PURPOSE/APPLICATION

To provide guidance on working safely around the various sources of radiation that may be present in or around Strike's work areas.

PPE
- Strike minimum requirements
- Specialized eye protection (HSEMS Section 6)

TRAINING
- Site specific radiation and NORM awareness (as required)
- Strike Orientation

HAZARD SOURCES & CONCERNS
- Occupational illness or injury

RADIATION

Radiation is energy emitted by an atom or other body as it changes from a higher energy state to a lower one. Natural background radiation can be found in almost anything and contributes to about ¾ of a person's annual radiation exposure. There are however, some significant sources of radiation on Strike's worksites; if not properly controlled these can be extremely hazardous.

IONIZING VS NON-IONIZING

Radiation is classified into two broad categories; ionizing and non-ionizing. The classification is based on the level of energy emitted. Generally speaking, the more energy produced the more damaging the radiation.

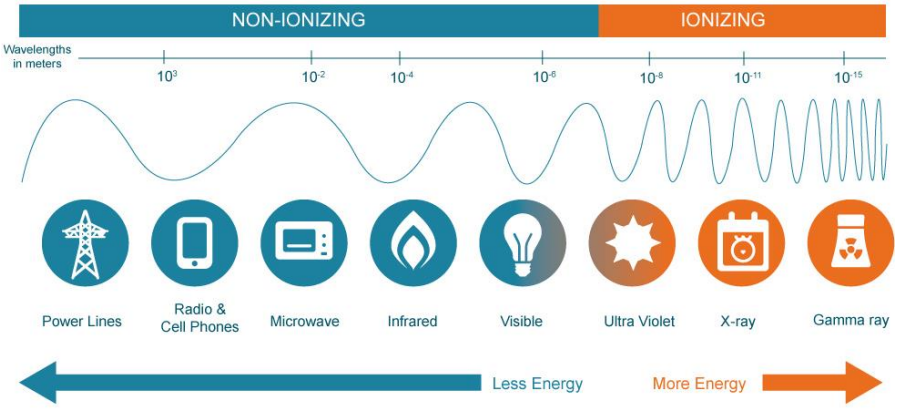


Figure 1 – Common Sources of Radiation

The energy emitted by a source of radiation determines how far it can penetrate into the human body and how much damage it is able to cause to tissue and/or DNA. X-rays, gamma rays, and neutrons represent the greatest health hazard because of their ability to penetrate the human body. The main sources of ionizing radiation in the oil and gas construction industry are from non-destructive testing (NDT) radiology, welding, sun exposure and naturally-occurring radioactive materials (NORM's).

ROUTES OF ENTRY

When dealing with radiation there are two main concerns for route of entry:

1. **Internal exposure** — radioactive substances can be ingested, inhaled, or absorbed through the skin. Some can be eliminated within a few hours via urine and feces while others are stored in the body and eliminated slowly over many years. This is of particular concern when grinding or working with radioactive material that may be ingested (i.e. NORM's)
2. **External exposure** — sources of radiation with a higher level of energy can result in damage to human tissue simply from being exposed to them. Lower levels such as infrared (IR) from welding can damage the skin or eyes while high levels such as Gamma from NDT may lead to radiation poisoning or an increased risk of cancer

Two kinds of health effects result from exposure to ionizing radiation:

1. **Immediate effects** — High doses of radiation delivered in a short period to the whole body or particular organs can produce various health effects (including death), within a few weeks after exposure. The severity of symptoms depends on:
    1. the total radiation dose
    2. how quickly the dose was delivered
    3. the type of radiation and the part of the body exposed

    If there is a chance a worker has been exposed to high levels of radiation then medical attention should be sought immediately.
2. **Delayed effects** — Workers exposed to low doses of radiation are at increased risk of developing cancer later in life and of passing on damaged genetic material to their offspring. Cancers common in workers exposed to low levels of radiation include leukemia, thyroid, breast, lung, and bone cancer.

COMMON SOURCES OF RADIATION AT STRIKE

SUN EXPOSURE

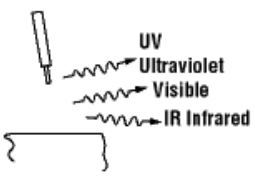
Radiation from the sun can burn unprotected skin and eyes depending on duration and intensity of exposure. Radiation can pass through your skin and damage your skin cells. Sunburns are a sign of skin damage. Sun exposure intensity can increase around reflective surfaces such as concrete, water, metal, snow, etc. Monitor UV index for current and forecasted UV levels.

WELDING RADIATION

Welding arcs give off ultraviolet, visible light and infrared (IR) radiation. This radiation can be dangerous to the skin and eyes of nearby workers.

