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Navy Radon Assessment and Mitigation Program Questions and Answers Navy Policy and Guidelines

Q: Why is the Navy concerned about radon?

A: The health of its military personnel, civilians, and their families, is a primary concern of the Navy and Marine Corps. When various federal and state studies showed that indoor radon could be a health risk, the Navy decided to start a program (Navy Radon Assessment and Mitigation Program [NAVRAMP]) to identify Navy and Marine Corps buildings with elevated radon levels and to correct and manage the problem as quickly as possible.

Q: What does NAVRAMP stand for?

A: **NAV**y **R**adon **A**ssessment and **M**itigation **P**rogram

Q: Where is Marine Corps Radon Policy found?

A: The current Marine Corps Radon Policy is established in Volume 6, Chapter 3, Paragraph 0307 of Marine Corps Office (MCO) 5090.2 (11 June 2018).

Q: What does Navy radon policy require?

A: Navy radon policy requires that all Navy and Marine Corps installations worldwide perform radon testing and, if needed, radon mitigation. If mitigation systems are installed, the policy also requires periodic inspection and preventive maintenance. The policy also requires where applicable that radon-resistant features be incorporated into new construction.

Q: How is the Navy radon program implemented?

A: The *Navy Radon Assessment and Mitigation Program* Guidebook (NAVRAMP) divides radon testing into three phases:

Screening: Testing a statistically significant number of buildings determines the elevated radon potential of an installation.

Assessment: All occupied buildings are tested at an installation with a known elevated radon potential.

Monitoring: An ongoing testing process is conducted at installations with known elevated radon potential to ensure that buildings with radon mitigation systems are still working properly and that no new, renovated, or previously tested building develops an elevated radon problem in the future.

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Q: What are the Navy and Marine Corps radon action levels?

A: Consistent with the recommendations made by the United States Environmental Protection Agency (EPA), the Office of the Chief of Naval Operations (OPNAV) establishes an annualized average of 4 picocuries per liter in air (pCi/L) as the action level.

Q: If a building has radon concentrations equal to 4 pCi/L for part of the year, but less than 4 pCi/L for the rest of the year, is mitigation required under Navy and Marine Corps policy?

A: Consistent with EPA recommendations, the decision to take corrective action (e.g., mitigate) is based upon the annualized (1 year) result. If a 1 year test or data extrapolation finds radon concentrations equal to 4 pCi/L, yes. However, if the opposite is true, mitigation would not be required.

Q: What is the Navy policy timeline for corrective action?

A: With close consultation with the Navy Bureau of Medicine and Surgery, the following corrective action schedule was developed:

Category	Radon level (pCi/L)	Action
1	0 to <4	No action required
2	4 to <20	Mitigation within 2 years
3	20 to <200	Mitigation within 6 months
4	>200	Mitigation within 3 weeks

Note: The schedule for corrective action (e.g., the mitigation clock) should be based upon the testing report date. In cases where confirmation is required, mitigation should be based upon the report date of the initial test.

Q: Are there written procedures for radon testing and mitigation within the Navy and Marine Corps?

A: As required by OPNAV, Commander Naval Facilities Engineering Command has developed and distributed the September 2017, *Navy Radon Assessment and Mitigation Program Guidebook for Naval Shore Installations*, which addresses every facet of radon testing and mitigation for all shore installation buildings.

Q: Why are the Navy testing procedures slightly different from EPA and other radon industry standards?

A: For the most part, EPA and other industry standards were written to address radon testing within individual homes or small populations of buildings where, in the event of an elevated result, retesting is performed in most cases. However, in large testing populations, retesting can delay

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the implementation of possible corrective action, in some cases for years. Therefore, to reduce the overall risk to the population, the Navy decided to implement a quality assurance (QA) and quality control (QC) program that greatly increases the probability of obtaining an accurate and defensible testing conclusion with a single set of measurements. Therefore, mitigation, if needed, can proceed without the need of further retesting.

Q: Is elevated radon found only in Navy and Marine Corps buildings?

