

RF Safety

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WELL WELL WELL

WHAT DO WE HAVE HERE ?

FUNNY PICTURES .COM

AmeriStop



Food Mart

**MY BOSS TOLD ME
TO CHANGE THE
STUPID SIGN
SO I DID**

**EMERGENCY
GASOLINE
SHUT OFF**

**TOUCHING WIRES CAUSES
INSTANT DEATH**



\$200 FINE

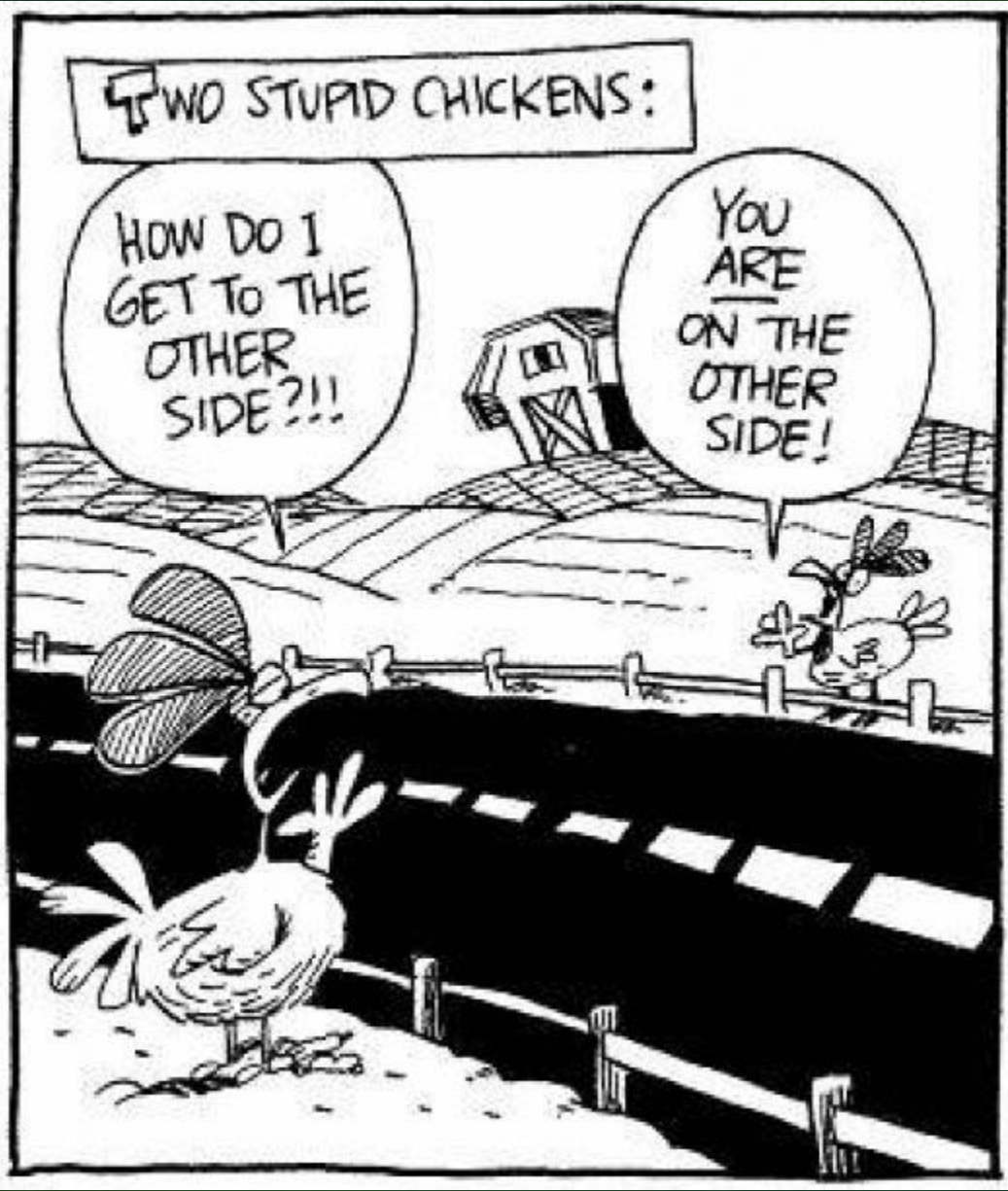


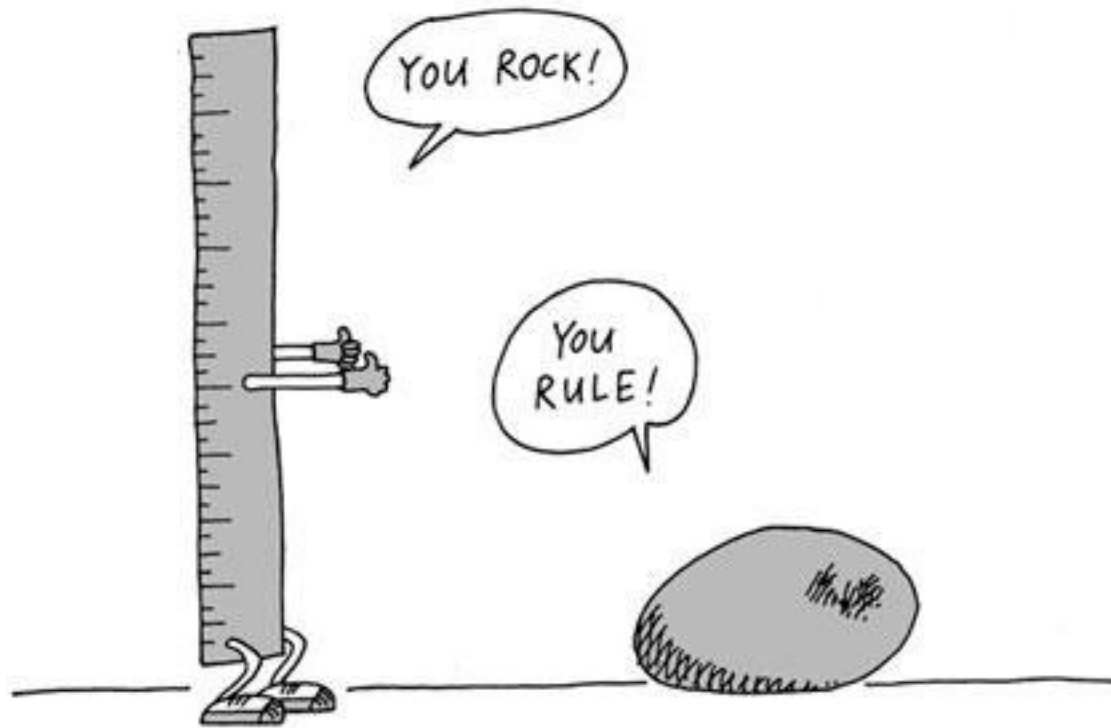
• Newcastle Tramway Authority •

TWO STUPID CHICKENS:

HOW DO I
GET TO THE
OTHER
SIDE?!!

YOU
ARE
ON THE
OTHER
SIDE!





Simon Bernier ©

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Presentation Overview

- Definitions.
- The Standard Deal.
- Safety Plans.
- Discussion and Questions.

Definitions

- Radiation is the process in which particles, energy, or waves travel through a medium or space.
- There are two distinct flavors of radiation.
- Ionizing.
- Non-ionizing.

Ionizing Radiation

- Sufficient energy exists to ionize an atom.
- Ions are atoms with electron excess or deficit. Ionized atoms have a net electrical charge.