The UV radiation in a welding arc will burn unprotected skin (as with UV radiation in sunlight). This is true for direct exposure to UV radiation, as well as radiation that is reflected from metal surfaces. Long-term exposure to any form of UV radiation can lead to skin cancer.

Welding radiation can produce an injury to the surface membrane (conjunctiva) of the eye commonly known as "welders' flash" or "arc flash." The symptoms include:



- Pain - ranging from mild to intense
- Tearing and reddening of the eye and membranes around the eye
- Sensation of "sand in the eye" or abnormal sensitivity to light
- Inability to look at light

Exposure to just a few seconds of intense UV light can result in welder's flash. These symptoms may not be felt until several hours after exposure (often the next morning).

Exposure to infrared light can heat the lens of the eye and produce cataracts over the long term.

Figure 2 - Welder's Flash

PREVENTING WELDING RADIATION EXPOSURE:

THE DO'S

- **DO** Warn other workers in the area before you strike an arc
- **DO** Wear all appropriate PPE as per Strike's *HSEMS Section 6 PPE*
- **DO** Wear appropriate eye and face protection, (welder's helpers too, where appropriate) as per HSEMS Section 6
- **DO** Review *SWP 43 Portable Arc Welders* before beginning work
- **DO** Set up welding screens or other barriers where available to protect workers in the area before starting
- **DO** Use sunscreen to help protect exposed skin from radiation
- **DO** Avoid looking directly at welding arcs when walking past
- **DO** Wear CSA-approved safety glasses that fit close to the face to help limit exposure to radiation

RADIOGRAPHIC TESTING (RT) - RADIATION

Radiographic Testing (RT) is an important tool in the nondestructive evaluation of welds; however, health effects can result from exposure to high levels of radiation, or from low levels over a long time. The primary concern with occupational radiation exposure is an increased risk of cancer. The amount of risk depends on the radiation dose received, the time over which the dose is received, and the body parts exposed.

Industrial radiography uses two sources of radiation: X-radiation (X-rays) produced by an x-ray generator, and gamma radiation, the product of radioactive atoms.

Generally, gamma radiation is used on Strike's work sites in the form of an NDT "camera" which contains and protects workers from the radioactive "source" when not "shooting". *See figure 3 and 4.*

Figure 3 - NDT Camera

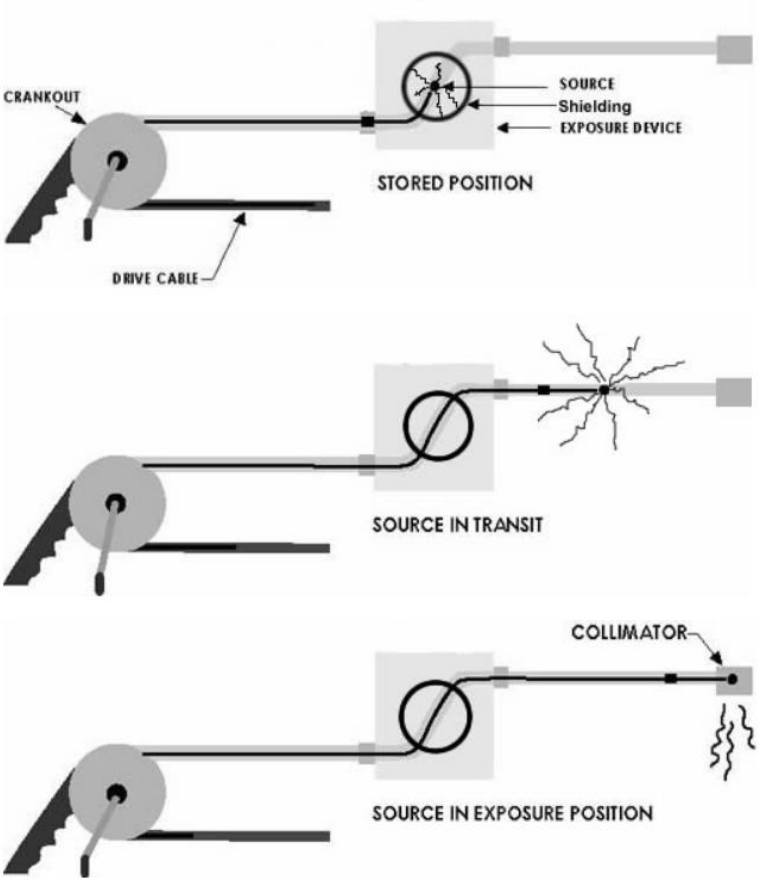


Figure 4 – NDT Camera Operation

LIMITING EXPOSURE

There are three primary ways to reduce occupational radiation exposure:

