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Tracy Regan

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Background and Requested Comments

NJDEP Discussion Paper

Discussion paper to generate dialogue on the concept of requiring granular activated carbon treatment *in lieu* of or in addition to air stripping for the removal of organic contaminants from public drinking water supplies.

Summary

The New Jersey Department of Environmental Protection (Department) is seeking input and requesting comments regarding an approach to develop a treatment-based primary drinking water regulation for the removal of unregulated organic contaminants from New Jersey's drinking water.

The approach would result in amendments to the New Jersey Safe Drinking Water Act regulations to include a treatment technique (i.e., granular activated carbon) as a primary drinking water regulation to remove currently unregulated synthetic organic compounds. The action would apply to community water systems that currently have a violation of a drinking water standard for a regulated organic contaminant and have installed or are planning to install air-stripping treatment to remove it. A primary drinking water regulation specifies either a maximum contaminant level (MCL) for each contaminant of concern or allows the Commissioner of the Department to specify a treatment technique that results in the reduction of the contaminant in water when determining the level of the contaminant is not economically or technologically feasible.

The concept arose after numerous internal and external discussions regarding the best options for protecting public health due to the occurrence of regulated, unregulated and tentatively identified organic contaminants in drinking water. The semi-volatile and non-volatile organic contaminants are not routinely monitored in drinking water through conventional analytical methods but have been detected in New Jersey drinking waters through research studies. Given the results from these studies, the Department is considering, what, in the absence of information on human health information on these compounds, its response should be in order to protect human health.

What

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In order to solicit public input as early as possible, the Department is releasing this discussion paper to generate dialogue on the issue. This discussion paper represents one approach being considered by the Department to address the issue of unregulated contaminants in drinking water. Under this approach, the Department would continue its efforts to identify contaminants of concern and establish MCLs, where appropriate.

Following is a description of: the results of recent studies showing the presence of unregulated and tentatively identified compounds; the current approach to setting standards for drinking water contaminants; the current approach to addressing the occurrence of unregulated contaminants; and the treatment technique approach to achieving removal of unregulated contaminants in drinking water.

Occurrence of Unregulated Compounds and Tentatively Identified Compounds in New Jersey Waters

Discussion on the topic was prompted by the recent release of studies showing that many more contaminants are present in raw and finished drinking water supplies than are currently regulated. Studies conducted by the Department with the Environmental and Occupational Health Sciences Institute (EOHSI) of New Jersey (1) and the US Geological Survey (USGS) with NJDEP (2) and the federal Centers for Disease Control and Prevention (CDC) (3) have shown that water samples analyzed by more advanced analytical methods show the presence of low levels of household and industrial compounds. Current regulatory analytical methods are not capable of detecting these compounds. Some of the compounds detected in the studies were reported as "tentatively identified compounds". A tentatively identified compound is one that can be seen by an analytical testing method, but its identity and concentration cannot be confirmed without further analytical investigation. Tentatively identified compounds are reported in virtually all analytical tests for organic compounds.

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A photograph can be used as an analogy to describe a tentatively identified compound. The photograph's subject, located in the foreground, is in focus and identifiable to the viewer. The photograph also captures background information, and, often, this information is fuzzy and not identifiable to the viewer. The photographer can

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ask others to identify the fuzzy components and name them, but since he has not identified them for himself, they remain tentative identifications.

The results of these studies indicate that:

- Analytical methods are capable of detecting many more organic compounds than are currently regulated at very low levels (below one part per billion, ppb) in surface, ground and drinking water samples.
- Quality Assurance procedures are vital for interpretation of results (certain compounds were detected in both water samples and blank samples)
- Only a fraction of the detected compounds in the studies have regulatory standards, guidelines, or criteria.
- Some compounds survive existing water treatment.
- Some compounds are introduced during water treatment.
- Little is known about human health effects and even less about ecological effects.
- Most water samples contained more than one organic contaminant.

Summaries and full reports for the completed portions of these studies are available at <http://www.state.nj.us/dep/dsr/> and <http://toxics.usgs.gov/regional/cmc.html>.

Human health effects data for many of the unregulated and tentatively identified compounds have not been generated. It is not possible for the Department to develop the toxicological study data needed to establish an MCL for all these compounds given the large numbers of unregulated compounds detected (several hundred) and the amount of time and expense associated with developing the toxicological data for just one MCL when no health information exists (e.g., in Toms River, it has taken over 5 years and \$5 million to conduct toxicity studies on one unregulated contaminant). In addition, there is little information available about the health effects of compounds when two or more are present in the same sample, as researchers continue to struggle with this field of study.