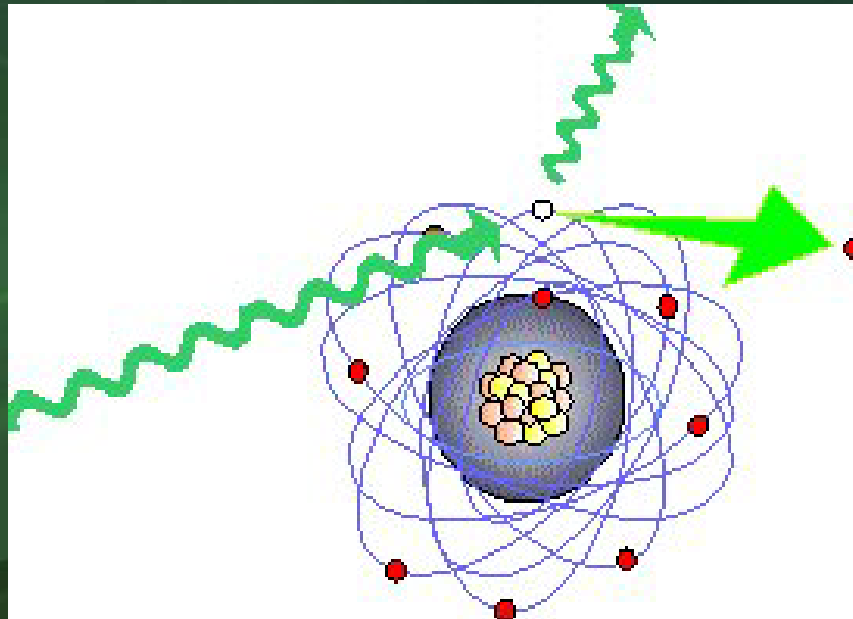
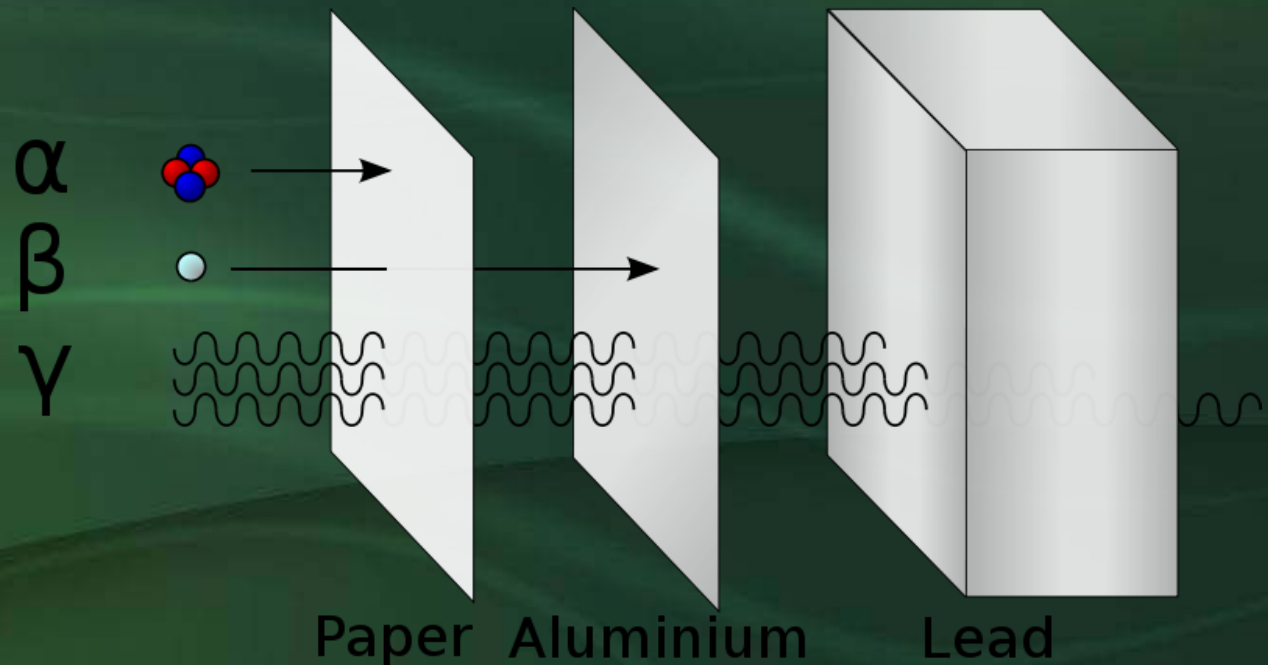


Image courtesy IAEA.

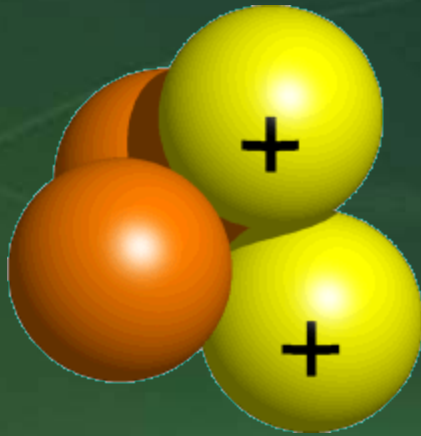
Ionizing Radiation

- α -particles (Alpha)
- β -particles (Beta)
- γ rays (Gamma)
- X-Rays



Ionizing Radiation

- α and β particles are physical matter and not electromagnetic radiation.



