Radon in Water
A Regulatory History

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Water Monitoring Council
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Overview of the Presentation

- Radon in Air
- Radon in Water
- Regulatory History
Indoor Radon Became an Issue in 1984

Stanley Watrus measured 2700 picocuries of radon per liter (pCi/L) of air in his Pennsylvania home.
In 1985, the discovery of very high concentrations of radon in a home in Boyertown, Pennsylvania

New Jersey responded with a statewide study of radon

In 1986, passed legislation that authorized establishment of the NJ Radon Program and development of a mandatory certification program

Established a voluntary certification program - approximately 200,000 tests were conducted between 1986-1991
NJ Radon Program

• In 1991, established mandatory certification program
• Regulations require certification of all businesses and individuals that test or mitigate
• Extensive Radon Database
  • All of the following are from 1991 through October 2017:
    • # homes tested – 992,638
    • # homes mitigated – 80,117
    • # of tests (all types) – 1,874,470
• Developed Radon Potential Map for New Jersey
  • Updated every 5 - 10 years
  • Identifies areas of low, moderate and high radon potential
• Radon Hazard Code
Radon Entry Points

Air

Water
Fate of Indoor Radon

Radon-222 → Radon Decay Products → Airborne
- Breathable
- Measurable

Radon Decay Products → Plated Out
- Non-Breathable
- Non-Measurable
Radon Exposure

• Radon and Radon Decay Products (RDPs) are breathed in and the Radon is exhaled.

• Because they are solid particles, RDPs remain in lung tissue and are trapped in the bronchial epithelium and emit alpha particles which strike individual lung cells and may cause physical and/or chemical damage to DNA.
Strengths of Radon Risk Assessment

- Known carcinogen
- Extensive Epidemiological Studies
- Risk Model Derived from Human Data
- Well Characterized Exposure of General Population
- Analysis of Dosimetry in Mines & Homes
- Extensive Peer Review & Detailed Uncertainty Analysis
- International Consensus on Risk
Radon Action Level

• The USEPA set an action level for indoor radon concentration of 4.0 picocuries of radon per liter of air (pCi/L).

• USEPA selected 4.0 pCi/L because of the technological and economical bases.

• Risk at 4.0 pCi/L about seven (7) people out of a thousand could get lung cancer.
How many folks in this room tested their homes for radon in air?

As part of real estate transfer

Just wanted to know
Are there regulatory requirements to test for radon in air?

The answer is yes.

Is it for schools? No

Is it at the time of home sale? No

Only daycare centers are required to test for radon in air.
1st Attempt to regulate Radon in DW-1991

- 300 picocuries per liter
- 27,000 ground water systems affected
- greater than 600 comments received
- concerns re: cost, relative risk, impacts on small systems
- NJDEP one of the commenters who raised the option of risk trading
1996 SDWA

• Statutory Requirements -
  • Withdraw 1991 radon proposal (8/97)
  • Risk assessment by National Academy of Sciences
  • Health Risk Reduction & Cost Analysis (HRRCA)
  • Maximum contaminant level (MCL)
  • Alternative maximum contaminant level (AMCL)
  • Multimedia mitigation program
Radon Reality Check

• Indoor Air
  • 15,000 – 22,000 lung cancer deaths per year

• Radon in Water
  • 168 fatal cancers per year
  • 89% due to lung cancer
  • 11% due to stomach cancer
EPA’s Proposed Rule

• Set a Maximum Contaminant Level (MCL) for radon in water at the 2 in 10,000 risk level (300 pCi/L)

• Set an Alternate MCL (AMCL) at the 3 in 1000 risk level (4,000 pCi/L)
  • If utility is over 4,000 pCi/L, must fix
  • If utility is between 300 and 4,000 pCi/L, don’t have to fix water, but have to pay to enhance State radon in air program
Drinking Water Contaminants

- Mitigate Water
Radon in Water

- Mitigate Water
- Mitigate Something
MMMP: More bang for the buck.....

Risk Reduction Potential

Year 1  Year 2  Year 3  Year 4

Adopt AMCL And MMMP

Year 1  Year 2  Year 3  Year 4

Adopt MCL
# Radon 222 in Community Water Systems

<table>
<thead>
<tr>
<th>Location of Sample</th>
<th>Number of Samples</th>
<th>Observed Radon 222 (pCi/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>detects</td>
</tr>
<tr>
<td>Entry Point*</td>
<td>96</td>
<td>94</td>
</tr>
<tr>
<td>Raw Water*</td>
<td>189</td>
<td>189</td>
</tr>
<tr>
<td>Distribution System*</td>
<td>837</td>
<td>825</td>
</tr>
</tbody>
</table>

* Data from New Jersey Drinking Water Quality Institute, 2009, Maximum contaminant level recommendation document on radon-222, prepared by the radon subcommittee.

