

Producing a Video to Communicate Radon Health Risks in Williamsburg

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Introduction

Radon gas is a common hazard in residential basements, where radon seeping out the ground can enter into houses and eventually cause lung cancer. The William & Mary Geology Department has been investigating the presence of radon in the Williamsburg area for years. Since the 80s, Rick Berquist has been conducting and encouraging research projects that build this knowledge. These efforts have culminated in the development and validation of a radon risk map of the Williamsburg area (Miller, 2021; Mondshine, 2021). Online videos are an increasingly common medium for information and entertainment consumption, and have potential for effective science communication (Finkler and Leon, 2019). One of the ways to make science communication engaging is to tell a story. Storytelling allows people to connect to a concept, and informs their decisions (Joubert et al., 2019). There is a general lack of understanding in the United States of radon and the health risks it poses (Vogeltanz-Holm and Schwartz, 2018). For this project, I will produce a video that tells the story of radon to the Williamsburg community. It will communicate what radon is, previous research at William & Mary, and how people can learn more about it. This project will include the development of storytelling methods and accessibility standards that the video will follow.

Research Goal

The purpose of this video will be to communicate how radon is a potential health hazard to the Williamsburg public. To do so, it will establish what radon is and how it is naturally formed, as well as how it is a health risk. The video will then summarize previous research on Radon in the Williamsburg area, including student research projects at William & Mary. The video will conclude with encouragement for viewers to learn more about radon, and to get their homes tested. To do all of this effectively, a thorough review will be conducted of the previous research done concerning radon in the Williamsburg area, and how it fits

into the broader landscape of radon literature. This review will include radioactive decay processes, the stratigraphy of Williamsburg, and the methods of previous researchers. I will also research best practices in video communication of science, as well as what accessibility guidelines should be followed. This will inform the scriptwriting process, and create objectives to be met by the final video. The video will be an approachable introduction to why radon is an important topic for everyone in Williamsburg to be aware of.

Geologic Background

Radon is a chemical element with the atomic number 86. It occurs naturally as a short intermediate step in uranium decay chains (Figure 1). It has three isotopes: ^{219}Rn , ^{220}Rn , and ^{222}Rn (Weigel, 1978). ^{222}Rn is the most impactful on humans, and the isotope of radon I'll be referring to for the remainder of this project. ^{222}Rn has a half-life of 3.82 days, meaning that after that amount of time half of a given quantity of ^{222}Rn will have decayed into the next decay product. The products directly following ^{222}Rn are solids, and also short-lived. Two of them, ^{218}Po and ^{214}Po , emit alpha particles when they decay. When ^{222}Rn is inhaled into the lungs, this process can take place within the lungs. Alpha particles can damage the cells lining airways within the lungs, eventually leading to cancer. This is how exposure to radon increases one's risk of lung cancer (National Research Council (US) Committee on the Biological Effects of Ionizing Radiations, 1988). Radon exposure is the second-highest cause of lung cancer in the United States, behind smoking tobacco.

Concentrations of radon are commonly measured in becquerels per kilogram (Bq/Kg), or picocuries per liter (pCi/L). Becquerels and curies are both measurements of radioactivity, i.e. they represent the frequency of radioactive decays.

The Environmental Protection Agency's published radon risk map shows Virginia's coastal plain as the lowest-risk region in the state, labeled as "Low Potential (less than 2pCi/L)" ("Virginia - Radon Zones"). The Virginia Department of Health has published the same map on their website ("Indoor Radon Program – Radiological Health"). Someone living in the Williamsburg area who reads this map would likely conclude that their home is at negligible risk of radon exposure. While this might be true for much of the coastal plain, research has shown there are areas of higher risk that would be colored in red on the aforementioned map.

