

**AC SAFETY
CONSULTANTS SERVICES LLC**

NUCLEAR & RADIATION SAFETY AWARENESS GUIDE

Fundamentals for personnel working in or around radiological and nuclear environments

SAFETY. COMPLIANCE. PROTECTION.

Awareness-level resource - follow the facility radiation protection program and authorized Radiation Protection personnel at all times.

1. Purpose and Scope

This guide introduces basic ionizing-radiation safety concepts for workers, supervisors, contractors, and support personnel. It is intended for awareness only. It does not qualify a person to perform radiological surveys, operate radiation-producing equipment, handle licensed radioactive material, enter controlled areas without authorization, or perform duties reserved for qualified Radiation Protection (RP) personnel.

Nuclear facilities may be regulated by the U.S. Nuclear Regulatory Commission (NRC), an Agreement State, the U.S. Department of Energy (DOE), OSHA, or other authorities depending on the facility and activity. Site procedures and the applicable license or authorization govern the work.

2. What Is Ionizing Radiation?

Ionizing radiation has enough energy to remove electrons from atoms. Sources may include radioactive materials and radiation-producing equipment.

Common types

- Alpha particles - short range; primarily an internal hazard if radioactive material is inhaled, ingested, or enters the body.
- Beta particles - can present skin and internal exposure hazards depending on energy and source conditions.
- Gamma rays and X-rays - penetrating radiation that can create external whole-body exposure hazards.
- Neutrons - highly penetrating radiation encountered in certain nuclear and research environments; specialized controls and monitoring may be required.

3. Exposure vs. Contamination

Concept	Meaning	Key point
Radiation exposure	Being in a radiation field where energy may be deposited in the body.	Leaving the radiation field stops the external exposure.
Radioactive contamination	Radioactive material is present where it is not intended - on a person, surface, tool, clothing, or in an area.	Contamination must be controlled and evaluated under site procedures.
Internal contamination	Radioactive material enters the body by inhalation, ingestion, absorption, or a wound.	Prevention focuses on containment, contamination control, respiratory protection when required, and good work practices.

4. ALARA and Basic Exposure Controls

Radiation-protection programs use the ALARA principle - keeping occupational radiation exposure As Low As Reasonably Achievable while considering practical factors. Basic external-exposure controls include:

- Time - minimize the time spent near a radiation source or in a radiation field.
- Distance - maximize distance from the source when practical; radiation intensity generally decreases as distance increases.
- Shielding - use appropriate barriers or engineered shielding selected for the type and energy of radiation.

- Containment - control radioactive material to prevent the spread of contamination.
- Planning - review the work, expected dose, radiological conditions, tools, access, hold points, and contingency actions before beginning.

5. Radiological Areas, Signs and Boundaries

Facilities use postings, signs, labels, ropes, barricades, and access controls to communicate radiological hazards and restrictions. Terminology and thresholds depend on the governing regulations and facility program.

- Do not enter a posted or controlled radiological area unless authorized and properly trained.
- Read and understand all postings and Radiation Work Permit (RWP) requirements before entry.
- Do not move radiological boundaries, signs, tags, shielding, or monitoring equipment unless specifically authorized.
- Stop and contact RP if conditions differ from the briefing, posting, permit, or expected work scope.

6. Dosimetry and Personnel Monitoring

Personnel monitoring may include dosimeters used to measure occupational dose and contamination monitoring used to detect radioactive material on personnel. Wear and use assigned dosimetry exactly as site procedures require.

- Never share, intentionally expose, tamper with, or misuse assigned dosimetry.
- Report lost, damaged, alarming, or abnormal dosimetry immediately.
- Use electronic dosimeters, alarming devices, extremity dosimeters, or other monitoring devices when required by the work authorization.
- Observe site dose limits, administrative limits, stay-times, and alarm set points.

7. Radiation and Contamination Surveys

Radiological surveys are performed to characterize radiation levels and contamination conditions. Portable instruments may measure radiation intensity, contamination, or both, but instruments have different capabilities and limitations.

- Only trained and authorized personnel should perform surveys that support radiological decisions.
- Use the correct instrument and probe for the radiation type and measurement objective.
- Verify required source checks, calibration status, response, background, and instrument condition under site procedures.
- Survey speed, detector geometry, background, counting time, and surface conditions can affect detection capability.
- Do not declare tools, equipment, material, or areas 'clean' unless authorized survey and release requirements have been satisfied.

8. Contamination Control Practices

- Follow step-off-pad, protective-clothing, frisking, and controlled-area practices exactly as instructed.
- Keep clean items separated from potentially contaminated tools, materials, and surfaces.
- Minimize unnecessary contact with surfaces in contamination-controlled areas.
- Use bags, covers, containment, catchments, or ventilation controls when required by the work plan.
- Do not eat, drink, smoke, chew gum, or apply cosmetics in areas where site rules prohibit these activities.
- Report damaged protective clothing, spills, unexpected contamination, or loss of containment immediately.

- Do not remove items from restricted or controlled areas until required radiological release controls have been completed.