- α -particle is a Helium nucleus.
- It consists of two protons and two neutrons.



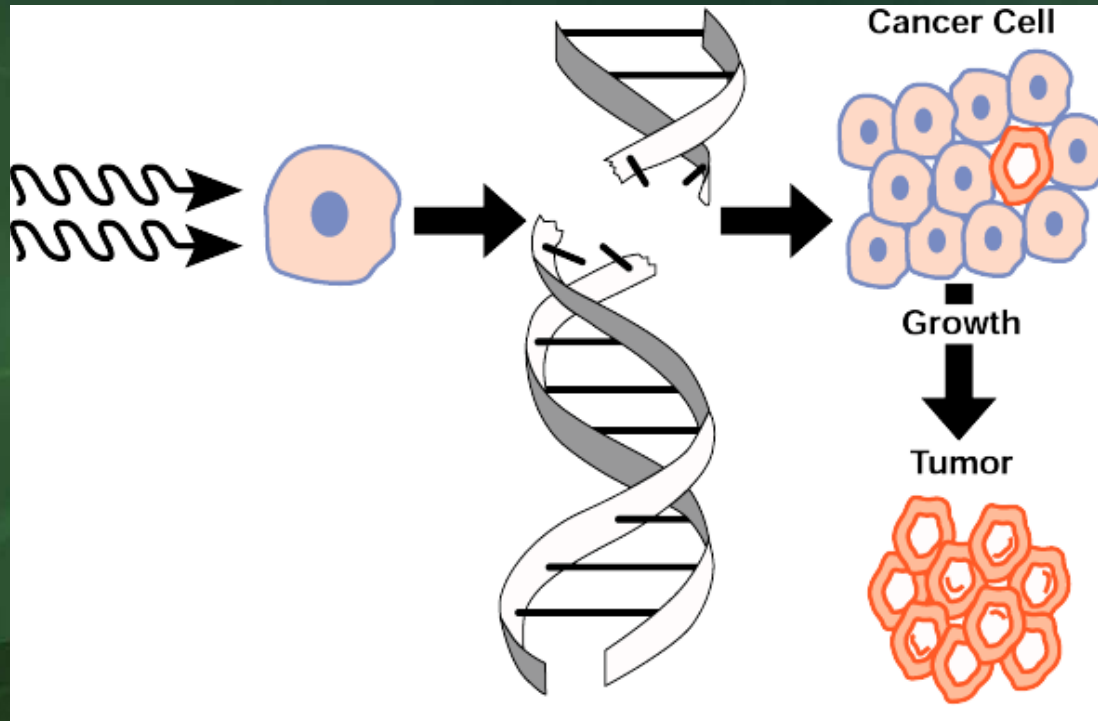
- β -particle is a free electron or positron.
- Greater velocity than alpha particle.

Ionizing Radiation

- γ -Rays and X-Rays are electromagnetic waves.
- It is the same stuff as light or RF, but at a much higher frequency (and higher energy).
- Visible Light Frequency 400-790 THz.
- X-Ray Frequency 30 PHz – 30 EHz.
- γ -Ray Frequency >30 EHz.
- 1 THz (TeraHertz) = 1,000 GHz.
- 1 PHz (PetaHertz) = 1,000,000 GHz.
- 1 EHz (ExaHertz) = 1,000,000,000 GHz.

Ionizing Radiation

- High energy ionizes atoms.
- Ionization damages DNA.
- Substantial and proven health risks associated.



Non-Ionizing Radiation

- This is different than Ionizing Radiation.
- Energy is insufficient to ionize atoms.

Examples of Non-Ionizing Radiation:

- Visible light.
- Sound.
- Heat.
- Broadcast Auxiliaries (STL stuff)
- AM, FM & TV Broadcasts.

Non-Ionizing Radiation

- Affects the vibrational or rotational configuration of atoms...the kinetic energy.
- In other words, heating may be caused.
- This is the microwave oven concept.
- An intense flood of non-ionizing radiation will not cause ionization unless temperature is raised sufficient for spontaneous ionization.
- The public does not know the difference.
- Their assumption is they will glow in the dark.

The Standard Deal

- Numerous standards developed over the years.
- The standards continue to evolve.
- IEEE co-sponsored C95 project in 1960.
- The first standard, C95.1 was published in 1966.
- Revised in 1974, 1982, 1992, 1999, and 2005.
- NCRP – National Council on Radiation Protection & Measurements – has also issued standards.
- Current FCC standard is hybrid of NCRP 1986 recommendations and IEEE C95.1-1991.

