Health and Safety Standard

RADIATION

1 PURPOSE

This standard establishes the requirements for managing risk associated with various types of radiation found at SaskPower.

2 SCOPE

This standard applies to all hazardous radiation that is produced and emitted by equipment used at SaskPower including Ionizing and Non-Ionizing radiation sources.

This standard does not address hazard/aspect or risk from naturally occurring radiation except Radon.

This standard outlines the minimum requirements that shall be met or exceeded by SaskPower workers and contractors. Failure to comply may result in injuries, damage to equipment and property, environmental harm, performance management or any combination thereof.

The use of the word “shall” within this standard denotes a mandatory action, whereas the use of the word “should” or “may” denotes a recommended action.

3 DEFINITIONS

The following definitions apply to this standard:

Electromagnetic Frequency (EMF) - Extremely low frequency electromagnetic fields (EMF) are invisible waves that travel through space and exert force on charged particles. Extremely low frequency EMF consists of electric fields and magnetic fields in the frequency range of 1 Hertz (Hz) to 3 kilohertz (kHz) of the electromagnetic spectrum. Common sources of extremely low frequency EMF are household wiring, electrical appliances and household electrical products, power lines, transformer boxes and electrical substations.

Extremely Low Frequency (ELF) Radiation (Non-Ionizing) - is at the low-energy end of the electromagnetic spectrum and is a type of non-ionizing radiation. Non-ionizing radiation has enough energy to move atoms around or make them vibrate, but not enough to directly damage DNA. ELF radiation has even lower energy than other types of non-

ionizing radiation like radiofrequency radiation, visible light, and infrared. ELF includes EMF and Radiofrequency radiation types.

Ionizing Radiation - is radiation with enough energy so that during an interaction with an atom, it can remove tightly bound electrons from the orbit of an atom, causing the atom to become charged or ionized. This type of radiation includes X rays, radon and gamma rays.

Naturally Occurring Radiation - exists in the earth's crust. The decay of thorium and uranium produces many different types of radioactive materials, called isotopes. Some examples of these isotopes are Radium-226, Potassium-40, and Radon-222. These isotopes of Naturally Occurring Radioactive Materials (NORM) are generally found in low concentrations.

NORM can come to the earth's surface due to natural processes (radon gas moving through cracks in rocks or dissolving and being transported by ground water flows), or due to human activities (mining, oil and gas extraction, etc.). Additionally, the human activities that bring NORM to the surface may cause NORM to become more concentrated than its natural state. For example, coal ash from coal-burning power plants contains a more concentrated form of NORM than the coal did when it was taken from the ground. Because NORM is radioactive, once it is brought to the surface or concentrated, the ionizing radiation that it emits can now interact with humans.

Radiofrequency (RF) Electromagnetic Radiation (EMR) (Non-Ionizing) – is the transfer of energy by radio waves. RF EMR lies in the frequency range between 3 kilohertz (kHz) to 300 gigahertz (GHz). RF EMR is non-ionizing radiation, meaning that it has insufficient energy to break chemical bonds or remove electrons (ionization).

Radiofrequency (RF) radiation are electromagnetic waves emitted from a variety of common wireless communication devices, including cell phones, cordless (DECT) phones, Wi-Fi computer networks, smart meters, and baby monitors.

4 REQUIREMENTS

4.1 GENERAL REQUIREMENTS

All practical steps shall be taken to minimize worker exposure to radiation that may be hazardous or harmful to the health or safety of a worker.

Where applicable, work procedures and processes shall be developed and implemented that are as safe as reasonably practicable for work in proximity to radiation sources.

Where practicable, appropriate controls shall be implemented to eliminate or minimize exposure to radiation.

4.1.1 HAZARD/ASPECT AND RISK ASSESSMENT

A documented Hazard/Aspect and Risk Assessment (HARA) shall be completed to identify hazardous sources of radiation, Ionizing and/or non-Ionizing, a worker may be exposed.

4.1.2 STORAGE AND DISPOSAL

All hazardous radiation sources in the workplace shall be stored and/or disposed of in accordance with federal, provincial, and municipal regulations.

4.1.3 CONTROL MEASURES

4.1.3.1 RADIATION HAZARD CONTROL PLANS

Where a worker may be exposed to a radiation hazard, the worker shall be provided with information regarding the hazard and appropriate controls. For known harmful sources of radiation, the business shall develop documented work practices that will aid the worker to mitigate the hazard. Radiation controls to eliminate or minimize exposure to radiation, can include, but are not limited to:

- Elimination of radiation source from work location.
- Addition of appropriate engineering controls to ensure that radiation exposure limits are not exceeded;
- Administrative measures to reduce or remove radiation exposure.

4.1.3.2 LABELS

Each known hazardous radiation source utilized at SaskPower shall have a label (manufacturer or workplace label) affixed and are to remain legible and in good condition. If the applied label to a hazardous radiation source becomes illegible, damaged or accidentally removed, the label shall be replaced with either a manufacturer label or workplace label.

4.1.3.3 PERSONAL PROTECTIVE EQUIPMENT

Workers exposed to a known radiation source shall wear the appropriate personal protective equipment considering the type of radiation hazard. Selection of radiation protective clothing shall be documented with respect to the above considerations in the HARA.

