RPIP	CONDUCTING RADIOLOGICAL SURVEYS	NUMBER: RPIP 1118
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INFORMATION USE
• **Procedure should be available, but not necessarily at the work location.** • **Procedure may be performed from memory.** • **User remains responsible for procedure adherence.**

PORC REVIEW DATE:	APPROVAL:
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1.0 PURPOSE / SCOPE

This procedure provides guidance for conducting routine radiation and contamination surveys for the Radiation Protection Group.

2.0 GENERAL DISCUSSION

2.1 The purpose of routine surveys is to verify the radiation and contamination present in representative areas of the plant. Inspection of existing postings should always be part of the survey process. Clean areas of the Radiologically Controlled Area (RCA) should be surveyed by Radiation Protection (RP) for radiation and contamination on a regular basis as controlled by the scheduling program. The following areas should be included in the surveys outside the RCA as determined by the scheduler:

- Turbine Buildings
- Service Building including lunchroom
- D-3 Lunchroom
- Admin Building including lunchroom
- Operators study/lounge area and lunchroom
- I&C shop
- Outside by the roll up doors of the Rad Waste Building and Resin Disposal building.
- Buildings located on site as designated by RP Supervision

Routine radiation surveys should be performed utilizing ion chambers because they are dose equivalent meters. Ion chambers should also be used when performing Hot Spot trending surveys because the dose rate on Hot Spots may vary with survey instruments due to the different distances from the source to the center of the detector. Dose rates will read higher with Geiger-Mueller (G-M) meters due to the small size of the detector and the close proximity of the detector to the source in comparison to an ion chamber. Keep large magnets away from radiation detection instruments. OE13798 describes an incident where a magnet, carried with a Teletector, caused the meter movement to fail. Also, magnets have been shown to reduce the count rate of photomultiplier tubes in the Tool and Equipment Monitor (TEM).

Contamination is reported in units of disintegrations per minute (dpm) or counts per minute (cpm) depending on the method used for performing the survey. Smears are reported in dpm and are used to quantify contamination levels, while Masslinn/Wipe surveys, Discrete Radioactive Particles and contamination removed from personnel are reported in cpm. Smears are taken by applying moderate pressure over 100 cm^2. A 100 cm^2 area is equal to an area of 16 in^2. This is a 4 inch by 4 inch area, or a line of one inch wide (2 fingers) and 16 inches long. Masslinn/Wipe surveys are taken using masslinn/Wipe cloths over an area and is a qualitative analysis of contamination levels only. The average Masslinn/Wipe broom at Prairie Island is 21 inches at its widest point. Therefore, 10 square feet will be covered by pushing the broom with Masslinn/Wipe cloth 6 linear feet. 25 square feet will be covered in 14 linear feet. With a walking step of 30 inches, 25 square feet will be covered in 6 steps. The TEM alarm set point is 2.2 nCi (equivalent to 5,000 dpm). It will alarm at about 1.5 nCi to achieve a 90% confidence level and a 1% false alarm rate. One nCi is equal to 2220 dpm, which equates to the following:

Square feet	dpm / 100 cm^2
5	50
10	25
25	10

3.0 REFERENCES / ATTACHMENTS / RECORDS

3.1 References

3.1.1 RPIP 1120, Posting of Restricted Areas

3.1.2 RPIP 1558, Protean Operation , Daily Checks and Plateaus

3.1.3 D54, Control of Openings in the Auxiliary Building Special Ventilation Zone Boundary

3.1.4 10CFR50.75(g), Reporting and Recordkeeping for Decommissioning Planning

3.1.5 21CFR1020.40, Cabinet X-ray Systems

L **3.1.6** Commitment to MN Dept of Health to meet MN Rules 4732.1000 and 4732.1040 for Security X-ray equipment

3.1.7 OE13798, Teletector Meter Movement Destroyed by Contact with Magnet

3.1.8 FP-RP-AM-01, Alpha Monitoring Program

3.1.9 RPIP 1112, Visual Survey Data System (VSDS) Survey Preparation

3.1.10 RPIP 1550, Ludlum 2000 Scaler with 43-2 Alpha Detector Operation and Calibration

3.2 Attachments

NONE

3.3 Records

3.3.1 PINGP 258, Radiation Protection Survey Record

3.3.2 PINGP 1607, Records of Spills or Other Unusual Occurrences (Reference 10CFR50.75(g))

3.3.3 RP Scheduler (VSDS)

3.3.4 PINGP 1023, Monthly Radiation Survey

3.3.5 Security X-ray Machine Survey Record

4.0 PRECAUTIONS / LIMITATIONS

4.1 IF unexpected contamination or radiation levels are discovered, an Alpha Level 1 area becomes an Alpha Level 3 area, or smear results show a beta-gamma to alpha ratio less than 50,

THEN notify RP Supervision.