A: Elevated radon is not found just in Navy and Marine Corps buildings. Buildings in surrounding civilian communities would have the same radon potential based on similar geologic formations. In fact, the Navy reviews data collected by the EPA, state and local governments, and host nations to prioritize installation testing worldwide. The EPA Map of Radon zones can be reviewed here:

<https://www.epa.gov/radon/epa-map-radon-zones>

Q: Does NAVRAMP apply to all Navy and Marine Corps installations worldwide?

A: Yes, and it also applies to leased buildings not located on federal property.

Q: Is the Navy and Marine Corps responsible for radon testing in private-public venture housing, leased, or international-use properties?

A: OPNAV affords the same level of protection from radon exposure to Navy and Marine Corps personnel (including military, civilian, and dependents) who are occupying testable buildings that are not Navy-owned. However, consultation with appropriate legal counsel should occur first to determine who has the main responsibility for radon testing and mitigation (if applicable).

Q: At my previous assignment, radon was being managed differently. Does the Navy and Marine Corps have different policies for each installation?

A: Implementation of NAVRAMP will vary from installation to installation, depending upon what testing phase an installation is in (screening, assessment, or monitoring) and whether any elevated radon has been found.

Q: Why is the Navy and Marine Corps not testing all the buildings at the installation?

A: Radon sampling at a given installation will depend upon what testing phase the installation is in (screening, assessment, or monitoring). In screening and monitoring at sites with no history of elevated radon, only selected types of buildings are chosen for testing. If elevated radon is found, then all buildings (assessment phase) will be tested for radon.

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Q: Does NAVRAMP cover rental or private homes?

A: No. However, the Navy and Marine Corps do encourage personnel who live off-base to test their homes. To find information about Local Radon Zones and State Contact Information, visit:

<https://www.epa.gov/radon/find-information-about-local-radon-zones-and-state-contact-information#radonmap>

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Radon and Its Health Risks

Q: What is radon?

A: Radon is a colorless, odorless, tasteless gas that is produced by the breakdown (radioactive decay) of naturally occurring uranium found in rock, soil, and water. Outdoors, radon is harmlessly diluted by the atmosphere. However, in enclosed places such as homes and buildings, radon can accumulate to unacceptable levels.

Q: How common is radon?

A: The EPA has estimated that nearly 1 of every 15 homes in the United States is estimated to have elevated radon levels. Elevated radon has also been found in almost every country in the world. No area in the world is considered radon-free.

Q: What is the health risk from exposure to radon?

A: Exposure to elevated radon over many years can lead to an increased life time risk of contracting lung cancer. Radon is the number one cause of lung cancer among people who do not smoke. It is the second leading cause of lung cancer for people who do smoke. The EPA estimates that radon causes more than 20,000 deaths from lung cancer each year in the United States. If you smoke and your home has a high radon level, your risk of lung cancer can increase even more.

Q: Are there any other health risks from exposure to indoor elevated radon other than lung cancer?

A: According to the EPA, there are no other known health risks from exposure to elevated radon in air.

Q: How do radon-induced lung cancer deaths compare with other cancer deaths in the United States?

A: Cigarette smoking is the most common cause of lung cancer. Radon represents a far smaller risk for this disease, but it is the second leading cause of lung cancer in the United States. Scientists estimate that 15,000 to 22,000 lung cancer deaths in the United States each year are related to radon.

Q: How do the lifetime risks from radon exposure compare with other lifetime risks?

A: According to the EPA, if 1,000 people who never smoked were exposed to 4 pCi/L over a lifetime, seven of them would develop lung cancer. This risk would equal the same risk as dying in a car crash. If 1,000 people who never smoked were exposed to 10 pCi/L over a lifetime, 18 of them would develop lung cancer. This risk is equal to 20 times the risk of dying in a home fire.

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Q: Are there different isotopes of radon, and is the Navy testing for them?

A: There are 33 known natural and manmade isotopes of radon. However, only two natural isotopes (^{220}Rn and ^{222}Rn) have half-lives long enough to enter the indoor environment, and the long-term detection devices used by the Navy will detect both. Of those two isotopes, ^{222}Rn is by far the most common.

Q: Am I being exposed to elevated radon?

A: The only way to know if elevated level radon is present in the building is to test.