The NJDEP-EOHSI (1) and USGS-NJDEP-CDC (2, 3) studies indicate that unregulated contaminants tend to occur at those water systems where elevated levels of a

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regulated contaminant are already present. That is, the highest numbers of unregulated contaminants in drinking water occurred in those systems that already had some type of treatment in place to remove a regulated contaminant, in most instances, a volatile organic contaminant. Air-stripping for removing volatile organic contaminants was the most commonly used treatment technology. A volatile compound "evaporates" readily into the air. A non-volatile compound evaporates much more slowly or not at all. A semi-volatile compound falls in between. Many of the unregulated contaminants detected in the studies are non-volatile and semi-volatile in nature. The studies demonstrate that volatile organic compounds, which are the current regulatory focus of analysis for organics in drinking water, may serve as markers for the presence of mostly unregulated non- and semi-volatile compounds. Due to the historical focus on volatile organic compounds in drinking water, the full picture of exposure and health risk from other unregulated compounds in drinking water may not have been adequately determined. With the emergence of more sensitive analytical capabilities for non- and semi-volatile organic contaminants, a more complete assessment of this additional contamination, if and where it exists, can be made. As stated above, there are still many outstanding questions regarding the toxicity of the unregulated contaminants detected.

A follow-up study by NJDEP and EOHSI will investigate whether or not unregulated contaminants reach public supply wells where there are no MCL violations and where contaminated sites are located within the Source Water Assessment area for the wells.
 For information about the state's Source Water Assessment program, go to www.state.nj.us/dep/swap.

New Jersey's Current Approach to Regulation of Contaminants in Drinking Water

A drinking water standard or maximum contaminant level is the highest amount of a contaminant allowed in drinking water, as defined by the Federal Safe Drinking Water Act and the New Jersey Safe Drinking Water Act. All federal primary drinking water regulations are also New Jersey regulations because they are adopted by the New Jersey Department of Environmental Protection by reference (N.J.A.C. 7:10-5.1). Where both

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the State and federal government have standards, the more stringent standard is required to be used in New Jersey, by statute. In the absence of a federal MCL, New Jersey may set its own, using the methodology outlined in the New Jersey Safe Drinking Water Act. Currently, over 90 biological and chemical constituents are regulated in drinking water in New Jersey.



The 1983 amendments to the New Jersey Safe Drinking Water Act describe the drinking water standard-setting process for New Jersey. The Drinking Water Quality Institute, a 15-member advisory body defined in the 1983 amendments to the New Jersey Safe Drinking Water Act, recommends MCLs to the Commissioner of the Department using the process outlined in the Act. The standard-setting process in New Jersey is a compound-specific approach and is similar to that used by the U.S. Environmental Protection Agency (EPA). First, a health-based level is determined using the most currently available toxicological data with appropriate safety factors. The drinking water health-based goal is a one in one million excess cancer risk over a lifetime of exposure for carcinogens, and a goal of no adverse physiological effects for noncarcinogens. While the EPA goal for noncarcinogens is the same as that used by the Department, EPA has established a health-based goal policy for carcinogens of zero as the allowable concentration in drinking water. EPA includes these health-based levels or "maximum contaminant level goals" in the EPA regulations, but water systems are not required to comply with the maximum contaminant level goals, only the MCLs.

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After determining the health-based level based on the health goals described above, a practical quantitation limit for each contaminant is established. Analytical capability is a key component of standard setting in both the New Jersey and Federal Safe Drinking Water Acts. The practical quantitation limit is the level where quantitation can be achieved with acceptable uncertainty among most laboratories. The practical quantitation limit is derived by evaluating performance data from several laboratories at several different concentrations of a particular compound, or by multiplying the detection limit by a pre-determined factor to account for the variability among the laboratories. Established EPA analytical methodologies are always used to analyze drinking water for compliance purposes. the Department's approach to determining the practical quantitation limits is similar to EPA's.

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mg (The respective technological feasibility of water treatment techniques is then evaluated to determine if the contaminants can be effectively removed from drinking water. For noncarcinogens only, cost can also be considered in standard setting in New Jersey.

Differences in MCLs between EPA and the Department have resulted due to the slight variations in the process for setting these limits between the two agencies. In New Jersey, there are 13 MCLs that are more stringent than federal MCLs for the same contaminant. Further, the Department regulates five additional contaminants that are not regulated by EPA. New Jersey MCLs are listed at www.state.nj.us/dep/watersupply/standard.htm.