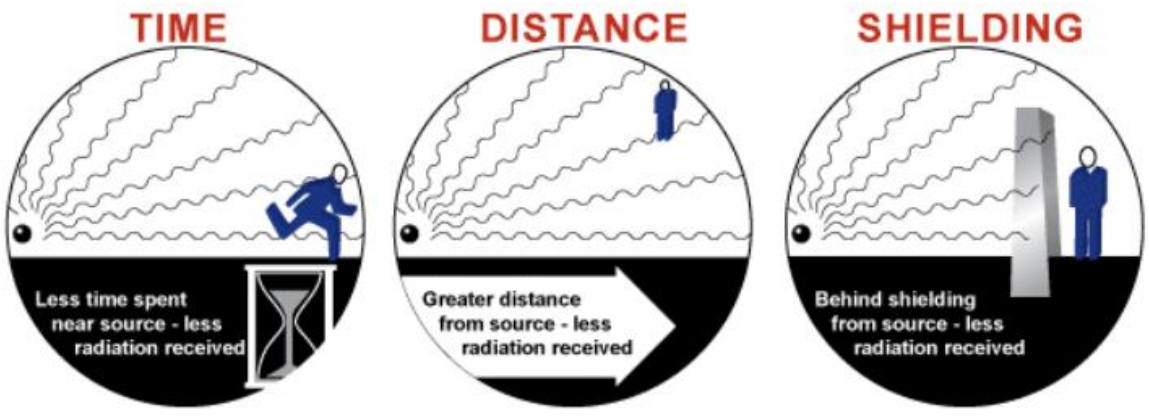


Figure 5 – Limiting Radiation Exposure

When NDT technicians arrive on a work site they will first assess the exposure area (distance calculations are made for restricted area boundaries), and ropes and signs are placed appropriately. Only once this is complete, will the radiographer remove the exposure device (camera) from its storage compartment in the vehicle. During the exposure, the second NDT technician will survey the boundary to determine the levels of radiation present. If the survey meter indicates levels are higher than calculated, the boundary must be extended

Figure 6 – Testing Barrier Set up

Preventing Exposure:

THE DO'S

- **DO** Schedule testing for times when there are no (or fewer) other workers on site (at night, on days off) whenever possible
- **DO** Walk down the exposure area, check in vehicle and equipment cabs and make sure everyone is clear
- **DO** Consider assigning workers to monitor the test area so no one accidentally enters it
- **DO** Double check that all access routes to the area are marked with signs and/or radiation ribbon. If there are doors that enter the area lock them (where possible and safe), or put warning signs on the other side
- **DO** Check with NDT technicians before entering the area; do not assume the process is done because the technicians have left the area
- **DO** Stay clear of any incident involving an NDT vehicle or camera. In the event of an incident the source may be exposed and the area may be extremely hazardous
- **DO** Report to your supervisor immediately if you or anyone else enter the testing area; potential overexposure is serious and must be investigated
- **DO** Communicate the risk at tailgate meetings and update HIACs
- **DO** Communicate with anyone who may come to site about potential hazards (cleaning staff and overnight security are frequently overlooked)

THE DON'Ts

- **DON'T** Cross radiation barriers, even if you can't see a technician. Some sources are stronger than others and can require a very large area
- **DON'T** Assume all workers know what the radiation symbol means, communicate with your work group and review the hazards with new workers
- **DON'T** Move barriers or signs. The technician has calculated the safe area; moving it could put you or other workers at risk

NATURALLY OCCURING RADIOACTIVE MATERIAL (NORM'S)

NORM'S are radioactive elements present in the earth's crust and within the tissues of all living beings. Although the concentration of NORM in most natural substances is low, higher concentrations may arise as the result of human activities. NORM's are particularly common in sealed underground facilities where residue and scale can build up. For example, calcium scale precipitated from oil recovery brine may contain radium at much greater concentrations than the water source itself. NORM Radiation can be found in many forms depending on location and types. NORM's can change the molecules it collides with irradiating pipe or other buried facilities. Some elements such as uranium decay can release radiation.

Before beginning any demolition, maintenance work or turn around work - engage the client/owner to determine if NORM contaminated materials are present or if the potential for exposure exists within the work scope. Special precautions are needed for handling, storing, transporting, and disposal of this material, by-products, end-products or process equipment.

See Strike's Safe Work Practice 73 - NORM's for more detailed information on working safely with NORM's.

REFERENCES / ADDITIONAL INFORMATION

1. Strike SWP 73 – NORM's
2. Radiation Safety Institute of Canada
3. Canadian Center for Occupational Health and Safety
4. NDT Resource Center
5. NRCan National Non-Destructive Testing Certification Body
6. CNSC – Canada's Nuclear Regulator – Canadian Nuclear

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