

ILLINOIS POLLUTION CONTROL BOARD
July 11, 1985

CITY OF AURORA,)
)
 Petitioner,)
)
 v.) PCB 85-51
)
 ILLINOIS ENVIRONMENTAL)
 PROTECTION AGENCY,)
)
 Respondent.)

MICHAEL WEINSTEIN, CITY ATTORNEY, APPEARED ON BEHALF OF PETITIONER; AND

WAYNE WIEMERSLAGE APPEARED ON BEHALF OF RESPONDENT.

OPINION AND ORDER OF THE BOARD (by J. Anderson):

This matter comes before the Board on the April 16, 1985 petition filed by the City of Aurora (City) for a five year variance from the 5 pCi/l radium 226 and radium 228 drinking water standard contained in 35 Ill. Adm. Code 604.301(a). The purpose of the request is to eliminate the effects of "restricted status", which in this case is a determination by the Illinois Environmental Protection Agency (Agency) that the City's public water supply is delivering finished water containing combined radium in excess of the 5 pCi/l state and federal standards. Pursuant to Board regulation, the Agency may not issue permits for new water main extensions to a public water supply which violates the drinking water standard. See 35 Ill. Adm. Code 602.105 and 602.106.

The Recommendation of the Agency filed May 15, 1985 and amended June 25, 1985, is that variance with conditions should be granted. However, the Agency believes variance should be granted, not from the radium standard, but from 35 Ill. Adm. Code 602.105 precluding Agency permit issuance. On May 28, 1985, the City filed a response to the Agency Recommendation indicating basic agreement with the conditions suggested, but disagreement with variance from the permit issuance rule rather than from the radium standard.

Various citizens filed objections to the grant of variance. As explained in some detail in the Board's Order of May 30, 1985, incorporated herein by reference, although some of the objections were untimely, the Board determined that the public interest would be best served by setting this matter for hearing. Hearing was therefore held in this matter on June 25, 1985 at the Aurora City Hall, some 35 members of the public being in attendance.

Prior to discussing the hearing, recitation of various facts contained in the petition and the Agency Recommendation is in order. The City of Aurora, located in Kane and DuPage Counties, provides public services, including potable water supply and distribution, for 22,857 residential and 1,112 industrial and commercial utility customers representing approximately 85,000 residents and approximately 40,000 employees (as of March, 1985).

The City's public water distribution system includes 12 deep wells and 1 shallow well, pumps and distribution facilities, and 1,682,650 feet (318.7 miles) of various sizes of water mains, ranging from 1 inch to 24 inches in diameter. The deep wells (No. 8, 12A, 15, 16, 17, 18, 19, 20, 21, 23, and 25) currently range in depth from 1400 feet to 2251; the City plans to drill another deep well (No. 24) in late 1985 or early 1986 to serve the Butterfield Subdivision. The shallow well, No. 101 is 116 feet deep. All wells discharge directly into the distribution system, with the exception of Wells 12A and 22. Well No. 12A pumps into a reservoir and Well No. 22 can be used to pump into a reservoir or into the system. The City operates two booster stations and three overhead towers to obtain sufficient pressure in the system. Total water production was 3,816 million gallons in 1984, approximately 318 million gallons per month.

The City was first advised of the excessive combined radium content of its water by an Agency letter dated January 25, 1984, reporting a radium-226 content of 7.3 pCi/l and a radium-228 content of 2.2 pCi/l; this is slightly in excess of twice the 5 pCi/l allowed combined concentration. Thereafter, the City took samples from ten of its deep wells and distribution system, as well as from two shallow wells and the Fox River (none of which are connected to the City's distribution system). The analyses of these samples, which were performed by the Argonne National Laboratory, indicate for the deep wells an average radium 226 concentration of 6.40 pCi/l and an average radium-228 concentration of 7.54 pCi/l. The radium concentrations for the shallow well and river samples were negligible. These samples were submitted to the Agency for its review. By letter of October 29, 1984, the Agency advised the City that its water supply was being placed on restricted status, as those samples verified that the radiological quality of the City's water had not changed since the taking of the earlier samples, and the water continued to be out of compliance with the standards.