Once an MCL is established, the 600 community water systems and approximately 900 noncommunity water systems are required to add the contaminant to the list of contaminants for monitoring and reporting according to a schedule established in both state and federal regulation. The owner of the water system is responsible for installing drinking water treatment when a violation of the MCL is confirmed. Depending on the source of the contaminant, treatment costs are provided by the owner of the water system, the Spill Compensation Fund, or those responsible for causing the contamination.

New Jersey's Current Approach to Addressing Unregulated Compounds in Drinking Water

There are several ways that the Department currently addresses the presence of unregulated compounds in drinking water when there are no corresponding MCLs.

1. Develop a new MCL.
2. Use ground water quality standards.
3. Use generic standards.

1. The first approach is to set a new MCL. In addition to MCLs for microbiological, inorganic, radiological, and disinfection byproduct contaminants, there are currently MCLs for 26 volatile organic contaminants and 30 synthetic organic contaminants (mainly pesticides) in New Jersey. The 1983 amendments to the New Jersey Safe

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Drinking Water Act included classes of unregulated compounds for consideration in future rulemaking. Criteria for selecting additional compounds to regulate are: 1) frequency of occurrence in drinking water; 2) availability of toxicity data on which to base a chemical-specific risk assessment; 3) availability of an analytical technique capable of detecting the compound; and 4) availability of treatment methodology to remove the compound from water. The 1983 amendments to the Safe Drinking Water Act provided the authority for the Department to regulate more contaminants in drinking water than the original list of 22 included in the Safe Drinking Water Act, provided that the contaminant occurred with some frequency in New Jersey drinking water. In 1996, the Department used this procedure to identify and regulate five additional contaminants than were originally included in the 1983 Safe Drinking Water Act amendments.

2. Another way the Department addresses the occurrence of unregulated contaminants is through the use of the Ground Water Quality Standards (N.J.A.C. 7:9-6). The Department's Bureau of Safe Drinking Water uses the Ground Water Quality Standards when there is no drinking water MCL available to trigger an advisory regarding the potability of the water supply. The methods used to develop drinking water standards have been adopted into the New Jersey Ground Water Quality Standards and there are many more ground water quality standards (over 160 groundwater standards) than there are MCLs. In addition, in the absence of an established MCL or Ground Water Quality Standard, the Department has the ability to develop an interim specific criterion for a specific contaminant to address contaminants quickly through the or Ground Water Quality Standard process (96 interim specific criteria to date). For information on Ground Water Quality Standards, go to www.state.nj.us/dep/wmm/sgwqt/njac79-6.pdf.

3. The final method for evaluating drinking water quality in the absence of an MCL is to apply a generic standard to compounds for which no current MCL exists: 5 ppb for carcinogens and 100 ppb for noncarcinogens. This policy has been in effect since 1989, however, it is seldom used.

These informal methods currently used to address unregulated contaminants in New Jersey have been satisfactorily applied in the state for many contaminants that do

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not have MCLs. These contaminants have health information available, and monitoring and treatment guidance has been developed for the water systems on a case-by-case basis. However, the recent studies by NJDEP-EOHSI and USGS-NJDEP-CDC show that there may be groups of unregulated contaminants present in public water systems that are too numerous to address under the current system. Many may be by-products of other compounds and, individually, may have very different mechanisms of actions on the human body. In addition, some may have no effect at all individually but when in the presence of other compounds, may exert a deleterious effect.

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During the course of the development of the approach being considered for the removal of organic contaminants from drinking water, several additional options were introduced and are being considered. They include: classifying contaminants by their health endpoint, such as carcinogens, and regulating these carcinogens at the "no detect" level; classifying contaminants by their chemical characteristics and regulating the chemical groups as generic classes; investigating the potential presence of unregulated contaminants through more thorough and intense scrutiny of contaminated sites; and expanding the current approaches to addressing unregulated contaminants to include and accommodate the larger number being detected. While considering these other options, the Department has chosen this treatment technique approach for a number of reasons. First and foremost, this strategy represents a proactive approach to protecting public health in the absence of little or no definitive scientific information on the contaminants being detected. Given the uncertainty in the health information available for these contaminants, the current methods of addressing unregulated compounds cannot be applied. In order to develop an MCL, a ground water quality standard or an interim ground water quality standard, some toxicity information is necessary. For many contaminants detected in the NJDEP-EOHSI and USGS-NJDEP-CDC studies, this information is lacking. Rather than wait for studies to be completed, the Department feels it is prudent to take precautionary action in this instance.