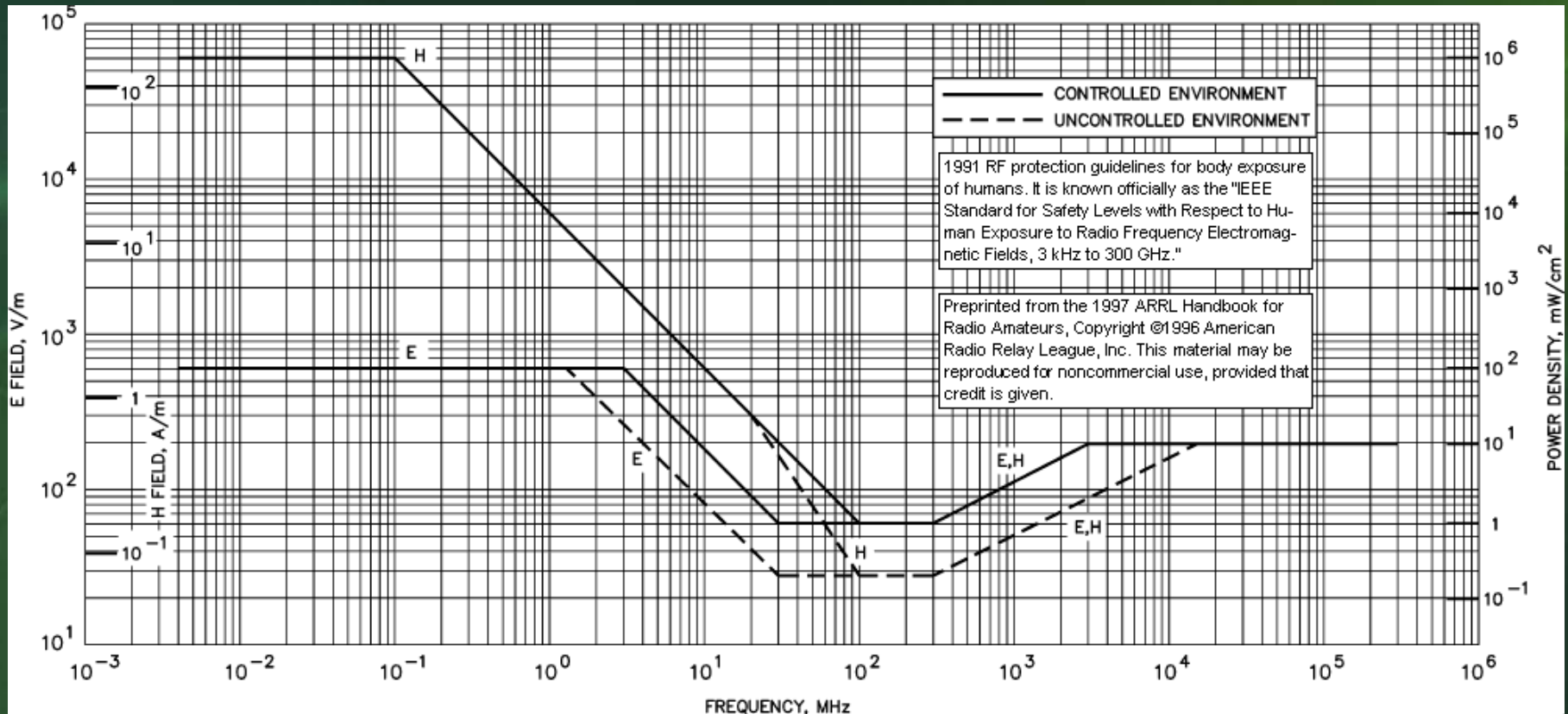
The Standard Deal

- Other countries use varying standards.
- Canada's standard, last revised in 2009 is known as Safety Code 6.
- Japan uses a standard nearly identical to the FCC standard.
- ICNIRP – International Commission on Non-Ionizing Radiation Protection also develops standards. Their latest is from 1998.

The Standard Deal

- FCC standard considers controlled and uncontrolled environments.
- Uncontrolled pertains to general public, and those where exposure cannot be controlled.
- Controlled pertains to cognizant persons, and areas where exposure can be controlled.
- Parking lot is uncontrolled, tower controlled.
- Uncontrolled limits are 20 percent of the controlled environment limits (in our interest areas).

