SAFETY Guidelines for Journalists: Radiation Incidents

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atomic reporters

The Stanley Foundation

Contents

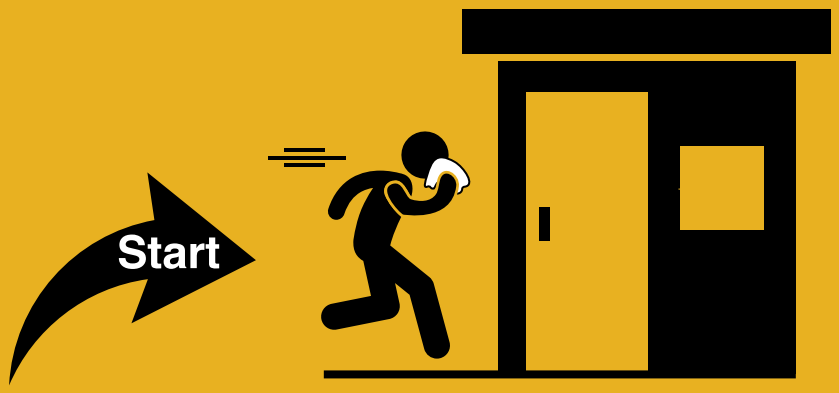
Feedback on this document was received from peers in the field of health physics, emergency response, risk communication, and journalism.

This report and the infographic are available at *http://www.stanleyfoundation.org/radsafereporting.cfm* and *www.atomicreporters.com*.

Figure 1

3 Steps to Survive a Radiation Incident

Take these actions to protect yourself if you are in the area where a dirty bomb or nuclear reactor incident occurs:



Step 1: GET INSIDE

Cover mouth and nose against radioactive dust. Go inside a building, close windows, and turn off ventilation.

Step 2: GET CLEAN

Remove exterior clothing that may have touched radioactive dust. Place in plastic trash bag and store away from you.

Take a shower to wash hair and skin that may have touched radioactive dust.

Step 3: GET INFORMED

Wait for further instructions from emergency responders to determine when it is safe to exit the building. Use social media from reliable sources to obtain updated information.

If you must leave the building prior to receiving instructions, protect yourself by covering your skin, mouth, and nose, and quickly move upwind of the event.

Created by
Brandy Saldana, UC Berkeley

Table 1: Terminolgy

Terminology	Definition	Action
Radiological Dispersion Device (RDD or Dirty Bomb)	A device that uses conventional explosives around or mixed with radioactive materials to spread radioactive contamination. It is not a nuclear weapon and it does not release an atomic explosion of energy.	**3 steps** • **Get Inside** • **Get Clean** • **Get Informed**
Nuclear Reactor Incident	An incident such as a reactor core melt that results in a large release of radioactivity into the environment.	**3 steps** • **Get Inside** • **Get Clean** • **Get Informed**
Nuclear Bomb	An explosive device powered by a fission or fusion nuclear reaction that releases a very large explosion of energy.	**3 steps PLUS** • **Get Inside** • **Get Clean** • **Get Informed** **+ Stay inside for at least 24 hours**
Improvised Nuclear Device (IND)	Illicit nuclear bomb that has been bought, stolen, or fabricated from illegally obtained nuclear materials.	**3 steps PLUS** • **Get Inside** • **Get Clean** • **Get Informed** **+ Stay inside for at least 24 hours**

Basic Safety Information for Journalists Covering a Radiation Incident

Introduction

In the event of a radiation incident such as the use of a so-called dirty bomb or nuclear reactor incident, accurate and swift reporting is vital to public safety. This guide is intended to both help protect you, the journalist, to be safe if you are covering such a story and to provide basic safety information that can be conveyed to the public to limit the risk of radiation exposure.

One of the objectives of using a radiological dispersion device—a dirty bomb—in a terrorist attack is to cause mass panic and hysteria. News of a nuclear reactor incident would generate panic and fear as well. The best defense against both possibilities is to empower members of the public with accurate and timely information on the risks involved and safety measures they can take to assure their safety. Journalists have an indispensable role to play in communicating this factual information.

