BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R 04-21
REVISIONS TO RADIUM WATER QUALITY STANDARDS: PROPOSED NEW 35 ILL. ADM. CODE 302.307 AND AMENDMENTS TO 35 ILL. ADM. CODE 302.207 AND 304.525	)	(Rulemaking-Water)

NOTICE OF FILING

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PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board the **PRE-FILED TESTIMONY OF JERRY KUHN, ROBERT MOSHER and BLAINE KINSLEY** on behalf of the Illinois Environmental Protection Agency, a copy of which is herewith served upon you.

ENVIRONMENTAL PROTECTION AGENCY
OF THE STATE OF ILLINOIS

By: Deborah J. Williams

Deborah J. Williams
Assistant Counsel
Division of Legal Counsel

DATED: March 18, 2004
Illinois Environmental Protection Agency
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PRE-FILED TESTIMONY OF JERRY KUHN

My name is Jerry Kuhn. I am the manager of the Permit Section for the Division of Public Water Supplies of the Illinois Environmental Protection Agency ("Illinois EPA") and have held that position since October of 2000. The Permit Section is responsible for the review of construction permit applications by community water supplies. A construction permit is required by the Illinois EPA for construction of any new community water supply and for changes or modifications to an existing community water supply including water main extensions and water treatment plant modifications. I have worked for the Illinois EPA for approximately 21 years, including eleven years in the Division of Water Pollution Control Permit Section and eight years in the Bureau of Land as the RCRA Unit Manager in the Permit Section. Prior to my time at the Illinois EPA, I worked for a consulting engineering firm. I received a Bachelor of Science in Engineering degree from Bradley University in 1975 and a Master of Science in Thermal and Environmental Engineering Degree from Southern Illinois University at Carbondale in 1985. I have been an Illinois Licensed Professional Engineer since 1980.

Today I will testify in regards to the Illinois EPA's proposed changes to the water quality standards for radium and the proposal's impact on Illinois community water

supply systems. Regulations for radionuclides in drinking water were first promulgated in 1976 as interim regulations under the authority of the Safe Drinking Water Act of 1974. The standard was proposed for revision upward to 20 pCi/L in 1991, but eventually it was determined that the original 5 pCi/L should remain the MCL standard. On December 7, 2000, U.S.EPA finalized revisions to the 1976 radionuclide regulations, which have since been adopted by the Illinois Pollution Control Board. The Board's regulations were finalized on October 4, 2001 in rulemaking docket R01-20. These regulations retained the existing Maximum Contaminant Level (or "MCL") of 5 picocuries per liter ("pCi/L") for Radium 226 and 228 combined and 15 pCi/L for gross particle activity. The rule became effective on December 8, 2003.

Entities regulated by this rule are public water systems that are classified as community water systems. Community water systems provide water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serve an average of at least 25 people year-round. Over 100 community water supplies in Illinois are impacted by these regulations, due to the presence of radionuclides in their source water used for drinking at concentrations higher than the MCL. The radionuclides found in Illinois groundwater wells are naturally occurring and located primarily in deep bedrock aquifers.

Community water supplies that exceed the MCL for radionuclides have three basic options to lower their radium levels: (1) blend their water with a source of water with no or low amounts of radium to meet the MCL, (2) acquire another source for their drinking water with radium below the MCL, or (3) install treatment for their source water.

Under the Safe Drinking Water Act, U.S. EPA must specify best available technologies for treatment of each MCL. In regards to treatment for removal of radionuclides, U.S. EPA considers ion exchange, reverse osmosis and lime softening to be the best available technology. Additionally, small system (serving less than 10,000 people) compliance technologies include green sand filtration, hydrous manganese oxide filtration and enhanced coagulation/filtration. All of these radionuclide removal technologies produce residual waste streams that must be dealt with. Anywhere from five to twenty-five percent of the water obtained from well sources and treated by one of the radium removal technologies ends up as wastewater containing radionuclides removed from the source water and discharged to the local wastewater treatment plant. Depending on the initial groundwater concentration, removal efficiency in the wastewater treatment plant and the dilution available in the receiving stream, communities with radionuclides in the source of their drinking water have or will have, once they implement a radium removal technology, a problem with violations of the existing radium water quality standard as it applies to most the waters of the state.