The City presently does not treat its water to control radium content. It has identified four possible control strategies. The first would be to develop a shallow well field whose waters could be blended with those of the deep wells. This would involve drilling of new shallow wells for use in addition to existing Well 101, acquisition of property and construction of necessary facilities. The City estimates that time for full implementation of this option would be between 42 and 60 months, with capital expenditures amounting to \$9.75 million dollars.

The second option would be to develop the Fox River as a water supply. The research and engineering data for this alternative would require approximately twenty-four (24) months at a cost of \$500,000. Substantial additional time and money expenditures would then be required for construction of treatment facilities were this alternative chosen, just as for implementation of the third option.

This third option would be construction of treatment facilities in order to properly treat all water supplies. This would require construction of a treatment plant as well as connection to the existing water distribution system. Cost could range up to \$30-40 million, and could take up to 60 months to totally implement.

The fourth option would be to utilize Petitioner's Lake Michigan water allocation which would replace water presently supplied by deep wells. Petitioner's Lake Michigan allocation is effective 1990 and is as follows: 1990: 14.49 million gallons per day (mgd); 2000: 19.51 million gallons per day (mgd); 2010: 21.01 million gallons per day (mgd); 2020: 21.45 million gallons per day (mgd).

Possible costs are unknown at the present time but are projected to be in excess of the previous option. Time for completion would be in excess of 60 months.

At this time, the City leans towards the first option, development of shallow wells for use in a blending program at a ratio of 1 part shallow well water to 3 parts deep well water. However, the City has not committed to any option, having plans to retain outside consultant(s) to assist in reviewing and evaluating results from data which has already been obtained from the State Geological Survey (R. Gilkeson), a well driller (Layne-Western), and the State Water Survey (Adrienne Visocky), for resolving the present situation. The City anticipates a 12 month period of time will be needed to accomplish this task.

The City asserts that denial of variance would impose an arbitrary or unreasonable hardship, because of the effective stoppage of construction in the area. More particularly, construction has been unable to proceed on a 368 acre industrial park to be known as Fox Valley Corporate Village, to be developed by Aurora Ventures, and which is expected to bring 5,900 jobs to the Aurora area. The City asserts that there are also a number of other developments which will require construction permits in the near future, including three new strip shopping centers to be built at a total cost of approximately \$15,000,000, the Fox Valley Retirement Center (total cost approximately \$10,000,000); and Phase II of CMD's Meridian Business Campus (total cost approximately \$15,000,000). Additionally, several major landowner-developers have already submitted, or are in the process of submitting, construction permit applications for the extension of water mains.

The City alleges that denial of variance would also be arbitrary or unreasonable, given its past efforts and expenditures to develop an adequate and safe supply of water for Aurora's present and projected needs. Chronologically, these have included:

- (a) A study completed in 1971-72, performed by Crawford, Murphy & Tilly, Consulting Engineers and the Illinois State Water Survey, concerning Shallow Water Supply.
- (b) The City's request in 1980 for a Lake Michigan Water Allocation from the Illinois Department of Transportation; an allocation, beginning in 1990, was subsequently awarded. In 1982, the City became a member of the DuPage Water Commission. Assessed costs of membership were approximately \$20,000.00. (The City resigned from its membership in early 1983.)
- (c) In 1982, a study was completed by Black and Veatch, Consulting Engineers, concerning the possible use of the Fox River as a suitable water supply source.
- (d) The City, along with Kane County and other Kane County municipalities, conducted a study in 1980 - 1982, concerning the feasibility of groundwater as a possible water supply source.
- (e) Since 1983, the City has actively participated, along with Kane County and other Kane County municipalities, in a shallow aquifer study being conducted by the State of Illinois. The University of Illinois, in conjunction with the Illinois State Geological Survey and the Illinois State Water Survey, is in charge of this study. The City's proportional share of Phase One of said study has been approximately \$40,000.00.
- (f) The City has now begun a test well program in order to confirm the initial positive findings of the shallow aquifer study. The city council, on April 2, 1985, authorized the expenditure of \$3,350.00 for a 130 foot, 4 inch pilot hole. An additional request for \$19,475.00, which is needed to complete the first test well, was pending before the city council at the time of filing of the petition, with passage expected on April 16, 1985. (Hearing testimony does not specifically indicate whether this expenditure was authorized, although it was stated the City "had a test well scheduled." See R. 71-72.)