Please note: The safety procedures and basic information included in this guide can most effectively be applied in radiation scenarios such as the use of dirty bombs or nuclear reactor accidents. Incidents involving a nuclear explosion, like a nuclear bomb or improvised nuclear device, would present another set of risks resulting from the massive blast itself. While the information in this guide would be helpful in such an emergency, sheltering inside for at least a day would be required.

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If you are reporting on a dirty bomb or nuclear reactor incident and you are in the area where it occurs, what should you do to protect yourself?

If you are close to the area of the incident, follow the **3 Steps to Survive a Radiation Incident** and improvise as needed:

1. **Get Inside**. Cover mouth and nose against radioactive dust. Go inside a building, close windows, and turn off ventilation.

2. **Get Clean.** Remove exterior clothing that may have touched radioactive dust. Place in plastic trash bag and store away from you. Take a shower to wash hair and skin that may have touched radioactive dust.

3. **Get Informed.** Wait for further instructions from emergency responders to determine when it is safe to exit the building. Use social media from reliable sources to obtain updated information.

How can you obtain emergency information?

You should try all common methods to contact the fire or police departments for information. You may have to wait for emergency responders to come to your area with announcements. Social media may be the most helpful for obtaining updated information from local emergency response organizations.

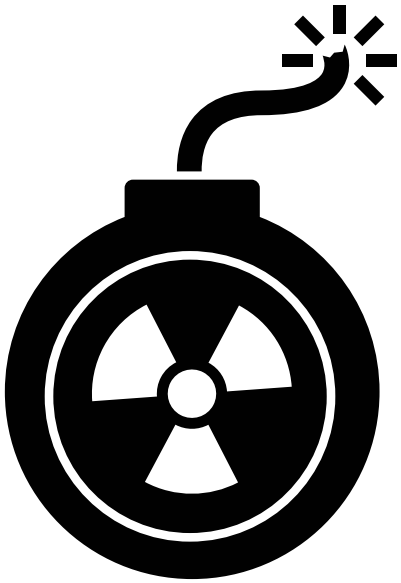
When can you leave the shelter?

Stay inside the building until emergency responders advise you that it is safe to leave. If you must leave prior to receiving information on how to safely evacuate, cover your mouth and nose with a cloth, cover your skin with clean clothing, and exit the area promptly. Go upwind of the incident if possible.

If you are outside the incident area and upwind

You may be able to remain in the area and report from there, unless the emergency responders instruct you otherwise.

Once an exclusion zone is established in the area where an incident has occurred, you *must* stay outside of it. If you walk or drive or fly into the area, you may become contaminated. Depending on the weather conditions, the airborne contamination will move with the air currents or be washed out of the air to the ground if it rains.



What is a radiological dispersion device, or dirty bomb?

- Often referred to as a dirty bomb, a radiological dispersion device (RDD) uses conventional explosives around or mixed with radioactive materials to spread radioactive contamination. It is not a nuclear bomb, and it does not release an atomic explosion of energy.

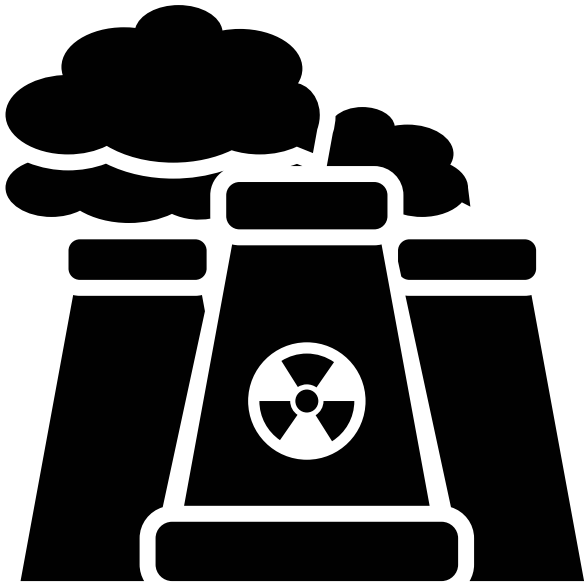
What are the radiation hazards after a dirty bomb explosion?