It is my opinion that the Agency's proposed changes to the Board's water quality standards for radium will assist community water supplies in coming into compliance with the Safe Drinking Water Act and prevent their efforts to reduce radium in drinking water from becoming an issue of non-compliance with surface water quality standards for publicly owned treatment works while still protecting surface water quality.

Finally, I would like to thank the Board for the opportunity to submit this pre-

filed testimony and for its consideration of the Agency's rulemaking proposal.

By: _____

Jerry Kuhn, P.E.

March 18, 2004

Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

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PRE-FILED TESTIMONY OF ROBERT MOSHER

Background and Qualifications

My name is Bob Mosher and I have been employed by the Illinois Environmental Protection Agency ("Illinois EPA") for over 18 years with more than 16 years experience in the Water Quality Standards Unit. I am an aquatic biologist by training with a specialization in stream ecology and laboratory aquatic life toxicity studies. Most recently I have been involved in the development of water quality standards for nutrients, radium and sulfates for eventual adoption by the Illinois Pollution Control Board ("Board") as well as water quality standards implementation support for the Permit and 401 Water Quality Certification Sections of the Bureau of Water. I have a Bachelor of Science degree in environmental biology and zoology from Eastern Illinois University and a Master of Science degree in zoology also from Eastern Illinois University. My pre-filed testimony in this matter will address the history and background of the Board's current radium water quality standards and the justification for the Illinois EPA's proposed changes to those standards.

Introduction: Radium 226 and 228

Radium is a naturally occurring radioactive metal that exists in several isotopes. Radium forms when two other radioactive metals, uranium and thorium, decay. These substances are naturally found in rocks and therefore radium is ubiquitous in the environment. Radium is usually measured in picocuries per liter ("pCi/L"). A picocurie is a very small amount of radioactivity. One picocurie is associated with about one trillionth of a gram of radium. Radium 226 emits alpha radiation and radium 228 emits beta radiation. The half-life of radium 226 is 1,600 years while radium 228 has a half-life of 5.7 years. There are two other natural isotopes of radium that have half-lives of just a few days.

Radium may exist in small Illinois streams below sewage treatment plants serving communities that utilize high radium groundwater as drinking water at levels exceeding the existing general use water quality standard of 1 pCi/L. Discharges to larger streams probably receive sufficient dilution to meet the standard. Recent stream concentrations measured in the Fox River were under 1 pCi/L. The Fox River flows through a region where many communities depend on high radium groundwater, illustrating that ambient river water is very low in radium and that the overall effect of dischargers is minor. The vast majority of Illinois community water supply facilities with high concentrations of radionuclides in their source water (all groundwater) are located in the northern half of the State and in a region that stretches from Henderson County in the west to Cook and Lake Counties in the northeast. Sewage treatment plant discharges to very small streams where no dilution water is present have the potential to contain as much as 5 to 10 pCi/L

of radium depending on concentrations in the groundwater and efficiency of treatment in removing radium to the sewage sludge.

History of the Existing General Use and Lake Michigan Basin Water Quality Standards

The existing General Use water quality standard for radium 226 is 1 pCi/L and is found in 35 Ill. Adm. Code 302.207. This standard was adopted by the Board as part of its initial set of water quality regulations first promulgated in 1972 in docket R71-14. An identical standard first appeared in the regulations for the Lake Michigan Basin in 1997 due to a change in the format of how Lake Michigan standards were presented. This standard has been continuously applicable in Lake Michigan since 1972, however. The Board's 1972 opinion accompanying adoption of the radium standard mentioned that the new regulation "retains existing radioactivity levels" which implies that this standard existed prior to 1972 in the Sanitary Water Board (the precursor to the Agency and Board) regulations. A justification document that appears to have accompanied the rulemaking also simply says that the radioactivity standards "retain[s] existing radioactivity levels." We now have reason to believe that the Board's 1972 radium 226 standard did not preserve a then existing state standard but rather was derived from a federal suggested value current at that time.