Q: Is elevated radon found only in family housing?

A: No, in fact Navy studies have shown that the frequency of elevated radon within individual rooms in non-residential buildings is about the same as in family housing at the installation.

Q: What are the sources of indoor radon?

A: In most cases, radon originates from the soil and rock immediately surrounding or under a building. However, it can also come from groundwater and, in very rare cases (i.e., <1%), from building materials.

Q: How does radon enter a building?

A: Typically, radon gas comes from the soil and rock immediately surrounding or under a building. Wherever air and moisture seep in through drains, joints, cracks, and pores in the foundation and exterior walls, radon can enter as well. If the foundation and building construction is tight, the radon cannot escape and it may build to unacceptable levels.

Q: What are the risks from radon in water exposure?

A: According to the Centers for Disease Control, 30 to 1,800 stomach cancer deaths per year in the United States are attributed to the ingestion of radon in water. However, almost all of those deaths are attributed to the use of drinking water from private wells or public water supply systems that use untreated groundwater.

Q: Where can I get additional information on radon?

A: The EPA has numerous publications available online: <https://www.epa.gov/radon>

Q: Are there laws and regulations for radon?

A: The only federal law is the Indoor Radon Abatement Act of 1988. The law declares the national goal to be that the air within buildings in the United States be as free of radon as the ambient air

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outside the buildings, and it requires each federal agency that manages any buildings to test them for radon. However, the law does not stipulate that corrective actions be taken. At the local and state level, however, some cities and states require radon testing and mitigation if needed as part of the sale of a home.

Q: Is the Navy and Marine Corps responsible for the elevated radon in my home or building?

A: No, radon is naturally occurring. It comes from the soil and geological formations surrounding or under the building.

Q: Do tight building shells enhance indoor radon retention?

A: Yes, studies have shown that the tighter the building shell, the lower the natural ventilation exchange rate, which in turn can increase the rate of radon retention.

Q: What is the radon action level in the United States?

A: The EPA has established 4 pCi/L as the action level in the United States. However, EPA recommends that mitigation be considered for any result ≥ 2 pCi/L.

Q: Do other countries have different elevated radon action levels?

A: Countries that have established action levels (most have not) that vary from 2 to 20 pCi/L. The World Health Organization currently recommends 2.7 pCi/L for developed nations.

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Radon Testing

Q: Why is the Navy testing for radon?

A: The health of its military personnel, their dependents, and Navy and Marine Corps employees is a primary concern of the Navy and Marine Corps. Because radon is odorless, tasteless, and invisible, the only way to know is to test.

Q: Why is the Navy and Marine Corps testing each site at the installation differently?

A: Generally speaking, indoor radon potential can vary because of geology and building type. The Navy protocol recognizes this variability and allows each installation the flexibility to select the most appropriate testing strategy for each site.

Q: Can indoor radon levels be seasonal?

A: Yes, numerous studies have shown that indoor radon levels can vary significantly as a function of seasonal weather patterns (e.g., rain, snow, prevailing winds, and outdoor temperature). This effect can also be enhanced by certain types of underlying geology (e.g., karst). Also, indoor radon levels can vary significantly over a few hours or days because of changing weather patterns (e.g., rain and wind) as well. For these reasons, the EPA and the Navy recommend that radon testing period be performed for as long as possible.

Q: Can indoor radon levels be enhanced by certain types of geology?

A: Yes, studies have shown that buildings constructed over certain types of geology (e.g., karst, lava tubes, layered basalts and volcanic tuff, weathered granite, and coquina) can exhibit enhanced indoor radon levels. Also, in some cases, these enhancements may be totally seasonally dependent on ambient outdoor temperature, wind, or precipitation.

Q: Can renovations impact the radon level within a home or large building?

A: Sometimes. EPA and Navy studies have shown that renovations that reduce the natural ventilation rate of a building (e.g., envelope weatherization), can result in an increase in radon levels.

Q: Is radon in water a problem?

A: Elevated radon levels in drinking water are not usually a problem when the water source is surface water or the water is treated. A problem with radon in water is more likely when the water source is groundwater (e.g., a private well or a public water supply system that uses untreated groundwater). However, according to the EPA, because typical water usage readily releases radon into the indoor air, testing for radon in air within the building is a valid substitute for testing for radon in the water supply.