The Standard Deal



- IEEE C95.1-1991 limits are illustrated above.
- These are the current FCC limits.

RF Safety Plans

- Importance of plan cannot be overstated.
- C95.1-2005 *requires* plan implementation.
- Plan use protects humans.
- Plan use reduces liability.
- Plan use reduces publicity issues.
- Plan use reduces insurance costs.

Elements of the Safety Plan

- Administrative.
- Inventory of sources.
- Assessment of exposure.
- Design of Controls.
- Education, Training, and Audit.
- Ancillary Hazards.

Administrative

- The plan must be written.
- The plan must be available for inspection.
- An unwritten plan is legally non-existent.
- RF Safety Officer (RFSO) must be designated.

RFSO Duties

- Continuous site evaluation.
- Maintenance of source inventory.
- Evaluation of existing safety procedures.
- Documentation of program.
- Monitor legal requirements.
- Dissemination of safety policy to organization.
- Policy/procedure advice to staff.
- Authorize and review surveys and controls.
- Maintain listing of approved personnel.

RFSO Duties

- Manage medical assessments for exposures.
- Coordinate safety training and maintain records.
- Conduct or arrange for site audit.
- Manage investigation of policy issues.
- Develop / approve hazard assessment tools.
- Arrange for calibration of measurement devices.
- Maintain archive and control of documentation.

RF Hazard Identification

- Complete inventory of sources at the facility.
- Include type, and all technical parameters.
- Intentional emitters.
- Unintentional emitters.
- Initial basic calculations.
- Measurement and/or modeling of sources.
- Measurement dependent on source nature.

Hazard Categories

RFSP Category	Exposure Condition	Required Control Actions

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- Action level is upper limit of uncontrolled environment condition.

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2	Exposure limit not exceed.	Scenario dependent.
3	Potential to exceed operational exposure level (OEL).	Scenario dependent.
4	Operational exposure level (OEL) exceeded.	Output of source must be restricted to achieve lower category, or prevent access.

- Action level is upper limit of uncontrolled environment condition.

Safety Plan Controls

- Engineering Controls.
- Administrative Controls.
- Personal Protective Equipment.
- Training/Education.

Engineering Controls

- Change equipment configuration to minimize exposure potential.
- Change site configuration to minimize exposure potential.
- Implementation of physical barriers to restrict access.
- Interlocks including lock-out/tag-out.
- Engineering controls are more effective than administrative controls.

Administrative Controls

- Work procedures and practices.
- Reduction of operating power.
- Cessation of operation.
- Time average exposure.
- Personal monitors.
- Lock-Out/Tag-Out.
- Proper signage.

Signage

- Use the appropriate sign at the appropriate location.
- Signs are used to demarcate boundaries of conditions.
- One sign per location.



Personal Protective Equipment

- Procurement of appropriate equipment.
- Inspection of equipment.
- Maintenance of equipment.
- Repair and Replacement of equipment.
- Training in use of equipment.
- Equipment is **NOT** a panacea. The use of equipment may not be appropriate.

More on Safety Plan Controls

- Measures taken depend on category.
- Three typical options: Not applicable, optional, and required.
- RFSP not required for Category 1 if levels stay below uncontrolled environment.
- RFSP becomes required for Category 1 if levels may exceed uncontrolled environment.
- Controls list the procedures that must be implemented during the plan.

Safety Plan Controls

- **REQUIRED** of all FCC licensees. You **MUST** coordinate with any other users of the site.
- Even if you are the sole user of a site, you, by default will necessarily have to have some controls in place as a condition of your license.

Training, Education, and Audit

- Describe and discuss RF exposure limits.
- Describe and discuss exposure effects.
- Describe and discuss mitigation controls.
- Describe and discuss relevant work procedures.
- Advise of medical device and implant issues.
- Discuss procedures to address accidents.
- Discuss procedures to address exposure.
- Employee involvement in program.
- Periodic review required.
- Periodic audit of program required.

Ancillary Hazards

- Electric Shock.
- Thermal burns.
- Ionizing radiation.
- Mechanical issues.
- Falls.
- Trip hazards.
- Hot work hazards.
- Heat stress.
- MSDS related hazards.

Questions....

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