The petition presented little information concerning the health effects on the City's consumers as a result of continued

consumption of the City's excess-radium-bearing waters for an additional five years. However, this issue was extensively addressed at hearing; Richard E. Toohey, Ph.D., measurements group leader for the Center for Human Radiobiology of Argonne National Laboratory, presented scientific testimony supporting his professional opinion that "there will be no adverse health risk" to Aurora's water consumers if a five year variance is granted (City Exh. 2, p.6, R. 15-35). Using slides as a visual aid for the hearing participants, Dr. Toohey explained that the data concerning actual, as opposed to assumed, effects of the internal consumption of radium, is derived from observation of some 3500 persons who have worked with radium in the United States, mostly by painting luminous watch dials in the 1920's or aircraft instruments in the 1940's. Additional information concerning retention of radium in the body was obtained from medical experiments in the 1930's seeking to establish a therapeutic use for radium in the treatment of mental patients. Based on observations of the radium workers, Dr. Toohey noted that the lowest intake of radium to cause tumors (bone cancers and head carcinomas) is 10 uCi*, an intake which could be achieved by drinking 2 liters of water containing 5 pCi/l of radium (the drinking water standard) every day for 13,000 years. Consumption of water containing 5 pCi/l of radium for a lifetime, however, results in an intake of 0.06 uCi of radium, a level at which no health effects were observed in the radium workers.

Dr. Toohey then noted that, in setting drinking water standards, that certain conservative assumptions are made, assumptions which he emphasized are not to be taken as scientific facts. These assumptions are that

- 1) "there is no "safe" level of radium intake; that is, any intake, no matter how small, has a certain probability of causing cancer and
- 2) the probability of a low dose causing cancer is linearly proportional to the dose; that is, if the probability that an intake of 1000 uCi will cause cancer is x, then the probability that an intake of 100 uCi will cause cancer is 0.1 x, that 1 uCi will cause cancer is 0.001 x, and so on. Together, these two assumptions are known as the linear no-threshold model." (City Exh. 2, p. 2-3)

Using such a model, USEPA originally derived a risk factor of about 100 excess cancers from drinking water at the 5 pCi/l level. However, using a linear no-threshold model to analyze the

*The unit used for radium intake is uCi. One uCi is one-millionth of a Curie, or one-millionth of a gram of radium. (One picoCurie, pCi, is one-millionth of a uCi or one-trillionth of a Curie.)

observed radium data yields a risk factor of not 100, but 42 excess bone cancers and head carcinomas per lifetime per million; USEPA has recently revised its calculations to give a risk factor of 44 per lifetime per million, although different types of cancers are predicted. Assuming, then, that the 100 cancers per lifetime per million figure originally arrived at by USEPA is the societally acceptable overall risk, Dr. Toohey believes that the 5 pCi/l standard could be raised by a factor of 4, to 20 pCi/l: 2 for the risk factor, which was originally calculated at double the revised results, and 2 for the amount of water consumed per day, which is closer to one liter than the two liters used in the USEPA calculations. Employing the risk factor above, Dr. Toohey calculated the risk to Aurora water drinkers, based on a radium intake of 14 pCi/l: For a population of 85,000 residents and 40,000 employees, the calculation is as follows:

$$\begin{aligned} 125,000 \text{ people} & \times \frac{44 \text{ cancers/lifetime}}{\text{million at } 5 \text{ pCi/l}} & \times 14 \text{ pCi/l} \\ & \times 5 \text{ years exposure} & \times \frac{1 \text{ lifetime}}{75 \text{ years}} \\ & = & 1.03 \text{ excess cancers.} \end{aligned}$$

However, Dr. Toohey then demonstrated the "bad fit" of a linear model to the radium health effects data observed at present: the data shows that the effects of a radium consumption are not linear but quadratic, that is, the effects are not proportional to the dose, but are instead proportional to the square of the dose. Thus, use of the linear model predicts the risk as being 18 bone cancers per million, as opposed to the 6 per billion predicted by the quadratic model. Dr. Tookey did, however, qualify his opinion, stating:

"We must note, however, that the observation of a few more bone sarcomas in our population could change that conclusion and, in fact, the linear model may become a better fit if more bone sarcomas appear. Only time will tell. We can't close the books on it until we have completely followed up the populations to the end fo their natural life spans..."