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Q: Why is the Navy testing for 1 year?

A: Numerous studies have shown that indoor radon levels can vary significantly from season to season (e.g., up and down) for geological and other reasons. Therefore, testing for shorter periods of time increases the chances that a building that averages equal to 4 pCi/L over a year might be missed (e.g., half the year the building is at 2 pCi/L, and the other half of the year the building is at 6 pCi/L).

Q: Why is the Navy testing for less than 1 year?

A: Under certain prescribed circumstances, an installation may elect to perform radon testing for periods of less than one year. For example, at some installations there are no distinct seasons, or previous studies at the installation have shown no significant seasonal dependency.

Q: Why is the Navy installing two detectors at each sample location?

A: One reason is that if an elevated radon concentration is found, and the two detectors agree, the elevated concentration is confirmed and follow-up testing is not required. That means that mitigation can be performed sooner. Another reason is that having a large pool of co-located duplicate data greatly enhances the overall precision of the survey.

Q: Are the testing devices used by the Navy accredited?

A: Yes, all devices used for reportable radon test results have been vetted by the National Radon Proficiency Program and/or National Radon Safety Board.

Q: How reliable are the Navy test results?

A: Because of enhanced QA/QC and data validation methods, published Navy results are typically within $\pm 15\%$ in the range of interest (e.g., 3–8 pCi/L) versus $\pm 25\%$ within the private industry.

Q: All my neighbors have elevated radon; why does my home not have elevated radon?

A: There are no simple or easy answers as to why some homes located on the exact same geology have elevated radon and other identical homes do not. Possible reasons include variations in the micro-geology under the homes, variations in soil compaction during initial construction, undetectable settling of the homes over time, and quite possibly smaller or fewer openings in some slabs. The bottom line is that these types of results are typical and not an unusual occurrence.

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Q: Why is the Navy testing every room in nonresidential buildings but only one location in family housing?

A: Within family housing, studies have shown that if an appropriate location is selected for radon testing, there is little if any variation in radon levels. However, in non-residential buildings, studies have shown that, most of the time, elevated radon within a large building is limited to one room or a few rooms. The reasons for this finding vary, but most of the time the reason is related to the buildings' mechanical systems.

Q: What are the criteria for testing a room in a nonresidential building?

A: Navy and Marine Corps policy is to test all occupied or readily occupiable rooms within a non-residential building that are routinely occupied for 4 hours per day, on average, in a single year. Bathrooms, locker rooms, dedicated storage rooms, janitor closets, and electrical or communication closets are typically not tested because they usually do not meet this criterion.

Q: Why did the Navy select more than one testing location in the main sales area of the commissary and/or exchange?

A: Studies have shown that within rooms larger than 2,000 feet, elevated radon could be localized. Therefore, the Navy and Marine Corps testing protocol requires more sampling locations within large rooms to address this concern.

Q: EPA, local, state, or host government radon test data indicate a different frequency of elevated radon in the surrounding communities. Why are the Navy results so different?

A: Typically, these estimates are based on residential results collected over a large geographical area (e.g., state or county level) employing a small number of measurements per unit of area. In contrast, the Navy and Marine Corps radon data are collected within a much smaller geographical area, using a much higher sample density per unit of area, and include both residential and non-residential data. Therefore, some differences are to be expected.

Q: Radon testing was performed at this installation in the 1990s . Why are you retesting?

A: Many changes in construction have occurred over the few decades. Most notable is that newer building envelopes are much tighter and have a lower natural ventilation rate. Studies have shown that the lower the natural ventilation rate, the greater the chance of having elevated radon. In addition, as buildings age, they tend to settle, creating cracks in the floors and foundations in the process. These cracks may provide openings for radon to enter the building.

Radon Mitigation

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Q: If elevated radon is found, how is the Navy planning to fix it?

A: There are many techniques for reducing radon within a home or workplace. To assist in the selection, radon mitigation diagnostics (scientific tests) are usually performed to assist in the selection process. Since the creation of NAVRAMP in 1988, the Navy and Marine Corps have installed thousands of mitigation systems worldwide.

