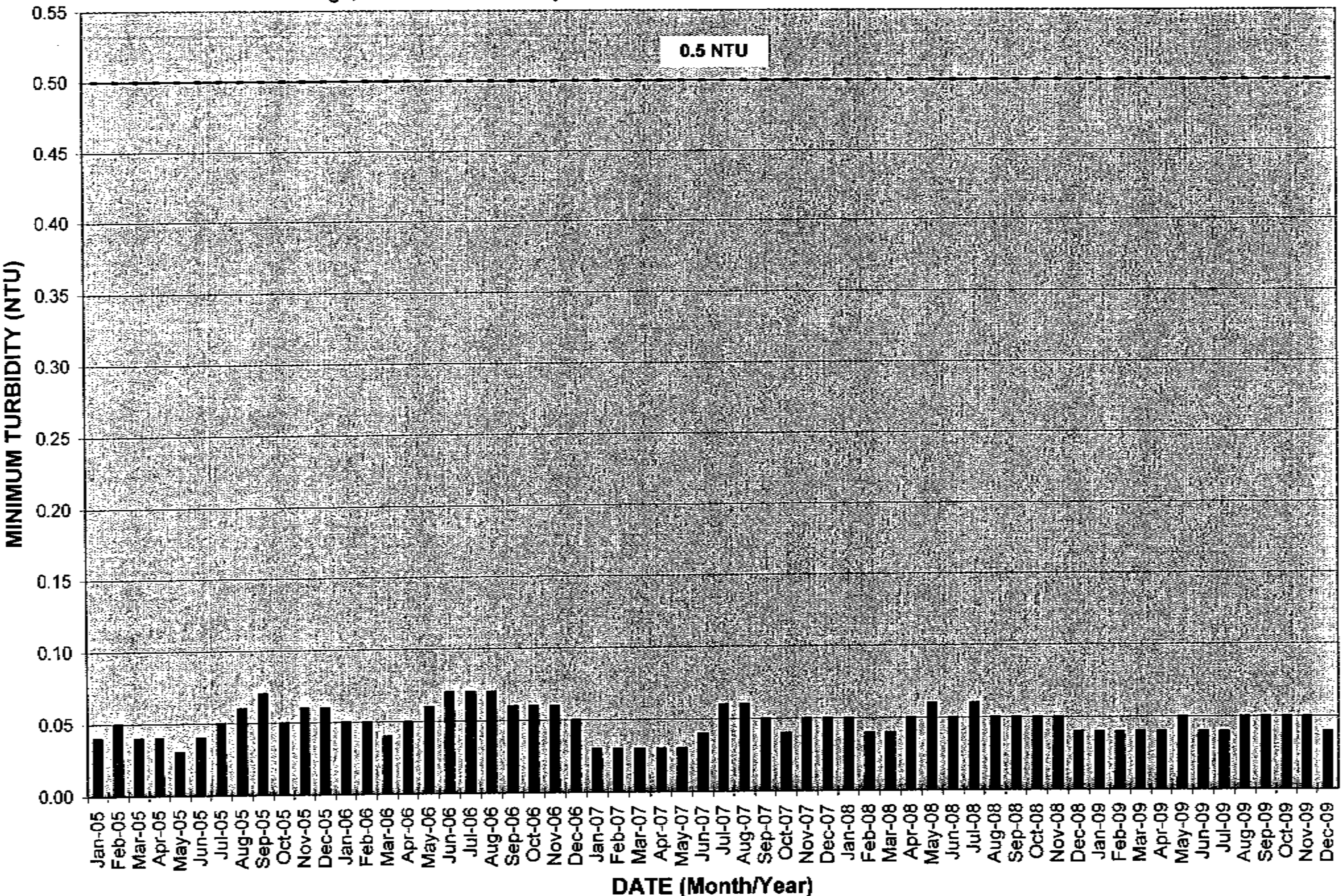
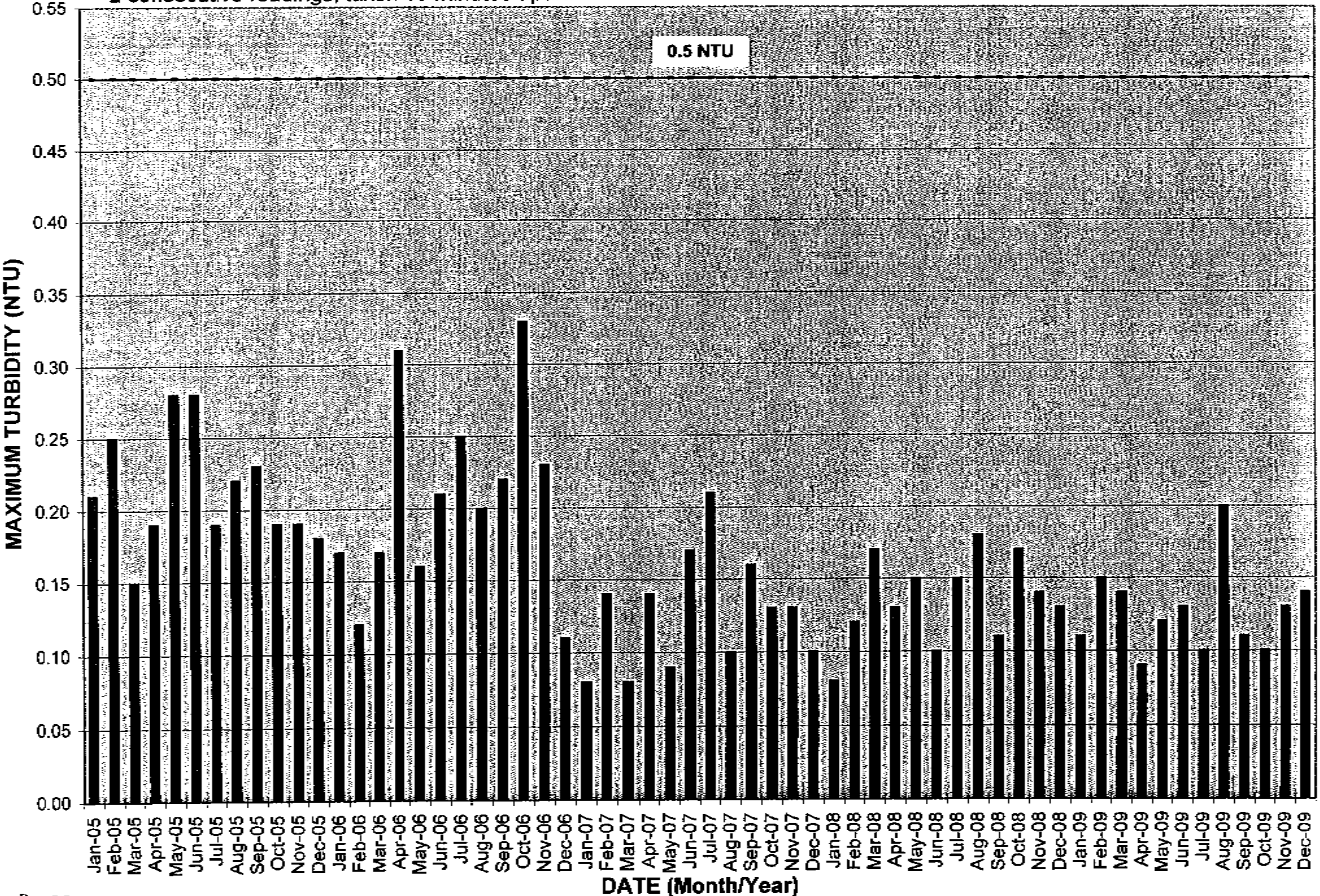


FIGURE 22: Maximum monthly turbidity in Alliance's finished water for the years 2005 through 2009. The MCL for turbidity is 0.5 NTU, in 2 consecutive readings, taken 15 minutes apart.



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