

Nuclear and Radiological Risk Resulting from the Invasion of Ukraine by Russia

Four Possible Scenarios

With the invasion of Ukraine by Russia, it is important to consider the implications of the use of nuclear weapons and the attack on nuclear power plants as a public health and safety issue in Vermont. There are four situations to consider – international/intercontinental nuclear weapons, tactical weapons in Europe, an improvised nuclear device (IND) used outside North America and an attack on a Ukrainian power plant. **Each scenario would likely result in low (or negligible) amounts of radiation in Vermont and no health impacts are expected.**

1. International/Intercontinental Nuclear Weapons

International/Intercontinental nuclear weapons have a nuclear yield measured in megatons (MT) of TNT equivalent. To put this in perspective, the weapons dropped by aircraft at Hiroshima and Nagasaki were of about 0.02 MT yield. **If international/intercontinental MT weapons were deployed outside the US, measurable radioactivity would circulate around the world and be detectable in Vermont, but health impacts are not expected outside the target nation.**

2. Tactical Nuclear Weapons

What may be more likely with Russia's invasion of Ukraine is the use of tactical nuclear weapons. These are meant for "battlefield" use, are of lower yield, designed to kill more people than to destroy critical infrastructure of value to the occupying nation, often designed to result in less nuclear fallout and are mobile. NATO has indicated they are prepared to employ tactical nuclear weapons in defense of Europe. Russia seems prepared to use them for defensive purposes, but also may do so offensively in Ukraine or elsewhere. **Tactical weapons could have the least health impacts on people away from the target area. Low levels of radioactivity may be detectable in environmental samples far from the scene including in Vermont.**

3. Improvised Nuclear Device Outside North America

INDs would most likely be small fractions of a MT in yield and are portable. They may be detonated at ground level by terrorists to purposely maximize destruction of critical infrastructure and to generate dangerous radiation zones from nuclear fallout. An IND detonated in a densely populated area could cause hundreds of thousands of casualties and disperse radioactivity that contaminates the environment for great distances. Food embargoes and land restriction may be necessary for large swaths of land hundreds of kilometers from the detonation site. As seen with Hiroshima, Nagasaki and Chernobyl, acute health impacts are localized to radii of multiple kilometers, and chronic health effects would occur over decades of exposure. **Detectable increases in radioactivity would likely be seen in Vermont if an IND is deployed outside of North America but not enough to result in health effects.**

4. Nuclear Reactor Release

Damage to nuclear plant systems, or the loss of electric power to keep a reactor cool could lead to a release ranging from very little as was the case with Three Mile Island in 1979 or extreme as was the case with Chernobyl in 1986. If there were a Ukrainian nuclear reactor release, **Vermont could experience slight increases in radiation above background as we did in 1986 following the explosion and fire at the Chernobyl Reactor 4. Health impacts are unexpected in Vermont.**

The United States has a mature Preventive Radiological Nuclear Detection (PRND) program managed jointly by the Department of Homeland Security (DHS) Office of Weapons of Mass Destruction and the Department of Energy (DOE) National Nuclear Security Administration Office of Radiological Security. They have helped the Department of Safety, the Department of Motor Vehicles, the Health Department Radiological Health Program, and the Vermont

Hazardous Materials Response Team (VHMRT) operate that program in Vermont. **These efforts help prevent special nuclear materials and nuclear weapon components from being brought into Vermont and the rest of the country. The PRND program is also designed to prevent other radiological devices from being misused.**

Summary

The risk of increased radiation exposure or health effects to Vermont related to a nuclear or radiological event in Ukraine is expected to be low and negligible for each of the identified scenarios. As the Health Department did with Fukushima in 2011, if an event were to happen frequent updates about what is known and what it means for Vermonters would be provided. Information sharing was inadequate during Fukushima. Federal agencies have worked to improve radiological incident sharing, but State and local agencies may need to fill the information void that may occur.

The Health Department could do sampling with the Vermont Hazardous Materials Response Team and other State agency partners to validate expectations that radioactivity levels are low. This was done during Fukushima. The Health Department monitors the air in Burlington (a monitor is on the Health Department's roof) as well as the air and water around Vermont Yankee. Monitoring for radioactivity would continue to take place to provide verification and reassurance that radiation levels are not significantly or meaningfully increasing. Finally, the PRND program would likely increase efforts to monitor people, vehicles, and locations for sources of radiation should officials determine this is warranted in Vermont.

Helpful References

- Current Federal guidance on nuclear detonation preparedness:

Planning Guidance for Response to a Nuclear Detonation, Second Edition, June 2010 available at <https://remm.hhs.gov/PlanningGuidanceNuclearDetonation.pdf>

- Draft revision of Federal guidance on nuclear detonation preparedness:

Planning Guidance for Response to a Nuclear Detonation, Third Edition (Draft), December 2021 available at https://www.fema.gov/sites/default/files/documents/fema_planning-guidance-response-nuclear-detonation.pdf.

- Communicating after a nuclear detonation:

Improvised Nuclear Device Response and Recovery Communicating in the Immediate Aftermath, June 2013, available at https://www.fema.gov/sites/default/files/documents/fema_improvised-nuclear-device_communicating-aftermath_june-2013.pdf.

- Vermont's Radiological and Nuclear Emergency Plan may be accessed [here](#).