4.1.3.4 EMERGENCY RESPONSE

Emergency response plans shall be developed for the radiation hazard present in each work site. Supervisors shall ensure workers who may use, store, handle, dispose and/or be exposed to hazardous radiation sources are trained to respond to an emergency, as per the applicable emergency response plan(s). These emergency response plans are developed by the applicable business unit.

4.2 IONIZING RADIATION

Ionizing radiation sources are used in various processes or in equipment at SaskPower. Due to the greater level of potential harm caused by ionizing radiation, there are stronger controls put on them. The use, storage, handling and disposal are regulated by the federal government through the Canadian Nuclear Safety Commission. At SaskPower, the management and procedures for use, storage, handling, disposal and licensing are coordinated by SaskPower's Radiation Safety Officer (RSO) or alternate.

4.2.1 RADIATION SAFETY OFFICER FOR IONIZING RADIATION

Radiation Safety Officer's (RSO) duties shall include, but not be limited to:

- Overseeing and managing SaskPower's compliance to its regulatory framework, including the Nuclear Safety and Control Act and applicable regulations;
- Any license applications and/or changes;
- Discussions with the Canadian Nuclear Safety Commission on SaskPower's behalf;
- Compliance reporting and inspections including audit reporting;
- Management of SaskPower's radiation safety and protection programs including disposal.
- Directors and managers shall understand the hazards if sources of ionizing radiation are present as defined under the Nuclear Safety and Control Act. Directors / Managers should contact the Radiation Safety Officer for information related to use handling storage or disposal.

4.3 RADON

Radon is a radioactive gas that occurs naturally when the uranium in soil and rock breaks down. In enclosed spaces such as basements, radon gas can accumulate to levels which can be a risk when inhaled for long periods of time. The highest risk environments would be living quarters in locations where radon is known to exist. The current

Canadian guideline for radon in indoor air for dwellings is 200 Becquerels per cubic metre (200 Bq/m^3).

Where conditions exist that may result in radon levels may be above the Canadian Guideline and workers are provided living accommodation, Radon levels should be tested to determine exposure. For additional information see Government of Canada: Radon Testing. Further, consideration should be given to consulting a certified radon mitigation specialist in the event controls are required.

4.4 NON-IONIZING RADIATION

4.4.1 RADIO FREQUENCY AND ELECTROMAGNETIC RADIATION

Radio frequency and electromagnetic radiation are by-products of equipment or systems used at SaskPower. Occupational risk from exposure to these types of radiation has not been established. Emerging research and/or regulatory change is being monitored by SaskPower. SaskPower is taking a precautionary approach and will provide information and guidelines on beneficial practice when using or working in proximity to these types of radiation as information is available.

4.4.1.1 RADIO FREQUENCY RADIATION

Radiation levels from SaskPower equipment that emit radio frequency radiation have been calculated. Examples are, antennas, satellite stations, and other communications equipment. Radio Frequency radiation levels from Advanced Metering infrastructure (AMI) meters have been measured and are known. Safety Code 6 provides guidance on exposure limits (3 kHz – 300 GHz) for communications equipment. SaskPower currently does not have any facilities that exceed the limits defined in Safety Code 6.

4.4.1.2 ELECTROMAGNETIC FREQUENCY EMF RADIATION (BELOW 0.3 KHZ):

EMF radiation is present whenever electricity is flowing. This radiation is made up of electric and magnetic fields.

IEEE 95.1 2019 Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 to 300 GHz states that the maximum exposure for a person's head and torso in an unrestricted environment (public) should not exceed 9.04 Gauss (0.904 milliTesla). It also says that for restricted environments (controlled areas) the limit should not exceed 27 Gauss (2.71 milliTesla). These are the most constraining limits using a frequency of 300 Hz.

Transmission and Distribution levels are typically between 0.000001 Tesla to 0.0000081 Tesla (10 mG and 81 mG (milliGauss)).

Workers with implanted ferromagnetic or electronic medical devices should not be exposed to static magnetic fields exceeding 0.0005 Tesla (5 Gauss).

5 IMPLEMENTATION

The requirements of this version of the standard are to be met within **six** months of the approval date at which time the previous version will be superseded.

6 RESOURCES

6.1 INTERNAL RESOURCES

Related Policies:	SaskPower Health, Safety and Environment Policy Hazard Aspect and Risk Assessment (HARA) Policy
Related Standards:	Hazard/Aspect and Risk Assessment (HARA) Standard
Additional Information:	Health, Safety and Environment Rule Book Radiography Safe Work Procedure (Control and Protection)

6.2 EXTERNAL RESOURCES

Related Legislation:	*Saskatchewan Employment Act, 2014* *The Occupational Health and Safety Regulations, 2020* *The Radiation Health and Safety Act, 1985* *The Radiation Health and Safety Regulations, 2005* *Nuclear Safety and Control Act 2017*
References:	Safety Code 6, 2015 Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz
Related Standards:	IEEE 1654-2009 Guide for RF Protection of Personnel Working in the Vicinity of Wireless Communications Antennas Attached to Electric Power Line Structures IEEE 2019 Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz ICNIRP 2020 Guidelines for Limiting Exposure to Electromagnetic Fields (100 KHZ TO 300 GHZ) BC Hydro Understanding Electric and Magnetic Fields
Additional Information:	Health Canada – Radon Gas: it's in Your Home

Ownership

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