The radiation hazards will come from:

- Radioactive dust landing on your skin and clothing, or inhaled into your lungs.
- Large pieces of the bomb's radioactive materials close to you.
- Radioactive dust landing on food that you consume (or on grass that animals eat).

What are the characteristics of a dirty bomb incident?

- Most dirty bombs would involve the use of common radioactive materials found in medical, research, or industrial settings combined with explosives.
- This type of bomb would disperse radioactive contaminated dust into the air and onto surfaces through the explosion.
- Casualties and damage would mainly occur because of the initial explosion and not because radioactive materials were involved. You would *not* see a mushroom cloud (that would be from a nuclear bomb explosion; see Table 1 on Page 4), but you may hear a loud explosion, and you may see dust in the air immediately.
- The area that is contaminated would experience a major disruption. People would be evacuated and the area closed off and isolated for a period of time.
- The eventual clean-up of the radioactive contamination may be difficult and costly.



What is a nuclear reactor incident?

This is an incident that takes place at the site of a nuclear reactor, such as a reactor core melt, that results in a large release of radioactivity into the environment.

What are the radiation hazards from a nuclear reactor incident?

- Operating nuclear reactors contain large amounts of radioactive materials that, if dispersed, can pose a direct radiation hazard and contaminate soil and vegetation.
- Human exposure at high enough levels can cause illness and long-term health effects from cancer and other diseases.
- Internal exposures to radioactive materials may result from breathing contaminated air or eating contaminated food or water, or from absorbing radioactive material through your skin.
- Relatively high external exposure to radiation fields could occur in close proximity to the reactor.
- The area that is contaminated would experience a major disruption. People would be evacuated and the area closed off and isolated for a period of time.
- The eventual clean-up of the radioactive contamination may be difficult and costly.

What should you report to members of the public about protecting themselves in the event of a dirty bomb or nuclear reactor incident?

Communicate the information below to the public and utilize Figure 1 to get across the key information.

Prevent internal exposure

- Cover your mouth and nose to avoid inhaling radioactive dust.
- Move inside a building as soon as possible and close the windows and vents. Turn off the air conditioning/heating systems. If a building is not available, get inside a car and close off the ventilation. If neither is available, increase your distance from the explosion area.
- Once inside a structure or out of the area, remove your outside clothing that has been exposed to the radioactive dust and store it in a plastic bag. Do not wash the clothing or dispose of the bag; leave the clothing sealed in a plastic bag away from you.
- Take a shower and wash your body and hair as soon as possible.
- Wait for emergency responders to provide further instructions on evacuation. If you must leave the shelter, cover your mouth, nose, and skin and seek an upwind location from the incident.
- Do not eat food or drink water that may have been exposed to the radioactive dust or eat or drink animal products (e.g., milk) exposed to the radioactive dust.
- Do not smoke or chew gum anywhere near the site of the incident.

Prevent external exposure

- Limit your time close to the radioactive source.
- Maximize your distance from the radioactive source.
- Place thick walls or objects between you and the radioactive source to shield yourself from the radiation.
- Avoid bomb fragments. The detonation of a dirty bomb may produce fragments in the form of shrapnel, and the large pieces may be highly radioactive. Do not handle suspect material.

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What are the right ways to protect children and pets from radioactive contamination?

- If your children are with you, stay together and all of you take the same protection actions described above. If your children are elsewhere or at school, they should remain in their building until emergency responders say it is safe to travel.

- If your pets are outside and it is easy to do so, bring them inside. Wash your pets with soap and water to remove radioactive dust.

Will the radioactive contamination make you sick?

- The health effects from exposure to radioactive contamination will depend on the type and amount of radioactive material, among other factors. The effects of a bomb designed to disperse radioactive materials using conventional explosives would typically be limited to the immediate area of the explosion and would not result in immediate health effects or fatalities in a large number of people.