4.2 Two meters should be used when entering areas with expected or known radiation levels greater than or equal to 10 rem/hr.

4.3 Whenever feasible, instrument readings should be taken with the instrument in the same position as the calibration position.

4.4 For radiation surveys conducted outside during cold weather. Follow the temperature operating guidelines provided in instrument procedures, instrument tech manuals, or the following general guidelines:

4.4.1 If the outside temperature is between 0 – 32 degrees F, the instrument should NOT be used for more than 5 minutes.

4.4.2 If the outside temperature is between -20 – 0 degrees F, the instrument should NOT be used for more than 2 minutes.

4.4.3 When the cold weather time period has expired, the instrument should be warmed up for an equal amount of time. If desirable, the instrument may be heated inside the surveyor's coat between survey points.

4.5 When using ion chambers for contact dose rates, the center of the detector (noted on the outside of the meter) should be used for best reading.

4.6 A 30 cm reading is taken from the center of the detector. For example, 30 cm for the center of an ion chamber detector would be approximately 10 inches from the housing face.

4.7 Extendable meters have multiple detectors in the head of the meter. The correct detector should be used (i.e., the upper range detector should not be used below its threshold) due to not recording the correct dose rates.

4.8 Cloth smears should be used when wet or rough surfaces are smeared, such as carbon steel pipes and unpainted concrete walls.

4.9 Smears should be dry prior to counting. Moisture will cause significant self-absorption of beta and alpha particles.

4.10 Removal of the brass floor plugs located on the 735′ elevation in the Basketball court area, breaches the Aux Building Special Vent Zone boundary. Multiple plugs may be removed during surveys (i.e. PINGP 1023), but only one plug may be removed at a time. Notify Unit 1 SS to ensure logging of CAT 1 Vent Zone Opening per D54 prior to removing first plug and notify Unit 1 SS to remove CAT 1 Opening after final plug installed.

4.11 The Technical Manuals for the Ludlum Model 177 and Ludlum Model 3 state that when the response switch is in "slow", it takes approximately 22 seconds for the meter to indicate 90% of the full-scale reading.

4.12 Decontamination, paint removal, or disturbance of contaminated corrosion layers may expose underlying elevated alpha contamination levels.

5.0 DEFINITIONS

5.1 Directionality – the change in the instrument reading with a change in orientation from the source. This is normally caused by the geometry of the detector and its position in relationship to the source.

5.2 Dose Rate – the dose per time usually expressed in mrem per hour or rem per hour for gamma readings. The unit “mrad/hr” is used to indicate Beta dose rates with a correction factor applied. Numbers on the survey maps based on position to the source are contact / 30 cm / 1 meter.

5.3 Contact Dose Rate – a dose rate reading with the meter within 1 inch of the radiation source, indicated on a survey map by an asterisk (*).

5.4 30 cm or 12 in – a reading that is taken specifically at 30 centimeter or 12 inches from a source, indicated on a survey map by a slash (/) following a contact reading.

5.5 1 meter or 3 ft – a reading that is taken specifically at 1 meter or 3 feet from a source indicated on a survey map by a (/) following a 30 cm reading.

5.6 General Area Dose Rate – dose rate taken waist high at a given location, indicated by a number on a survey map.

5.7 Geotropism – the gravitational forces acting on the analog meter movement. Digital displays are not affected by geotropism.

5.8 Hot Spot – a source of radiation in the plant which has a contact dose rate of greater than or equal to 100 mrem/hr, and at least 5 times greater than the general area dose rate.

5.9 Low Background Area – an area having significantly lower radiation dose rate than the surrounding area.

5.10 Radiation Survey – the determination and documentation of the radiation dose rate or exposure rate.

NOTE:	**This procedure is not required to be performed in its entirety. Individual sections may be performed alone as appropriate.** **Steps in this procedure are not required to be performed in sequential order. They are presented in a logical sequence in which they may be followed.**

6.0 RADIATION SURVEYS

6.1 **Obtain** a survey instrument which has a range that is higher than the maximum expected dose rate. Ion Chambers should be used for the following surveys:

- General Area dose rates
- Hot Spot trending
- Beta surveys

6.2 **Verify** the meter has been sourced checked for the date of use and has a current calibration sticker.