9. Protective Clothing and Respiratory Protection

Protective clothing can help prevent skin and clothing contamination, but it does not necessarily provide meaningful shielding from penetrating radiation. Respiratory protection may be required for airborne radioactive material or other hazards.

- Select and wear protective clothing based on the radiological conditions and site procedure.
- Use proper donning and doffing techniques to avoid spreading contamination.
- Respirators must be used only under an applicable respiratory-protection program with required medical evaluation, fit testing, training, and authorization.
- Never substitute PPE for feasible engineering or administrative controls when the governing program requires those controls.

10. Radiation Work Permits and Pre-Job Briefings

Many nuclear and radiological facilities use an RWP or equivalent work authorization to communicate radiological conditions and controls.

- Confirm the correct RWP or work authorization applies to the task.
- Understand dose-rate conditions, contamination conditions, PPE, dosimetry, respiratory protection, stay-times, boundaries, hold points, and special instructions.
- Participate in required pre-job briefings and ask questions before work begins.
- Stop work if scope, conditions, alarms, barriers, ventilation, shielding, or controls change unexpectedly.

11. Stop-Work and Abnormal Conditions

Workers should know the site's immediate actions for unexpected radiological conditions. Follow alarms and emergency instructions without delay.

- Stop work, place the task in a safe condition if possible, and warn nearby personnel.
- Leave or remain in place as directed by site alarms, postings, procedures, or RP personnel.
- Do not attempt to retrieve dropped tools or materials across a radiological boundary without authorization.
- Report spills, loss of source control, unexpected alarms, damaged sources/equipment, suspected intake, or personnel contamination immediately.
- Do not improvise radiological controls. Wait for qualified personnel to evaluate the condition.

12. Worker Responsibilities

- Complete required radiation-worker and site-specific training before performing assigned work.
- Follow the licensee/facility radiation-protection program, procedures, permits, postings, and instructions.
- Use assigned dosimetry and monitoring equipment correctly.
- Maintain contamination controls and good housekeeping.
- Know your role and remain within the limits of your qualification and authorization.
- Protect yourself and coworkers by communicating changing conditions and using stop-work authority when appropriate.

13. Supervisor / Contractor Planning Checklist

- ☐ Applicable facility authorization, work scope, and radiological hazards reviewed.
- ☐ Required worker qualifications and site access verified.
- ☐ RWP/work authorization and pre-job briefing completed.
- ☐ Expected dose and ALARA controls reviewed.
- ☐ Correct dosimetry and monitoring requirements identified.
- ☐ PPE, respiratory protection, tools, containment, and shielding planned.
- ☐ Radiological boundaries and material-control requirements understood.
- ☐ Hold points and RP coverage established where required.
- ☐ Emergency/abnormal-condition actions communicated.
- ☐ Post-job monitoring, material release, housekeeping, and lessons learned planned.

14. Regulatory Framework - Awareness

The regulatory framework varies by facility. NRC regulations for licensed activities include 10 CFR Part 20 (Standards for Protection Against Radiation) and worker-notification/instruction provisions in 10 CFR Part 19. OSHA maintains ionizing-radiation standards including 29 CFR 1910.1096, and construction standard 29 CFR 1926.53 incorporates provisions of 1910.1096. DOE facilities may operate under DOE radiation-protection requirements. Agreement States regulate certain radioactive materials under state programs.

Because jurisdiction and requirements vary, workers and employers should use the requirements applicable to the specific facility and activity rather than assuming one set of limits or procedures applies everywhere.

15. AC Safety Nuclear & Radiation Support

AC Safety Consultants Services LLC can support nuclear and energy projects with qualified safety and radiation-support personnel according to client requirements, worker qualifications, site access requirements, and applicable regulatory programs.

- Radiation technician / radiation protection support staffing.
- Industrial and construction safety professional support.
- Pre-job planning and safety coordination support.
- Workforce safety orientation and hazard-awareness support.
- Project-specific staffing solutions for nuclear and energy environments.

Personnel should perform only duties for which they are trained, qualified, authorized, and accepted by the client/facility.

16. Official Reference Resources

U.S. NRC - Radiation Protection: <https://www.nrc.gov/facilities-safety/radiation-protection>

U.S. NRC - Information for Radiation Workers: <https://www.nrc.gov/facilities-safety/radiation-protection/radiation-and-its-health-effects/information-for-radiation-workers>

U.S. NRC - Minimize Your Exposure: <https://www.nrc.gov/facilities-safety/radiation-protection/how-the-nrc-protects-you/minimize-your-exposure>

OSHA - Ionizing Radiation: <https://www.osha.gov/ionizing-radiation>

OSHA - Ionizing Radiation Hazard Recognition: <https://www.osha.gov/ionizing-radiation/hazards>

10 CFR Part 20: <https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/>

Important Disclaimer

This guide is an awareness-level educational resource. It is not a radiation-worker qualification course, Radiation Protection Technician qualification program, Radiation Work Permit, radiological survey procedure, emergency-response procedure, or substitute for an NRC/Agreement State license, DOE requirement, OSHA standard, facility procedure, or qualified Radiation Protection direction. Requirements and site conditions vary and can change. Always follow the governing facility program and current applicable regulations.

Contact AC Safety

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