In 1978, Khandelwal and Singh published a short article in Health Physics sharing that they had discovered radioactivity in whale bone vertebra in the Chesapeake Bay area, including in the Yorktown Formation. Research on radon at William & Mary started around 1989 when Jennifer M. Cooper wrote a report about

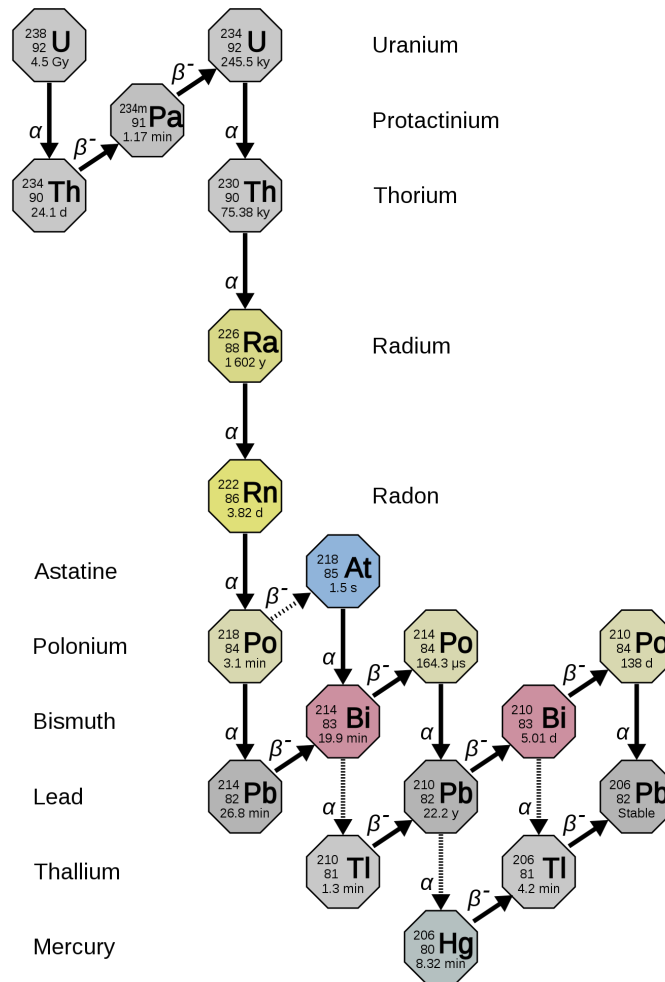


Figure 1: Decay chain of uranium (User:Tosaka, 2014)

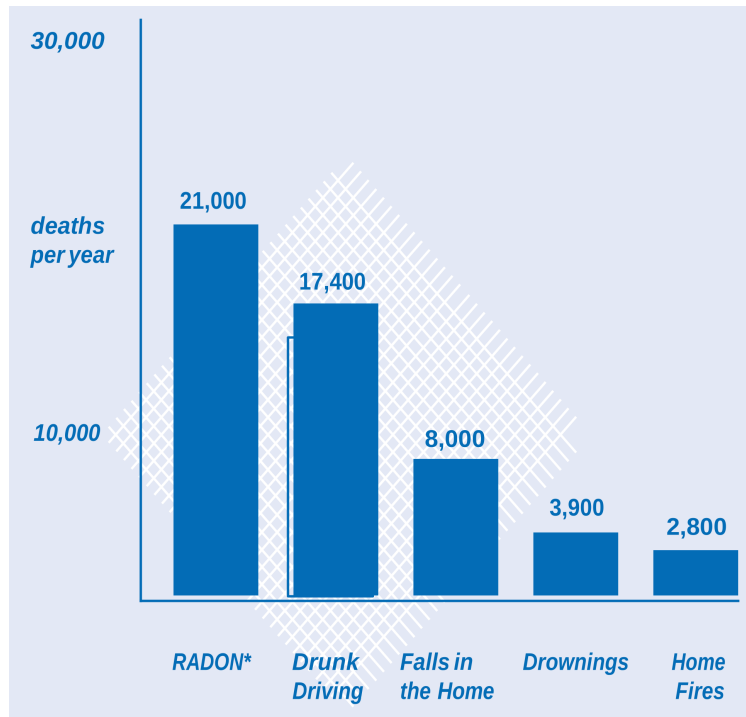


Figure 2: Yearly radon-related deaths compared to other common causes in the US (US EPA, 2014)

the Yorktown Formation as a potential source of radon in the Williamsburg area (Cooper, 1989). She tested a number of different locations in York River State Park, correlating the Yorktown formation with radon emission using her own data.

