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Radiation Control program
11 State House Station
Augusta, Maine 04333-0011*

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To : Registered Radon Service Providers

From : Bob Stilwell, Radon / Indoor Air Quality Coordinator
Radon/IAQ Section, Maine Radiation Control Program

Subject : Use of GAC Units for Removing Radon in Water

As specified in the Air and Water Radon Service Provider Registration Rules (10-144A CMR 224), the Maine Radiation Control Program, Radon / IAQ Section is to provide guidance on disposal options and disposal schedules for granular activated charcoal (GAC) used to remove radon from drinking water. Attached to this notice is the guidance for use in Maine. This guidance was sent for review over a year ago to the Maine Attorney General's Office and to all Maine registered radon in water mitigators. The AG provided no comment, and only one mitigator provided comment regarding the extensive nature of the paperwork associated with this guidance. No suggestions for modifications were made by any reviewer.

This guidance is being provided to all Maine registered radon service providers, not just to those providing radon in water mitigation services as it will be useful to any on-site service provider. Those who do not provide on-site services need to be aware of the guidance in case they receive questions from clients.

Should problems or concerns be found after implementation of this guidance, please contact me (see contact information below) as soon as possible, and follow that contact with a written description of the issue on company letterhead.

Thank you for your assistance in providing high quality radon services to Maine citizens.

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MAINE RADIATION CONTROL PROGRAM, RADON IAQ SECTION
GUIDANCE FOR THE INSTALLATION OF
GRANULAR ACTIVATED CHARCOAL FILTERS
TO REMOVE RADON FROM WATER

Effective November 1, 2005

General Information

To protect the public from potential health threats caused by radon, it is recommended that all water supplies with elevated concentration of radon have those concentrations reduced. One method is granular activated charcoal (GAC) filtration. This method removes radon through adsorption. The radon generally remains adsorbed on the GAC until it undergoes normal radioactive decay, at which time the decay products become trapped in the GAC (unless removed by acid wash or extreme heat).

Two short-lived radon decay product release gamma radiation when they undergo their own decay. This gamma radiation will penetrate the walls of the GAC filter, and can pose a potential health hazard to occupants of the structure where the GAC filter is installed. This guidance addresses this issue.

After the short lived decay products of radon are gone, a long lived decay product, lead 210, remains. Lead 210 will remain trapped in the GAC for decades, and will continue to increase in concentration as long as the GAC bed is in use. Eventually, it will reach a concentration where it reaches low-level radioactive waste criteria. This guidance addresses this issue.

Other contaminants can also be removed from water by GAC. Removal of other contaminants will result in reduced radon removal efficiency, and may result in secondary contamination of drinking water. This guidance addresses this issue.

It is imperative that all current and future occupants of the structure be aware of the benefits and hazards associated with using GAC to remove radon. This guidance addresses this issue.

Despite the above noted radiation hazard issues associated with GAC, it is considered a valid, reliable method for removing radon from water. In order to protect the occupants of structures where GAC is used to remove radon from water, a combination of information, documentation, labeling, and removal schedules will be used. It should be noted that, while this guidance does not specify a radon concentration above which GAC should not be used to remove radon, other removal methods are more appropriate for very high radon concentrations. This guidance is intended to identify when GAC is appropriate and when it is not.

Determining the extent of gamma radiation hazards:

Whenever a mitigator intends to install a GAC filter to remove radon from water, the mitigator shall use the Carbdose program (free from US EPA Region I) to determine the likely gamma radiation emissions, and clearance distance required from the GAC filter wall before the gamma radiation will be reduced to current limits allowed for exposure to the general public under 10 CFR part 20. If the mitigator does not have Carbdose, or is unable to operate this software, they shall provide the necessary information to the Radon/IAQ Section so Radon/IAQ Section staff can provide the mitigator with the gamma radiation hazard information and clearance distance. There shall be a \$20 charge for this service.

The data used to determine gamma radiation hazard shall be the maximum radon in water concentration measured prior to installation; removal efficiency of 95%, and the approximate number of gallons per day to be treated based on 75 gal/day per person. If during a real estate transaction, base the approximate number of gallons per day on the number of persons in the family buying the home; or on two persons per bedroom; whichever is greater.

The clearance distance information obtained shall be posted on the GAC unit. The specifications for information posted on the GAC unit follow in a later section of this guidance.

As a final safety measure, the Radon/IAQ Section will inspect the GAC unit and perform gamma radiation measurements within 90 days of first continuous use, to confirm that the clearance distances posted on the unit are reliable.

Use of shielding to reduce gamma radiation hazards

An accepted practice for reducing gamma radiation hazards is to provide shielding of some dense material around the GAC unit. The materials generally used for shielding are lead foil, bricks, or water (in a water bath). The concept of shielding works because it has been shown that gamma radiation has difficulty passing through heavy, dense materials.

The use of shielding shall not exempt the mitigator from determining the extent of gamma radiation hazards, or clearance distances. However, the required notice can be modified to show the clearance distance if the shielding is removed. All labels and notices that are required for the GAC unit shall also be applied to the outside of the shielding.