Dr. Toohey believes the linear model also overestimates cancers because of recent evidence that indicates that previous understandings concerning the body's retention of radium in the skeleton may have been in error. It is now believed that retention is proportional to dose so that the larger the amount ingested, the longer it is retained. Thus, it is now believed that the radium workers may have ingested more radium than previously believed, making the linear model an even worse fit with the data.

Dr. Toohey also believes the no-threshold assumption of the linear, no-threshold model overestimates cancer.

This is because "people don't live forever", and the age at which cancer appears increases with decreasing radium intake. More particularly, said Dr. Toohey:

"If we assume that the amount of radium ingested from drinking water at the 5 pCi/l limit over a lifetime could all be taken in one year, at age 20 say, and if that amount of radium were in fact to induce bone cancer, these data indicate that the cancer would appear at age 140.

The fact that people will die from some other cause long before their radium burden could cause cancer leads to a practical threshold of about 50 uCi radium intake, very close to what we actually see in the data: the lowest intake causing cancer in a dial worker was 40 uCi; the lowest intake causing cancer in anyone was 9 uCi - a young boy 8 years old given radium as a medical treatment." (City Exh. 2, p. 5-6, also R. 34)

In summary, then, it is the opinion of Dr. Toohey that the assumed (predicted) risk of drinking radium bearing water is greater than the actual risk, and that based on all of the foregoing observations, grant of variance would not pose an adverse health risk to Aurora citizens.

The balance of the witnesses presented by the City at hearing explained the economic reasons for its variance request, as well as the nature of its water needs and water supply system. George Petree, the City's Director of Utilities, answered questions concerning the information contained in the City's variance petition (City Exh. 1), as well as general questions concerning the public water supply (R. 5-6, 71-76). Mayor David L. Pierce generally explained that the City had no desire to jeopardize the health of its citizens, having a firm commitment to coming into compliance with the radium standard within three to five years, but needed variance relief to allow water main extensions "for economic development and growth so that we can pay the bills to fix the [radium] problem" (R. 6-14).

Statements in support of grant of variance were made by Ed Furth, on behalf of the Greater Aurora Chamber of Commerce (R. 37-45, City Exh. 3, 4), by Charles Doss on behalf of the Aurora Economic Development Commission (R. 45-46), and by Frank H. Gurry on behalf of the Illinois Department of Commerce and Community Affairs (R. 45-49, City Exh. 5). Ralph Kristensen, general manager of Aurora Venture, detailed the effect that the restricted status permit ban is having on its development of the Fox Valley Villages. One venture, which currently cannot receive water permits, Fox Valley Corporate Villages, is a \$130 million industrial park expected to employ 5,900 and contribute \$53.2 to

Aurora's tax base, stands to lose substantial sums as well as customers because of inability to proceed during the summer construction season (R. 51-53, City Exh. 6). Statements were made and/or questions asked by five citizens, none of whom voiced continuing objections to variance after hearing the City's testimony, provided that the City were to achieve compliance with the radium standard as it promised, and did not in so doing affect private wells. These were H. Ellis Boyer, Rev. Bob Molsberry, Richard Breining, Judy Range, and Virginia Johannessen (R. 54-74).