The second student at William & Mary to investigate radon was Tracy Whitesell. Her project involved testing different locations for radon, and she compared different formations by makeup and average radon concentration. Her results clearly show that the Yorktown has higher radon concentrations than nearby formations. Whitesell was one of the first to so thoroughly illustrate the radon landscape in the Williamsburg area, and her work was remarkable in confirming the suspicions of previous researchers. In the final sentence of her thesis, she recommended that “houses built within or on the Yorktown should be tested for radon” (Whitesell, 1990).

In 2020, Dorian Miller created a “risk map” of radon near William & Mary’s campus. This map was created by mapping elevation data at certain thresholds, because the Yorktown Formation is a horizontal layer that becomes closer to the surface as the elevation decreases (Miller, 2021).

In 2021, Zoey Mondshine validated the risk map, by testing individual homes and comparing their relative test results to the regions on the risk map. Among other observations, she identified a home in the “Low Radon Risk” region with radon levels above the EPA’s recommended limit of 4pCi/L (Mondshine, 2021).

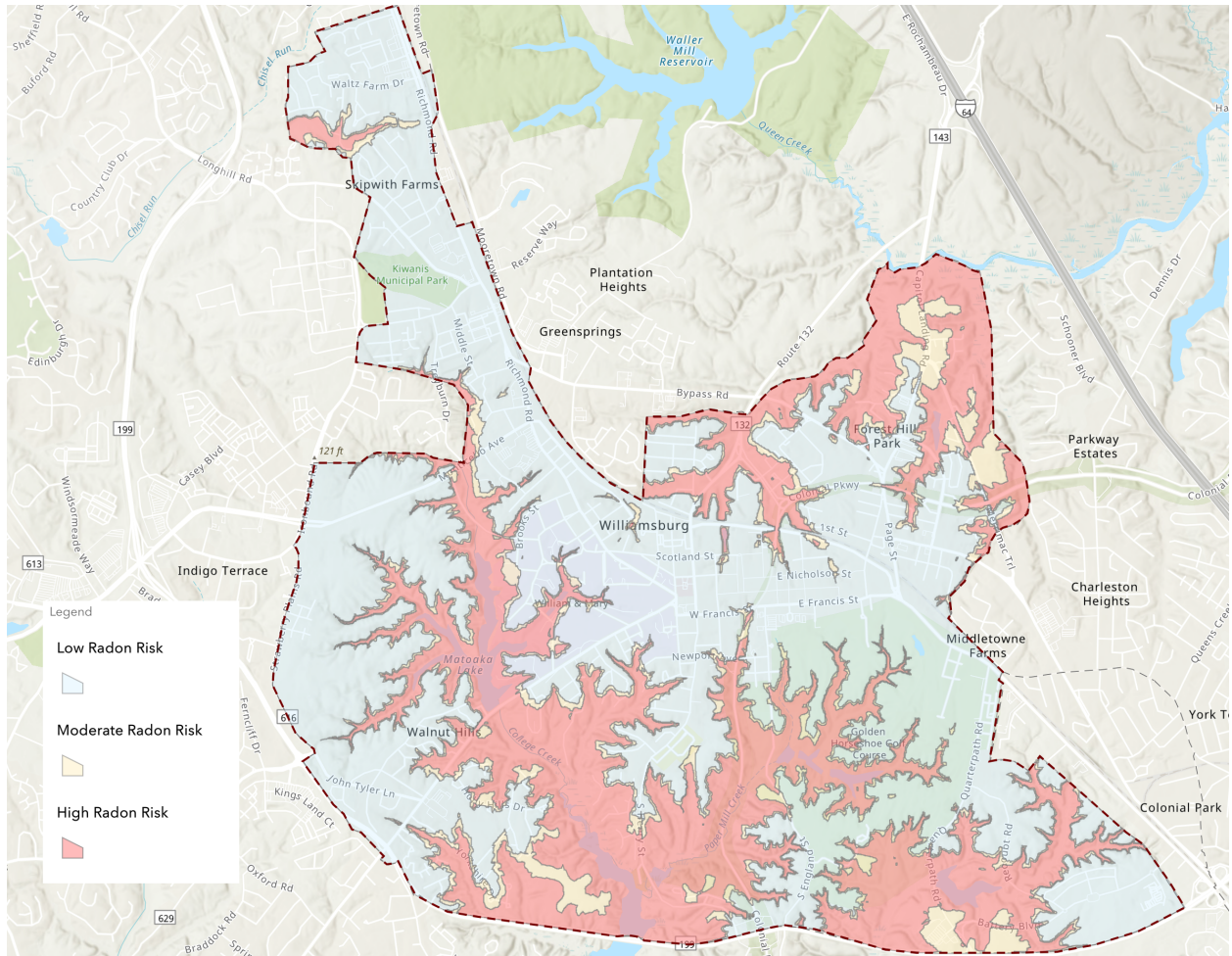


Figure 3: Radon risk assessment map of Williamsburg (Miller et al., 2020)

Materials and Methods

This video will be produced in three major stages. The first will be a literature review investigating what makes videos for science communication effective, and how to make them as accessible as possible using captions and colors friendly to the color blind. I will also continue to read about and communicate with the people who have conducted research on radon in this area.

The second stage of this project will be script development. I will write a script based on the research goals described above and the guidelines established in my literature review. This stage will include meetings with stakeholders including W&M faculty and students, and community members who have previously volunteered to participate in radon-related research. These meetings will help me hone the accuracy of the message and power of the story that I will communicate.

The third stage of this project will be the development of the video. This will include filming any interviews or other footage that I might need, and editing them together to realize the script. I will review the video with the same stakeholders before finalizing it. This will help ensure it represents their work as well as possible, communicates the topic in a way they find effective, and gives them an opportunity to review footage of themselves before the video is released.