Determining the period to reach low level radioactive waste criteria.

Whenever a mitigator intends to install a GAC filter to remove radon from water, the mitigator shall use the Carbdose program (free from US EPA Region I) to determine the likely period for lead 210 accumulation on the GAC bed to reach low-level radioactive waste criteria (2000 pico curies per gram-or pCi/g). If the mitigator does not have Carbdose, or is unable to operate this software, they shall provide the necessary information to the Radon/IAQ Section so Radon/IAQ Section staff provide the mitigator with the likely period for lead 210 accumulation to reach low level radioactive waste criteria. There shall be a \$20 charge for this service.

The data used to determine lead 210 accumulation rate shall be the maximum radon in water concentration measured prior to installation; removal efficiency of 95%, and the approximate number of gallons per day to be treated based on 75 gal/day per person. If during a real estate transaction, base the approximate number of gallons per day on the number of persons in the family buying the home; or on two persons per bedroom; whichever is greater.)

The likely period for lead 210 to accumulate to low level radioactive waste criteria shall be posted on the GAC unit. The specifications for information posted on the GAC unit follow in a later section of this guidance.

Other water contaminant issues

In general, any other water contaminant will be removed from water by GAC before it removes radon. This results in lower radon removal efficiency, and can eventually result in the failure of the GAC to remove radon. Some contaminants can actually plug up the GAC itself, reducing or stopping water flow through it. For these reasons, all other water contaminant issues should be addressed before installing GAC to remove radon.

Another concern is GAC will allow bacteria to grow, particularly if nutrients needed for bacterial growth are also in the water. This means that water sources with known bacteria problems should not have GAC for radon removal unless the bacteria has been removed or killed before the water passes through the GAC. Note: GAC has been used to remove radon from water in Maine for over 30 years. At this time no instances of bacterial contamination of GAC units used for radon removal have been reported to this office.

Notification to current and future occupants.

In order to ensure that current and future occupants of any structure containing an operating GAC unit used for radon removal are provided information necessary to avoid the potential hazards posed by these units, a notice shall be provided to them, as well as posted on the GAC unit itself. The notice posted on the GAC unit shall be easily visible from more than five feet away, and shall contain the following information in an easily read and understood format:

- Radon in water removal system
- Installation Date
- Installer (Company)
- Maine Radon Registration Number of Company
- Estimated Gallons Per Day Treated
- Influent Water Radon Concentration (concentration before the GAC filter)
- Treated Water Radon Concentration
- A statement that the unit is a possible radiation hazard
- The distance from the unit necessary to meet public radiation exposure guidelines (from the Carbdoose program)
- A statement that the unit may generate low level radioactive waste
- The period from installation after which the GAC bed is likely to be considered low level radioactive waste (from the Carbdoose program, using the layered option)
- A statement that the GAC bed should be replaced before that time period ends to avoid the issue of low level radioactive waste.
- A 'replace before' date to avoid the issue of low level radioactive waste.
- A statement that the address (street and mailing) shall be provided to the Maine Radiation Control Program, Radon/IAQ Section so that a system inspection and gamma radiation measurement can be scheduled within 90 days after the unit begins to be used.

Additionally, a copy of this guidance shall be posted within five feet of the GAC unit, and all information and labels required by the Maine air and Water Radon Registration Rules and the US EPA Radon Mitigation Standards are also required.

Suggested notice:

Radon Removal System
Caution :This GAC Filter May Be A Radiation Hazard

This GAC filter has been installed for the purpose of radon removal. Radon decay products collecting on the media in this tank may produce enough radiation to be a concern to the occupants of this room. Call the Maine Radiation Control Program, Radon/IAQ Section at 1-800-232-0842 for more information.

Installation Date _____

Installed By (company name, phone number here)

Maine Radon Registration Number _____

Estimated Gallons Per Day Treated _____

Influent Water Radon Concentration _____ Date _____

Treated Water Radon Concentration _____ Date _____

To avoid unnecessary radiation exposure from radon decay products, do not spend more than a few minutes within _____ feet of this unit.

Radon decay products will accumulate on GAC in this unit, and can build up to an amount that can be classified as low level radioactive waste. To avoid this, the GAC in this unit should be replaced every _____ months/years.

Replace before (date) to avoid the issue of low level radioactive waste.

The street and mailing address of the structure where this GAC unit has been installed shall be reported to the Maine Radiation Control Program, Radon/IAQ Section so they will be able to contact the occupants of this structure and schedule an inspection of this GAC unit within 90 days after it is installed. This inspection will include a gamma radiation measurement to confirm the clearance distance (noted above) that is required around this unit.

A pre- and post- treatment radon water test is recommended twice a year to confirm that this unit is operating as intended.

A copy of the Maine Radiation Control Program, Radon/IAQ Section guidance for removal of radon using GAC is attached to the unit, or within five feet.