- The health effects to the public from a nuclear reactor incident would depend on how much radioactive material is released and how far it is distributed into the atmosphere. No immediate health effects would be expected.

- The most significant health risk to the public would be to unborn children who are particularly sensitive to radiation exposure. See the **Radiation Health Risks** section, on Page 14 of this guide, for more information.

Should you take potassium iodide?

- Potassium iodide tablets to block the thyroid from absorbing radioactive iodine may be recommended in the case of a nuclear reactor incident. It is unlikely that a dirty bomb would be constructed using radioactive iodine, therefore potassium iodide would not be recommended after dirty bomb exposure. Potassium iodide can have side effects for some people and is not safe for everyone. Await instructions from emergency responders as to whether potassium iodide tablets are recommended.

When will food and water be safe to consume after a radiation incident?

- Any food that was outside and exposed to the radioactive dust is not safe to eat. Packaged food is safe to consume. If the outside of the container has been exposed to the radioactive dust, wash it off before opening.

- Milk may not be safe to consume if the pastures the cows were grazing on were exposed to the radioactive dust.

- Wait for authorities to advise you when fresh food is safe to consume again.

How will you know if you are contaminated with radioactive materials?

- You cannot see, feel, taste, or smell radioactive materials, so you will likely not know if you have been contaminated with radioactive materials or exposed to radiation. The only way you can confirm that you have been contaminated with radioactive materials is to be checked with a radiation detector.

- Low levels of radiation exposure, as would be likely in a dirty bomb incident, would not produce immediate symptoms from radiation exposure.

- High levels of radiation exposure may cause radiation-induced illness such as redness of the skin or nausea. Medical attention is required.

- If you are unsure if you have been exposed to radioactive materials, follow the precautionary measures in this guideline to prevent internal and external radiation exposure until you are able to confirm your radiation exposure status.

What will emergency responders do if a dirty bomb explodes or a nuclear reactor incident occurs?

- As soon as there is an indication that radioactive material may be involved in a contamination incident, emergency responders will move to provide assistance to any injured people and isolate the impacted area to prevent the material from spreading. Helping people and controlling the spread of contamination will be the priority.

- Air and material samples will be taken to identify the type of radioactive material.

- The authorities will calculate the likely pattern of dispersion in order to predict the area affected. As soon as the information is available, decisions will be made whether to evacuate people or to shelter in place based on knowledge of the current weather data and suspected radioactive materials involved.

- The contaminated area will be isolated into zones such as:

    - Exclusion zone ("hot area"), where high contamination is present closest to the incident.

    - Contamination reduction zone ("warm area"), where lower levels of contamination may be present. Decontaminating activities may occur here.

    - Support zone ("cold area"), where there is very low to no contamination. Incident command and other support functions will be stationed here. This is where you will be asked to stay if you are trying to report on the incident.

- Samples of the radioactive material may be taken to forensics laboratories to try to determine the origin of the material.

- After people are cared for, the process of decontaminating the area will occur. Surfaces will have to be cleaned, and the wash water or other cleaning agents used will have to be collected to remove radioactive contamination. This is typically a long, slow process, which may take weeks or months. Some porous surfaces cannot be decontaminated and will have to be removed and treated as radioactive waste.

When will journalists be able to safely enter the incident area?

- The emergency responders will ask that you stay in the support zone (cold area) at all times. If you choose to enter into an area that may be potentially contaminated, protect yourself by covering your mouth, nose, and skin with clothing and enter for the briefest period of time possible. When exiting the area, remove your outer clothing, place it in a plastic bag, and store it away from you. Take a shower and wash your hair and skin promptly.

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The Basics About Radiation, Radioactive Materials, and Risk

Radiation is energy traveling through space and matter at different frequencies, wavelengths, and energetic levels. There are two types of radiation:

- Nonionizing radiation, e.g., radio waves, microwaves, electricity, and ultraviolet light. This energy is not sufficient to cause ionization (the removal of an electron) in the material it interacts with.