At hearing, the Agency presented no direct testimony, relying on its Recommendation, but asked and answered clarifying questions. The Agency too believes that grant of variance would pose no significant health to Aurora's water drinkers, noting that original estimates of risk were "probably a high estimate" and suggesting that the 5 pCi/l standard might acceptably be increased to 20-30 pCi/l (Am. Rec. p. 7). The Agency has no disagreement with the City's estimates of compliance costs. The Agency did, however, add a caveat concerning one method for treatment technology for radionuclide removal, the ion exchange process, which it actively discourages, stating:

"if an ion exchange softener which is regenerated with salt is used, the sodium content of the water will be increased significantly. This may create a significant risk to persons who are hypertensive or who have heart problems. In addition, the waste from routine softening is high in total dissolved solids and may be very difficult to dispose of legally. The ion exchange process will concentrate the radioactivity and release the majority of the radioactivity in the waste stream in a concentrated form, which may be more of a hazard at that point than it is in the drinking water. Also, some of the radioactivity remains in the ion exchange material, so that it may be a hazard to anyone subsequently working on the softener, and disposal of the radioactive ion exchange material may be a problem." (Am. Rec., p. 8)

The Agency Recommendation endorses the compliance activities proposed by the City, and has suggested variance conditions which would require the City to effectuate those plans. [At hearing, the Agency agreed to a modification of a proposed variance condition to allow the Village to blend its high radium, deep well water with any other low-radium water source, as opposed to restricting the source to Lake Michigan water (R. 60-61, Agency Exh. 1.) The sole disagreement between the Agency and the City relate to the issue, earlier mentioned, as to whether the City should be granted a variance from the radium standard itself, or only from the effects of restricted status.

The source of the dispute lies in the interpretation given to that portion of Section 1415 of the Safe Drinking Water Act,

42 U.S.C. 300(g)-4, which provides that a federal variance may be granted when

"Because of characteristics of the raw water sources which are reasonably available to the system, the system cannot meet the requirements respecting the maximum contaminant levels of the drinking water regulations despite application of the best technology, treatment techniques, and other means, which the [USEPA] Administrator finds are generally available (taking costs into consideration);"

It has been the legal position of the USEPA that the system must "have in place and operational, or in the process of being installed, the best technology, treatment technique, or other means which the Administrator finds are generally available (taking costs into consideration", and that the Administrator has made his determination concerning treatment techniques in the USEPA publication "Manual of Treatment Techniques for Meeting the Interim Primary Drinking Water Regulations (May, 1977) (Am. Rec. p. 10-12). It has been the position of the Agency and the Board that the Manual is only a guideline, as it has not been promulgated as a regulation, and that variance relief is therefore warranted even if no treatment technology has been installed, e.g., City of Crystal Lake v. IEPA, PCB 84-2, May 29, 1984; Village of Altona, PCB 80-74, July 10, 1980.

The Agency notes USEPA's displeasure with the Agency/Board approach, and further notes that as a result thereof USEPA could seek to revoke such variances granted by the Board, and to revoke its determination to grant Illinois Primary Enforcement Responsibility under the SDWA, resulting in a loss to Illinois of \$1 million in federal funding. The Agency therefore suggests that

"concerns of the public water supplies to no longer be under the limitations of Restricted Status and the concerns of the USEPA that federal variances not be granted without installation of specific control technology can both be met by the Board granting a variance from the effect of being on Restricted Status, i.e., from 35 Ill. Adm. Code 602.105(a) Standards for Issuance, and not granting a variance from the combined radium or gross alpha particle activity standards. A variance from the effect of Restricted Status (i.e. Standards for Issuance) would allow water main extensions, while at the same time it would not be a variance from national primary drinking water regulations, and would not be a federal variance. Hence, there is no federal variance for the USEPA to be concerned about and no risk to the State of Illinois of loss of Primacy. (Public water supplies would still be subject to the possibility of enforcement for violations of the combined radium and/or gross alpha particle

activity. However, if the state variance required a compliance plan in, say, three years and compliance with the radiological standards by the end of five years, it is possible the USEPA would consider the variance order to be a "Compliance Order" and defer federal enforcement.)" (Am. Rec. p. 14).

The Board finds that the City of Aurora has made an unusually effective and persuasive showing that denial of variance would impose an arbitrary or unreasonable hardship. The record presents no reason to question the validity of Dr. Toohey's analysis or opinions concerning the lack of increase in health risks through grant of a five year variance. The economic effects of the restricted status construction moratorium on the City are of considerable magnitude. The question then, is what sort of variance should be granted.