The Illinois Sanitary Water Board had numerous regional water quality standards in place by 1966 and these included either a radium 226 standard or an "alpha omitters" (presumably the Sanitary Water Board meant "alpha *emitters*") standard depending on the region. This may have been due to the fact that standards for interstate waters reflected the neighboring state's preference, some choosing to regulate radium 226 and some alpha emitters. The numeric value was the same for either parameter and for all

regions, 3 pCi/L. Thhis standard was found in the Public Water Supply Intakes category and it was noted that these standards were intended to protect "river quality at the point at which water is withdrawn for treatment." This is consistent with the intent underlying the Public and Food Processing Water Supply Standards (Subpart C) in the current Board regulations. It is also interesting to note that the standard for strontium 90 was 10 pCi/L and gross beta concentration was 1,000 pCi/L in these Sanitary Water Board standards while the existing General Use water quality standards for strontium 90 and gross beta are 2 pCi/L and 100 pCi/L respectively and are found in 35 Ill. Adm. Code 302.207.

In looking to the origin of the Sanitary Water Board's standards, a federal source called the Public Health Service Drinking Water Standards published by the U.S. Department of Health, Education and Welfare in 1962 (and also cited in the Agency's rulemaking proposal) is implicated. In the 1962 document, finished drinking water standards are given: 3 pCi/L for radium 226, 10 pCi/L for strontium 90 and 1,000 pCi/L for gross beta radiation. These are the exact values adopted by the Sanitary Water Board for raw water being used as a public water supply.

In a later federal source, the Green Book (formally referred to as the Report of the Committee on Water Quality Criteria dated April 1, 1968 and cited in the Agency's proposal) a table is given in the section on public water supply standards which gives two values for each parameter, a "permissible" value and a "desirable" value. The permissible value is 3 pCi/L for radium 226 while the desirable value is <1 pCi/L. For strontium 90 these values are 10 and <2 and for gross beta 1,000 and <100 pCi/L, respectively. The Green Book cites the 1962 Public Health Service document as the source of its "permissible" criteria but it seems that the "desirable" criteria are its own

invention. The Green Book specifically states that these values apply not to finished water but "can be used in setting standards for raw water quality only" which implies that these were intended to be point of intake standards. Taking a finished water standard and applying it as a raw water standard adds conservatism, since any treatment provided by the community water supply would reduce concentrations. It appears that the Green Book took this liberty with the 1962 drinking water standards.

The Green Book appears to be the source for the Pollution Control Board General Use water quality standards of 1972. The Sanitary Water Board adopted their standards before publication of the Green Book and interpreted the 1962 Public Health Service values as point of intake standards for public water supplies. The Pollution Control Board apparently changed two things, making these standards general in applicability and taking the more stringent Green Book "desirable" value as the standard, simply dropping the "<" sign. The record indicating that the Board said it "preserved the existing standard" may therefore mean that it was the 1968 Green Book "desirable" recommendation rather than the standard applicable to Illinois at that time (adopted by the Sanitary Water Board) that was being preserved. It seems certain that the ultimate origin of the Sanitary Water Board's radioactivity water quality standards was the federal Public Health Service documents of 1962 while the Pollution Control Board's source was the Green Book. For reasons of concentration (1 pCi/L instead of 3 pCi/L) and applicability (General Use instead of Public and Food Processing Water Supply) the present radium standard, and the radioactivity standards in general, are more conservative than ever intended by the original source.

As explained in Jerry Kuhn's pre-filed testimony, the current U.S. Environmental Protection Agency finished drinking water Maximum Contaminant Level (or "MCL") for radium 226 plus radium 228 is 5 pCi/L. This standard is based on the fact that radium is a carcinogen. Persons drinking water over a lifetime will theoretically be protected from cancer at an acceptable risk level (10^{-6} to 10^{-4}) if the concentration of radium in drinking water is less than or equal to 5 pCi/L. Since the MCL is a finished water standard, this makes the previous federal standard of 3 pCi/L applicable at the point of intake (which applies to raw water) upon which the Sanitary Water Board standard was based, very conservative. Protecting nearly all waters at 1 pCi/L (IPCB) is excessively stringent. This level of protection is undocumented and is unwarranted.

Proposed Radium 226 Plus 228 Public and Food Processing Water Supply Standard

Radium is a recognized carcinogen and therefore standards protecting sources of drinking water are necessary and important. However, as far as may be determined, no other uses of water are known to be adversely impacted by radium. The Illinois EPA conducted a literature search for radium impacts to aquatic life and found no scientific papers or other information on this subject. Consultation with USEPA Region V water quality standards staff also found no indication that radium is anything but a threat to human health via drinking water.