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Budget

I do not anticipate any costs for this project. If I do need to meet with anyone outside of Williamsburg, it would probably be more appropriate to do so virtually anyways because of the ongoing COVID-19 pandemic.

Timeline

Summer 2021

During **June**, I will reach out to all potential stakeholders, including previous research participants, representatives from the City of Williamsburg, and professors who study science communication. I will describe the ways they can help with this project, including reviewing the script, reviewing the finished video, and helping to share it once it is completed. During this time I will continue to review literature on radon, with the goal of reading every previous paper about radon from William & Mary.

During **July**, I will focus on writing the script. I will first create an outline that I'll review with my advisors Heather, Rick, and Jim. Then I will flesh out the script into a cohesive story. I intend to make the script into a complete plan for the video, understanding that adjustments may be made to include interview footage and further research down the road.

I will review the script with the stakeholders in **August**. Everyone who agreed to participate in this project in June will receive a copy of the script, with the invitation to submit feedback. During these conversations, I will schedule some in-person interviews that will be recorded and included in the video. By the start of the 2021-2022 school year, I will have completed this review process, and will be ready to begin filming in earnest.

Fall 2021

I will have filmed all interviews by the end of **September**.

In **October** I will produce a draft video, collecting any final footage and assembling them into a timeline.

During **November**, I will send the draft to the appropriate stakeholders and have them review it and provide feedback.

In **December** I'll meet with my advisors again to go over my progress, and we'll make it clear what still needs to be accomplished for this project. This meeting will include a review of the feedback I received for my draft film, and collective decision-making about what changes are most important to prioritize in the Spring.

Spring 2022

In January and February, I will implement whatever changes need to be made to the video, and edit the script to reflect what the video will actually be.

In March and April, I will put the finishing touches on the video, and create the captions.

By the W&M Geology Department's Senior Research Saturday, the video will be completed, and sent to all stakeholders along with the final script.