

Introduction to Radon Mitigation and Water Treatment

By



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Jeff Twitchell, (Air and Water Quality)

Radon

In 1983, Jeff Twitchell performed his first radon testing on a super insulated home that he built for himself. This was the first home he mitigated. In 1986, he participated in the first hands on mitigation course offered in the State of Maine. This was only the second time this course had been offered. He was latter chosen as 1 of only about 50 people nationally to be trained by the EPA to provide instruction for other mitigators. He continued his mitigation instruction for the EPA for approximately 10 years. In 1989 he joined with Mike Gelberg to create Air & Water Quality (AWQ).

In the early years, Jeff was asked to travel to the Province of New Brunswick to provide diagnostics and mitigation designs for a number of their schools. This was the first of the many commercial jobs Air & Water Quality has done over the years. One of these jobs included the largest building in the greater Portland area. Air & Water Quality has also performed demonstration projects for the EPA in several Maine schools. As of late, AWQ was involved in a complicated remodeling job in the Penobscot County Court House. The design required the incorporation of the newly designed HVAC system to be an integral part of the mitigation system. Recent radon testing showed results of less than 1 pCi/L. All of this was done through the integration of room pressure sensors and the HVAC system to control both pressure and ventilation.

Water Treatment


In 1991, Jeff was frustrated by the lack of water treatment companies that could handle the pretreatment requirement of the water radon systems they were installing. As a result, he embarked on a quest to use his chemistry degree to see what he could provide for the company in the way of water treatment. After taking a limited 3 day crash course, he discovered how limited the availability of training and equipment really was. So after doing much of his own research and with many expensive in the field trial by fire tests, Jeff has developed one of the leading water treatment companies in Maine. He holds a Class II operators license, radioactive materials license, as well as a Maine license for radon water and radon air mitigation. He and his company are the only water treatment company in Maine to be licensed to handle radioactive materials produced from water treatment. He has made the company the “go to people” for many schools and small public water treatment systems. AWQ has handled many arsenic and uranium problems along with iron, manganese and odor issues for schools and other facilities across the State. We recently finished a project for the Medomak Valley Middle School; the sysetm is treating iron, manganese, arsenic, uranium and radon. Through innovative ways of using existing technology, we are often able to provide a superior solution at a lower price. In the past few months, we accomplished this in providing uranium treatment for the Oxford Hills school system. We had a solution that was far less expensive with far less maintenance than was offered by two competitors. In addition, it did not create any onsite disposal issues.



Radon System Design

Sub-Slab Systems

- Radon Mitigation- Air and water
- Soil Gas Mitigation- VOC




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Radon System Design

Water Treatment

- Water treatment-

Primary- -Arsenic -Bacteria -Radon -Uranium -Radium -Gross Alpha -Fluoride -VOC's	Secondary- -Iron -Manganese -Hardness -Hydrogen Sulfide -TDS
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Radon System Design

Types of Treatments

- Filtration
- Oxidation / Filtration
- Ion Exchange
- RO
- UF
- Acid Neutralization
- Adsorption
- Aeration



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Radon System Design

Radon Entry

- Emanation
- Water
- Soil Gas

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Emanation

- Least likely to be significant problem
- Building materials
 - Concrete
 - Brick
 - Sheetrock
 - Ceramic tile



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Water Radon

- Released from water as it is exposed to air
- 10,000/1 in typical residential applications
- Actual increase in air concentrations depends on
 - Concentration in the water
 - Quantity of water used
 - Type of use – kitchen prep, showers, washing machines



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Current MCL

- There is no official MCL
- EPA has proposed 300 pCi/L
- State of Maine is focusing on 4,000 pCi/L



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Soil Gas

- Usually the most significant source
- Pulled into buildings with other gases by pressure differentials
- Controlled by controlling pressure across soil/building barrier



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Current Action Level

- 4 pCi/L
- Recommendation is to reduce if practical to below 2 pCi/L



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Pressure Barriers

- Created by
 - HVAC System
 - Sub-Slab Depressurization




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Radon System Design

New Construction

- Sub-slab preparation
- Vent stack installation
- Activation




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Radon System Design

Sub-Slab Preparation

- Aggregate
- Piping
- Membrane




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Radon System Design

Slab

- Penetration sealing- pipes and pits
- Control joint sealing



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Vent Stack

- Minimum 4" diameter
- Pitched to remove condensation
- Fan outside of conditioned space
- Stack release point



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Typical Retrofit Outside Mount



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Retrofit

- Diagnostics
 - Testing for radon
 - Sub-Slab communication testing
 - HVAC system evaluation
 - Energy considerations



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Water Radon

Aeration-

Shallow Tray Technology by
Bisco – NEEP Systems





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New Well Approval

- Must have State approval for new well
- This will require substantial testing
- Will need to have pump test done on well



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What do we need to know?



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Getting the Information

- Estimated daily demand in gallons/day (GPD)
- Peak flow required
- Septic system sizing
- Well recovery rate
- Well pump output in gallons/min GPM
- Waste disposal
- Speciation for iron and arsenic



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New Well Approval

- Make sure to notify State for new well approval procedures



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Daily Demand

Daily demand is often difficult to determine if there is mixed use of new and old fixtures. It is usually best to take an inventory of the fixtures or use a water meter

- Sizing system
 - Storage
 - Treatment
- Operating Cost
 - Chemical and electrical use



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Peak Demand

- Storage sizing
- Repressurization (Booster) sizing
- Treatment sizing



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Septic Sizing

- Check and Balance on system sizing
- Confirm if adequate to handle volume of waste from treatment
 - Not uncommon to have waste volume be 2-3% of total use and in some cases this can be much more.



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Well Recovery

- Confirm well pump sizing is correct
 - Well pump flow should not exceed well recovery unless well is used for storage
 - Large static level variations may require up thrust protection.
 - Low water protection should be provide for well pump - usually current monitoring



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Waste Disposal

- Onsite
 - Single field or multiple field
 - Radioactive nuclide - 300 pCi/L limit for disposal
- POTW
 - Obtain approvals for waste



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Well Pump Output

- Used to size treatment system
- Used to determine if pump can handle pressure drop required for treatment



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Speciation -Iron and Arsenic

- Determines treatment technique
 - For arsenic this will determine if oxidation is required before treatment
 - For iron this will determine whether or not a softener will work.



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