Other states regulate radium in a similar manner to that proposed by the Agency. Oklahoma has a standard of 5 pCi/L at the point of intake for public water supplies. The Ohio River Sanitation Commission (referred to as "ORSANCO") has a water quality standard for the Ohio River of 4 pCi/L applicable everywhere in the river outside of mixing zones. ORSANCO considers the entire Ohio River to be a public water supply.

Indiana has an intake raw water standard of 3 pCi/L, which may be an artifact of the old Green Book standard. Several other states were contacted including California, Utah and Arizona, Western states that have had hard rock mining issues. Even these states have no aquatic life water quality standards for radium. Illinois appears to be unique in this regard.

The Agency's proposal to remove the General Use and Lake Michigan standards and establish a Public and Food Processing Water Supply standard at the federal MCL for radium 226 and 228 is protective of all uses that may be impacted by radium. Radium would then be regulated in a manner similar to other substances that may cause problems in drinking water yet do not have to be regulated as stringently for other uses. These substances are those listed under 35 Ill. Adm. Code 302.304. For example, chloride is regulated at 250 milligrams per liter under 302.304 to protect drinking water intakes from excess salts. There is no reason to regulate General Use waters at this low level since other uses of waters are protected at higher chloride concentrations. The existing General Use standard regulates radium unnecessarily and causes compliance issues at communities struggling with drinking water problems.

While there is no data for radium to indicate what the threshold concentration would be to protect aquatic life, the Illinois EPA is confident that it is much higher than the 5 pCi/L level given the lack of concern for this exposure route by the scientific community, the extremely low mass per volume concentration that this standard represents and the fact that barium, a much more common metal related chemically to radium, is not toxic to aquatic life at the low part per million level. Presently, the known sources of radium to the surface water environment are public water supplies that utilize

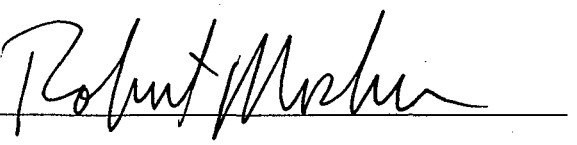
high radium groundwater. These are typically no higher in concentration than the groundwater, and as explained in Blaine Kinsley's pre-filed testimony, usually somewhat lower. Even direct discharges of wastewater resulting from treatment of high radium groundwater (should these ever occur) constitute only about double the radium loading expected from a sewage treatment plant. Other types of discharges are unknown. Should a new source of radium be proposed, the antidegradation standard would be imposed to require the new source to justify the radium discharge, which would include studies of treatment alternatives and steps to minimize any necessary radium discharges.

It is apparent from our investigation into the scientific information and the lack of concern in other states and at the federal level that drinking water protection is the only beneficial use classification of Illinois streams and lakes that warrants a radium water quality standard. This conclusion is based on concentrations existing or expected to be realized in Illinois surface waters from either naturally occurring conditions or those resulting from water treatment plant wastes or their affiliated publicly owned treatment works in those parts of the state that rely on radium-containing groundwater as their potable raw water source.

The proposed changes to the General Use and Lake Michigan Basin water quality standards removes the radium standard and replaces it with a standard that protects surface water intakes for raw drinking water at the established finished drinking water MCL standard. This change is protective of the sensitive designated use of Illinois waters to radium and provides a framework in the regulations for a sensible approach to radium in surface waters. Radium will now be regulated as a combination of radium 226

and 228 at Public and Food Processing Water Supply intakes at a concentration of 5 pCi/L.

I would like to thank the Board for the opportunity to submit this pre-filed testimony and for its consideration of the Agency's rulemaking proposal. I will be pleased to answer any additional questions presented by the Board or members of the public regarding the Agency's rulemaking proposal.

By: 

Robert Mosher

March 18, 2004

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PRE-FILED TESTIMONY OF BLAINE KINSLEY

My name is Blaine Kinsley. I am the manager of the Industrial Unit in the Division of Water Pollution Control, Permit Section. I have been in that position since December of 2002. The Industrial Unit is responsible for application review and issuance of National Pollutant Discharge Elimination System (also referred to as "NPDES") permits and State Construction permits for industrial facilities including backwash discharges from public water supply facilities. I have worked for the Illinois Environmental Protection Agency ("Illinois EPA") for nine years, all of which have been spent in the Industrial Unit. Before coming to the Illinois EPA, I worked for a consulting engineering firm in Louisville, Kentucky. I received a Bachelor of Science degree in Geological Engineering from the University of Missouri-Rolla in 1994. I have been an Illinois Licensed Professional Engineer since 2001.