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Second, this approach represents the likely action that would be taken if the other options are followed. That is, the best available technology for removing synthetic organic contaminants from drinking water is granular activated carbon. Most of the contaminants detected in the afore-mentioned government-funded studies were synthetic

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organic compounds. If the Department pursued the other options, the likely end result would be to install carbon treatment on numerous public water systems throughout the state.

Adoption of a Treatment Technique to Address Unregulated and Tentatively Identified Compounds in Drinking Water

Under this approach, the Department would continue its efforts to identify contaminants of concern and establish MCLs, where appropriate. A new primary drinking water regulation would be proposed in the New Jersey Safe Drinking Water Act regulations that would require granular activated carbon or a combination of air stripping with granular activated carbon as the acceptable treatment technologies for removal of organic contaminants. This would essentially eliminate the air-stripping-alone treatment technology as an acceptable option for removing organic contamination.

This water treatment option is being considered to address the issue of potential human exposure to synthetic organic contaminants in drinking water. Some of these synthetic organic contaminants are not well characterized either chemically or toxicologically, but their presence is associated with elevated levels of regulated volatile organic contaminants. Current the Department regulations require treatment of the source of water if there is a violation of the MCLs. There is not a requirement to install treatment if contamination of the drinking water is not confirmed. However, the Safe Drinking Water Act does include a provision that allows the Commissioner to require the use of treatment techniques to reduce the level of contaminants which, in his judgement, may have adverse effects on human health, and where it is not economically or technologically feasible to ascertain the level of such contaminant (N.J.S.A. 58:12A-3).

The treatment technique option would be to install granular activated carbon treatment on drinking water supplies already affected by regulated volatile organic contaminants. Water systems that currently have an MCL violation for volatile organic contaminants and have installed air-stripping treatment to remove these contaminants would be targeted for granular activated carbon water treatment. Carbon filters are very effective at removing organic contaminants from drinking water, and will even remove

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contaminants that may not be detected by current analytical methods used for compliance purposes. But carbon filters do have limitations and do not remove all contaminants from drinking water (e.g., lead, arsenic and mercury).

The Safe Drinking Water Act regulations would be changed through a future rule proposal to require granular activated carbon or a combination of air stripping with granular activated carbon as the acceptable treatment technologies for removal of organic contaminants. This proposal would essentially eliminate the air-stripping-alone treatment technology as an acceptable option for removing organic contamination.

Preliminary assessments of Bureau of Safe Drinking Water data show that there are approximately 93 facilities serving 52 public community water supplies with air stripping treatment technology that would be required to install these filters today. These systems have an estimated total capacity of 136 million gallons per day and a total estimated cost of \$93 million dollars for the installation of the treatment. Economic information from one water purveyor, United Water - Toms River, indicates that the cost to install one carbon unit at a facility (approximately one million gallons per day capacity) is approximately \$1 million. The annual operations and maintenance cost for the unit would be an additional \$70,000.

This discussion paper represents an early notice to the public of one approach being considered by the Department to address the issue of unregulated contaminants in drinking water.

Requested Input from Interested Parties

The Department is seeking input from interested parties on this approach pertaining to addressing the occurrence of unregulated contaminants in drinking water. The Department is interested in comments on these specific issues:

- Practical feasibility of the treatment technique concept.
- Limitations of the treatment technique concept.
- Anticipated benefits of the treatment technique concept.

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- Anticipated effectiveness of the treatment technique concept described to protect public health
- Ways in which the effectiveness of the treatment technique concept could be improved and ways to measure the effectiveness.
- Compliance, enforcement and reporting requirements issues associated with the treatment technique concept
- Financial burden associated with the implementation of the approach.
- Suggestions regarding possible ways to fund the costs.
- Financial burden associated with the implementation of the treatment technique.
- Other options that can be considered to enable DEP to address the presence of unregulated organic contaminants in drinking water.
- Other concerns not reflected in the above issues.

References

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2. Dana Kolpin, Edward Furlong, Michael Meyer, Michael Thurman, Steven Zaugg, Larry Barber and Herbert Buxton. Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance, Environmental Science & Technology, v. 36, no. 6, pages 1202-1211
3. Paul E. Stackelberg, Phil Roosa, Alden Henderson, Nicole Smith, & Robert L. Lippincott. Fate of Organic Wastewater Contaminants in a Drinking-Water Treatment Facility, unpublished data submitted to NJDEP as DRAFT final report.