The Board believes that, in this factual situation, a five-year variance from the radium standard of 35 Ill. Adm. Code 604.301(a) is warranted. The City has only recently become aware of its radium excursion. This is not a case which involves an issue as to whether an "individual system need ever comply at all with national regulations". Rather, the issue is one of how a system may best reach compliance in a finite period, given the nature of its current deep well raw water sources and its continuing search for additional, alternative water sources to attain both SDWA compliance and a reliable source of water for future needs. The variance here granted is in the nature of a compliance order, requiring activities which the City has agreed to perform in order to reach compliance within a five year period. In addition to conditions based on those suggested by the Agency, as adjusted to establish dates certain and to allow the possibility of use of any low-radium water source in a blending program, the Board will incorporate the specific activities listed by the City in its petition at p. 11.

This Opinion constitutes the Board's findings of fact and conclusions of law in this matter.

ORDER

1. Petitioner, the City of Aurora, is granted variance from the 5 pCi/l combined radium standard of 35 Ill. Adm. Code 604.301(a) until July 1, 1990, subject to the following conditions:

- A. On or before October 15, 1985, the Petitioner shall secure professional assistance (from present staff and/or an outside consultant) in investigating compliance options, including a review of the possibility and feasibility of achieving compliance by blending water from alternative water sources with that of its deep wells. On or before November 15, 1985, evidence that such professional assistance has been

secured shall be submitted to the Agency's Division of Public Water Supplies, FOS, at 2200 Churchill Road, Springfield, Illinois 62706. This information shall include, but not be limited to, activities described in the City's variance petition of April 15, 1985. More specifically, the City shall

- (i) Continue with its shallow aquifer engineering investigation program.
 - (ii) Beginning with existing shallow well number 101, construct and place on-line new shallow wells in conformance with the data generated by (i), above.
 - (iii) In conjunction with the Agency, continue the sampling program to monitor the radium levels in all wells as well as in finished water.
 - (iv) Continue monitoring the activity of the DuPage Water Commission in order to determine the feasibility of Lake Michigan as a water source for the years 1990 and beyond.
- B. As expeditiously after identification of a feasible compliance method as is practicable, but no later than July 1, 1988, Petitioner shall submit a program (with increments of progress) for bringing its system into compliance with radiological quality standards by July 1, 1990. This program should be submitted to the Agency's Division of Public Water Supplies, Permit Section, at 2200 Churchill Road, Springfield, Illinois 62706. The City shall adhere to all timetables contained in this compliance program.
- C. Until full compliance is reached, the City shall take all measures with its equipment as it from time to time exists to minimize the level of combined radium in its finished drinking water.
- D. Pursuant to 35 Ill. Adm. Code Section 606.201, in the first set of water bills issued after grant of this variance, the City shall send to each user of its public water supply a written notice to the effect that the City has been granted a variance from the Radium-226 and 228 combined concentration standard. The notice shall state the average concentration of Radium-226 and 228 in samples taken since the last notice period in which samples were taken.

2. Within forty-five days of the date of this Order, the City shall execute and forward to Wayne Wiemerslage, Enforcement Programs, Illinois Environmental Protection Agency, 2200 Churchill Road, Springfield, Illinois 62706, a Certificate of

Acceptance and Agreement to be bound to all terms and conditions of this variance. This forty-five day period shall be held in abeyance for any period this matter is being appealed. The form of this certificate shall be as follows:

CERTIFICATION

The City of Aurora hereby accepts and agrees to be bound by all terms and conditions of the Order of the Pollution Control Board in PCB 85-51, dated _____.

The City of Aurora

By: As Authorized Agent

Title

Date

IT IS SO ORDERED.

J. D. Dumelle concurred.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board hereby certify that the above Opinion and Order was adopted on the 11th day of July, 1985 by a vote of 7-0.

Dorothy M. Gunn
Dorothy M. Gunn, Clerk
Illinois Pollution Control Board