Q: What is the most common mitigation technique in the Navy?

A: Approximately 95% of all mitigation in the Navy and Marine Corps have been subslab depressurization (SSD). SSD mitigation uses a pipe inserted through the slab and connected to a fan. When the fan is activated, the area beneath the slab (subslab) is depressurized. The resulting depressurization prevents radon entry into the living area by redirecting the subslab radon into the pipe for discharge into the atmosphere, where it is harmlessly diluted.

Q: Why is SSD mitigation the most common technique in the Navy?

A: Studies have shown that SSD systems are by far the most durable mitigation method and require the least maintenance over the long term. Compared with other active mitigation techniques, SSD is also the most energy-efficient. SSD is also the most common technique used in the private sector.

Q: Other than SSD, are there other types of radon mitigation?

A: Other common active mitigation techniques use increased ventilation (energy recovery ventilation) or use conditioned outdoor air to pressurize the building (shell pressurization). However, these techniques use more energy and require increased maintenance as well.

Q: Do I need to vacate my home or office for mitigation?

A: In most cases, no. However, loud noise and dust generation will occur during mitigation.

Q: How long will mitigation take?

A: In most cases, a system can be installed in a home or office in 4 to 8 hours. However, some of the more challenging installations can take several days.

Q: Do I need to do anything special after the mitigation system is installed?

A: No. However, the most common type of radon mitigation system (SSD) in the Navy and Marine Corps has a performance indicator. If you happen to see that the system is not working, please report it so that it can be repaired.

Q: Does the Navy and Marine Corps require post-mitigation testing?

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A: Yes, post mitigation testing is required, and it must meet the same stringent QA/QC criteria as the initial test.

Q: What is RRNC?

A: **Radon Resistant New Construction** entails the incorporation of various building techniques into new construction which can reduce the indoor radon levels and make the building easier to mitigate if required.

Q: I was told that this building was constructed with radon-resistant features. Why does it now have elevated radon?

A: Incorporation of radon-resistant features into new construction does not make the building “radon-proof.” In most cases, it only makes the building easier and less expensive to mitigate. However, some studies do suggest that the frequency of elevated radon is lower within buildings with radon-resistant features, which include vent stacks.

Q: I have elevated radon in my home or office. Does opening the windows and doors in my home or office lower the radon concentration?

A: Over the short term, yes. However, the rate at which radon can build back up to a level of concern varies from building to building (e.g., from a few hours to days). At best, this fix is short term.

Q: How will the radon mitigation impact my mission?

A: A key part of mitigation system selection is installing a system with minimal or no impact.

Q: Will the installed mitigation system impact my quality of life?

A: A key part of mitigation system selection is installing a system with minimal or no impact.

Q: How much electrical energy will the mitigation system require?

A: The amount of energy varies depending on the type of mitigation system selected. However, for most SSD systems installed in the Navy and Marine Corps, the range is about 40–60 watts.

Q: In large buildings, can an adjustment of the building mechanical systems (supply, return, and exhaust) mitigate elevated radon in the building?

A: Sometimes. In some cases, the root cause of the elevated radon was found to be an out-of-balance mechanical system. Simple restoration of the mechanicals to the original design specifications fixed the problem. However, each building is different, and mechanical adjustments do not work in all large buildings.

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Q: After mitigation, will the Navy and Marine Corps perform follow-up testing to ensure that the system is still working over time?

A: Yes, the monitoring phase of NAVRAMP requires periodic inspections, including retesting to ensure that the radon levels have not increased to a point of concern.

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Questions to Refer to Subject Matter Experts

Q: A family member has had serious health issues since we have been stationed here. Is radon the cause?

A: I am not a medical professional. We recommend you consult your health care provider.

Q: Can I claim this on a VA disability?

A: I am not sure. You need to consult with the VA.

Q: We have worked/lived in this home/office for “X” years. Are we going to get lung cancer?

A: I am not a medical professional. We recommend you consult your health care provider.

Q: Can I sue the Navy over radon exposure?

A: I am not a legal expert; however, you can always consult with the installation’s legal counsel.