# Radon 222 in Domestic Wells

<table>
<thead>
<tr>
<th>Location of Well</th>
<th>Number of Samples</th>
<th>Observed Radon 222 (pCi/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>detects</td>
</tr>
<tr>
<td>Southern NJ*</td>
<td>111</td>
<td>111</td>
</tr>
<tr>
<td>Northern NJ*</td>
<td>1,214</td>
<td>1,214</td>
</tr>
<tr>
<td>Vernon Twp.+</td>
<td>82</td>
<td>82</td>
</tr>
</tbody>
</table>

+ Data from unpublished study of private wells in Vernon Township, Sussex County. Sponsored by NJDOH/CDC.
Radon in Water Treatment

• Granular Activated Carbon
  • Pros
    • Moderate to high removal efficiency
    • No pump or other electrical components needed
    • Improves taste and odor
    • Initial cost is low
  • Cons
    • Efficiency can be affected with common contaminants
    • Carbon needs to be replaced
    • Gamma emissions may limit use to lower radon levels
    • Disposal of carbon may be an issue
Radon in Water Treatment (Cont.)

• Aeration
  • Pros
    • High-efficiency
    • No radioactive accumulation
    • No waste
    • Removes other VOCs
  • Cons
    • Higher cost
    • Ventilation requirement
    • System is complex
    • Hardness of water may foul system
    • Bacteria may be come a problem needing treatment
USEPA Status

• EPA withdrew the 1991 proposed MCL for radon on August 6, 1997

• In 2003, Congress directed EPA to
  • 1. consult with State drinking water, air, and radiation programs, and
  • 2. evaluate options to implement a single drinking water standard for radon.

• EPA conducted two consultation meetings in September 2003 to address Congress’ directive

• Report to Congress: Radon in Drinking Water Regulations May 2012
• May 2009, Commissioner Jackson – charge to the DWQI
• Established a Radon Subcommittee
• Recommendation for Regulation of Radon in Drinking Water – February 9, 2009
  • NJDEP should initiate rulemaking to establish a MCL of 800 pCi/L of radon in water for community and nontransient noncommunity water systems.
  • Each public water system should be allowed to determine the best treatment technique, from several available options, to reach a MCL of 800 pCi/L.
  • The NJDEP should work with the Legislature to enact mandatory radon testing in indoor air for schools and for homes during real estate transactions, and to consider other mandatory actions to further reduce the public health risks posed by radon in indoor air.
  • The Subcommittee will address the application of this MCL to private wells in a separate report in the future.
Revaluation of the DWQI Recommendation

- The science behind this recommendation has not changed.
- NJDEP staff have done extensive additional internal work to support the information provided in the DWQI recommendation.
- Economic Benefit Analysis was performed.
- Other States.
Economic Impacts of an MCL

• Treatment Costs including size, monitoring, operation and maintenance
• Benefits estimated as fatal cancer cases avoided based on risk factors from National Academy of Science
• Calculated Cost-Benefit Ratios for different MCL options
  • Lower MCLs have higher costs, but also higher benefits
  • Higher MCLs have lower costs, but lower benefits
• System Size has a greater effect on per household cost for radon treatment than the MCL level
• Need to Optimize costs and benefits
  • 800 pCi/L has both an acceptable risk (around 5 in 10,000) and annual cost ($18.8 million)
## Occurrence in Other States

<table>
<thead>
<tr>
<th>State</th>
<th># Tests</th>
<th>Concentration Ranges (pCi/L) % exceedance</th>
<th>Advisory Level (pCi/L)</th>
<th>Population (2011)</th>
</tr>
</thead>
</table>
| New Hampshire  | 3400 (Private)   | 19% ≥ 10,000  
                  | 19% > 4,000 – 10,000  
                  | 37% > 1,000 – 4,000  
                  | 19% > 300 – 1,000    | 1,000  
                  | 1,318,194 |
| Maine          | 2231 (Public)    | 14% ≥ 4,000  
                  | 54% ≥ 800                           | None                 | 1,328,188 |
| Wisconsin      | 500 (Private)    | 1% ≥ 5,000  
                  | ~71% ≥ 300                           | None                 | 5,711,767 |
| New Jersey     | 660 (Public)     | 17% ≥ 800  
                  | 4% ≥ 4,000 (avg 876)                | 800 (DWQI Recommended MCL) | 8,821,155 |
|                | 1330 (Private)   | 70% ≥ 800  
                  | 25% ≥ 4,000                          |                      |
Next Steps

• DWQI is developing a work plan

• Finalize the reevaluation of the DWQI’s recommendation for radon

• Brief the new administration
Questions

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