My testimony today will focus on the fate of radium in publicly owned treatment works (which I will refer to as "POTWs"). The specific concerns I will discuss are in my testimony are how much radium can be expected to be removed in the various types of

treatment systems and whether the affected systems will be able to meet the existing water quality standard for radium 226.

There is little published information available on the fate of radium 226 in POTWs. The State of Wisconsin probably has more experience with radium than any of the states in U.S. EPA's Region V (which is the region that includes Illinois). A 1985 report by the Wisconsin Department of Natural Resources studied five Wisconsin communities with varying degrees of radium 226 and 228 in their wastewater. That study concluded that biological sludges, both fixed media and suspended growth, adsorb soluble radium and that insoluble radium is also removed in wastewater treatment processes by either physical settling or biological uptake. All of the communities studied had either activated sludge or Rotating Biological Contactor ("RBC") treatment processes. Removal efficiencies, based on influent versus effluent concentrations, ranged from a low of 29 percent to a high of 97 percent.

For the purpose of comparison and to address the lack of existing treatment efficiency or effluent data, the Agency used the fate of barium in a POTW to estimate the removal efficiencies for radium by the same wastewater treatment facilities. Both radium and barium are Group IIA metals on the Periodic Table of Elements which means they have similar chemical properties. Influent and effluent sampling data for barium does exist for some POTWs in Illinois especially those with approved pretreatment programs. The influent concentrations of barium at a sampling of these POTWs were well below the anticipated concentrations of radium. Removal efficiencies, based on influent versus effluent sampling, ranged from 25 percent to 62 percent. Four of the five POTWs reviewed utilized activated sludge and one used trickling filters. There did not appear to

be a correlation between the types of treatment and the removal efficiencies based on the limited number facilities where the data was available.

The Illinois EPA is in the process of requiring radium sampling of sludge at POTWs where high levels of radium are found in the community's source water. In addition, new State Construction permits for the discharge of radium backwashes to POTWs require influent and effluent sampling at the affected POTW. This requirement is necessary to ascertain the percent removal of radium in the treatment processes and to gage the number of facilities that may have problems meeting the 1 picocurie per liter (pCi/L) water quality standard for radium 226. To date, the Illinois EPA has received only very limited data from this type of sampling. Based on the data submitted by one discharger with two wastewater treatment plants, the radium removal efficiencies are between 31 percent and 60 percent. Both of these wastewater treatment plants employ an activated sludge treatment process. The difference between the two plants is that the plant with a 60 percent removal efficiency receives much more of its influent from combined sewer flows. The combined sewer flows would act to dilute the radium concentration coming to plant which would increase its apparent removal efficiency.

Considering typical raw water concentrations and expected removal efficiencies, it is anticipated that many POTWs discharging to streams with little or no continuous flow may have trouble meeting the existing radium water quality standard. The changes proposed by the Agency would assist these communities in remaining in compliance with water quality standards while still protecting all existing and future uses of the State's lakes and streams.

Finally, I would like to thank the Board for the opportunity to submit this pre-filed testimony and for its consideration of the Agency's rulemaking proposal.

By: _____
Blaine Kinsley, P.E.

March 18, 2004

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STATE OF ILLINOIS)
) SS.
COUNTY OF SANGAMON)

PROOF OF SERVICE

I, the undersigned, on oath state that I have served the attached Pre-Filed Testimony of Jerry Kuhn, Robert Moser and Blaine Kinsley upon the person to whom it is directed, by placing it in an envelope addressed to:

TO: Dorothy Gunn, Clerk
Illinois Pollution Control Board
James R. Thompson Center
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Amy Antoniolli, Hearing Officer
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and mailing it by First Class Mail from Springfield, Illinois on March 18, 2004, with sufficient postage affixed.

Cynthia Sims

SUBSCRIBED AND SWORN TO BEFORE ME

this 18th day of March, 2004

Brenda Boehner
Notary Public

OFFICIAL SEAL
BRENDA BOEHNER
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 11-14-2005

THIS FILING IS SUBMITTED ON RECYCLED PAPER