- Ionizing radiation, e.g., alpha, beta, gamma, x-ray, or neutron radiation. This energy is sufficient to cause ionization in the material that it interacts with. Ionizing radiation can be dangerous if you are exposed to too much of it.

Background Radiation

We live in an ocean of radiation—it is everywhere around us. Some sources of radiation occur naturally and others are man-made. The four major kinds of naturally occurring radiation are cosmic radiation, terrestrial radiation, radiation in food/water, and radon gas.

What are the units used to measure radioactive materials and radiation dose?

Unit of Radiation Dose: The sievert (Sv) is a unit for measuring dose equivalence in humans. 1 sievert (Sv) = 1,000 millisievert (mSv) = 1,000,000 microsievert (µSv). The millisievert (mSv) is the most common unit used to measure radiation dose to humans.

Unit of Radioactivity: The becquerel (Bq) is the unit of measure for radioactive materials. This is the amount of radioactive material that is contained in a radioactive source. The conventional unit of measure is the curie (Ci). A curie is equal to 3.7×10^{10} Bq.

What is a typical background radiation dose rate?

- Radioactive materials are naturally present all around us in the earth, air and cosmos. We call this 'natural background radiation.'

- Typical background radiation dose rates vary based on location and the type of instrument being used. Regardless, background radiation dose rates would be expected to be less than 0.0002 mSv per hour (or 0.2 µSv/hr) in most cases.

- Radiation contamination meters will read out in counts per minute and dose rate meters will read out in millisieverets or microsieverts per hour (1 millisievert per hour=1000 microsieverts per hour). For example, typical background radiation would be <0.0002 millisievert per hour (µSv/hr) on a dose rate meter and ~100 counts per minute (cpm) range on a contamination meter.

What is the average background radiation dose that people receive each year?

- Average background radiation results in a radiation dose of ~ 2–3 mSv/year[1] to everyone living on earth.

Common radiation doses received from man-made sources of radiation exposure are:

- Chest X-ray: 0.1 mSv
- CT scan, full body: 10 mSv
- Long airline flight (from cosmic radiation): 0.05 mSv

What is radioactive contamination?

- Radioactive contamination occurs when loose and dispersible radioactive materials are deposited on your skin, clothing, or any place where it is not wanted. Contact with radioactive material can contaminate you and can cause internal radiation exposure.

Table 2: What is significant radioactive contamination in general terms?

Contamination Meter Reading	Significance if Found on You
<2 times background	None
1,000 counts per minute (cpm)	Low
10,000 cpm	Medium
100,000 cpm	High

What is radioactive exposure?

- If you are standing in a radiation field, you will receive external radiation exposure. This is similar to receiving x-ray exposure and does not result in radioactive contamination. It is energy in air that deposits its energy in your tissue. If you get radioactive material inside you, you can receive internal radiation exposure. See the section on **Radiation Health Risks** below for more information.

What is radioactive decay and half-life, and how does it relate to safety?

Radioactive decay is the process by which a radionuclide releases its energy in order to become stable. The half-life, which varies for each different radionuclide, is defined as the time required for half of the atoms of a particular radionuclide to decay or become stable. If a radionuclide has a long half-life, it will remain radioactive for a long period of time. An example is Cs-137 (Cesium 137), a product of fission from a nuclear reactor or weapon, with a ~30 year half-life. If an area were contaminated with Cs-137 and the authorities were unable to clean up or remove the radioactive contamination, it would take 30 years for half of the radioactive materials to be gone. A common rule of thumb is that it would take at least 10 half-lives for the radioactive material to be close to background radiation levels. So if an area was contaminated with Cs-137 and the authorities could not remove the radioactive contamination, the area would need ~300 years for the radiation level to return to close to background levels.

Radiation Health Risks

Excessive exposure to radiation can have health effects over time to the exposed population of people and to unborn children in the womb at the time of exposure. The potential health effects from radiation exposure are:

Table 3: Radiation Health Effects

Dose Received	Resulting Effects
~2–3 mSv/year	Normal background radiation
<100 mSv	No detectable effects
100–250 mSv	Minor blood changes
1,000 mSv	Temporary sterilization in males
1,000–10,000 mSv	Gastrointestinal effects: nausea, gut lining damage
3,000–5,000 mSv	Lethal dose to 50% of the exposed population within 30 days

Additional risks

- Risk to unborn children exposed to doses greater than 100-200 mSv: Increased rates of birth defects and rates of cancer later in life may occur. See the International Commission on Radiological Protection document *Biological Effects After Prenatal Irradiation (Embryo and Fetus)* for more information.[2]

- Risk of cancer: ~5.0 percent increase in the rate of cancer in society per 1,000 mSv exposure. It is important to note that many things can cause cancer besides radiation exposure, including obesity, diet, and exposure to certain toxic substances. See "The 2007 Recommendations of the International Commission on Radiological Protection" for more information.[3]

- Heritable effects: < 0.5 percent increase in the rate of heritable effects in a population per 1,000 mSv to the first generation. Heritable effects are defined as radiation damage to a woman's eggs or a man's sperm that can result in genetic effects in offspring. Heritable effects from radiation exposure have not been seen in humans but have been demonstrated in other species. It is believed that there may be a small heritable effect to humans, but it is indistinguishable from the larger background rate of birth defects in our society. For more information, see *Hereditary Effects of Radiation*, a report by the United Nations Scientific Committee on the Effects of Atomic Radiation.[4]

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Preparing for a Radiation Emergency

Helpful items to have in a radiation emergency

- Change of clothes in a daypack
- Handkerchief or cloth to cover your mouth and nose
- Bottled water and food
- Plastic bags
- Cell phone and charger

Radiation Detectors

A number of apps are available that can turn a cell phone into a radiation detector for high energy gamma radiation. However, radiation survey readings from a cell phone may be unreliable.

More sophisticated radiation survey meters, such as a dose rate meter or contamination meter (pictured below) can respond to a wider variety of types of radiation with more accuracy. Information communicated to the public on radiation readings should be verified by officials or experts to assure accuracy.

Dose rate meter


Contamination meter

Conclusion

Journalists play a key role in communicating information to the public in the aftermath of an emergency. This role is especially important in radiation incidents, which present unique public safety challenges. This guide is intended to help bridge the knowledge gap in terms of radiation risks and basic safety protocols for the journalists covering radiation emergencies and the public they serve.

Resources and Endnotes

Resources

Further assistance can be found at:

US Department of Health and Human Services, *Awareness for Radiological Dispersion Device (RDD) Preparedness*, Worker Education and Training Program, National Institute of Environmental Health Sciences, National Institutes of Health, January 2008, https://tools.niehs.nih.gov/wetp/public/hasl_get_blob.cfm?ID=6210.

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US Nuclear Regulatory Commission, "Fact Sheet on Dirty Bombs," December 2012, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-dirty-bombs.html.

International Atomic Energy Agency, *Tools for Public Information Officers in a Nuclear or Radiological Emergency*, http://www-ns.iaea.org/downloads/iec/info-brochures/13-27051-public-info-officers-tools.pdf.

United Nations Environment Programme, *Radiation: Effects and Sources*, 2016, http://apps.unep.org/redirect.php?file=/publications/pmtdocuments/-Radiation__Effects_and_sources-2016Radiation_-_Effects_and_Sources.pdg.pdf.pdf

Endnotes

1 United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources and Effects of Ionizing Radiation*, 2010, http://www.unscear.org/docs/reports/2008/09-86753_Report_2008_GA_Report_corr2.pdf.

2 International Commission on Radiological Protection, *Biological Effects After Prenatal Irradiation (Embryo and Fetus)*, ICRP Publication 90, Ann. ICRP 33 (1–2), 2003.

3 *The 2007 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 103, Ann. ICRP 37 (2–4), 2007.

4 United Nations Scientific Committee on the Effects of Atomic Radiation, *Hereditary Effects of Radiation*, UNSCEAR 2001 Report to the General Assembly, with Scientific Annex, 2001.

About the Author

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