6.3 **Review** the current area survey maps to determine radiation levels and locations.

6.4 IF entering an area of unknown radiation levels,

THEN **select** a survey meter having the maximum meter range, and scale down as necessary to obtain a meter reading.

6.5 **Measure** and **document** general area dose rates. Include contact dose rates on any sources that significantly contribute to the general area dose rate.

6.6 IF a contact dose rate is greater than or equal to 100 mR/hr,

THEN also **measure** and **document** the 30 cm dose rate.

6.7 Contact and 30 cm dose rates should be measured and documented on all posted Hot Spots, along with the Hot Spot number.

6.8 Beta Surveys

6.8.1 **Conduct** a beta survey on any spill or leak from a suspected radioactive system.

6.8.2 **Calculate** the beta dose rate by multiplying the difference between the open and closed window by 5.

6.8.3 IF contact beta dose rates are greater than or equal to 100 mrad/hr,

THEN also **measure** and **document** the beta dose rate at 30 cm.

6.9 **Review** all radiation levels prior to leaving area to verify that postings are in accordance with RPIP 1120, Posting of Restricted Areas.

7.0 CONTAMINATION SURVEYS

7.1 Smear Survey

7.1.1 **Wipe** the smear over the surface to be surveyed.

7.1.2 IF the smear is believed to have activity greater than 50,000 dpm,

THEN **isolate** the smear from the other smears to avoid cross-contamination.

7.1.3 **Take** the smears to a counting station to determine the activity.

7.1.4 For smears from outside an RCA (Auxiliary/Radwaste Building, satellite, ISFSI) perform the following:

A. IF smears are less than 100 dpm/100 cm^2 beta-gamma and less than 10 dpm/100 cm^2 alpha

THEN

- **Document** the smear results on the survey as < 100 dpm/100 cm^2 beta-gamma and < 10 dpm/100 cm^2 alpha

B. IF smears are greater than 100 dpm/100 cm^2 beta-gamma or greater than 10 dpm/100 cm^2 alpha and verified to not be naturally occurring radioactivity

THEN

- **Control** personnel access to the area/material,
- **Inform** RP Supervision,
- **Document** the smear results, and
- **Decontaminate** the area/material, or
- **Move** the material into an RCA.

7.1.5 IF the smears are from an Alpha Level 1 area AND the area is an HCA THEN:

A. Count representative smears from the area for alpha.

B. IF any show alpha contamination levels > 100 dpm/100 cm^2 THEN take additional smears to determine the magnitude and extent of alpha contamination. Inform RP Supervision.

7.1.6 IF the smears are from an Alpha Level 2 area and beta-gamma contamination levels exceed 20,000 dpm/100 cm^2 THEN:

A. Count representative smears from the area for alpha.

B. IF any show alpha contamination levels > 100 dpm/100 cm^2 THEN take additional smears to determine the magnitude and extent of alpha contamination. Inform RP Supervision.

7.1.7 IF the smears are from an Alpha Level 3 area then a sufficient number of smears need to be counted for alpha to adequately evaluate the magnitude and extent of alpha contamination.

NOTE:	**Smears greater than 50,000 cpm are not normally counted using the Protean.**

7.1.8 IF the Protean is used to count the smears,

THEN **proceed** as follows:

A. **Place** smears in planchets with contaminated side up

B. **Count** the smears in the automatic smear counter IAW RPIP 1558.

(This step continued on the next page . . .)

(Step 7.1.8 continued from preceding page. . .)

C. Smears from alpha-containing sources including the final ISFSI cask survey, ISFSI concrete pad smears, installed ISFSI cask smears, smoke detectors, alpha sources, new nuclear fuel, etc should be counted long enough to achieve the appropriate contamination limit. These count times are:

1. 3 minutes when free releasing an item

2. 1.5 minutes for items not being free released

D. **Check** the printout for “flags” in the right hand margin.

E. **Record** the smear activity in dpm/100cm^2

7.1.9 IF the smear is wet and the situation requires rapid counting to estimate the contamination level,

THEN **proceed** as follows:

A. **Count** the wet smear with a frisker.

B. **Multiply** the smear’s activity by five to estimate the contamination level.

C. **Allow** the smear to dry and recount.

7.1.10 IF using a frisker to count smears,

THEN **proceed** as follows:

A. **Determine** the instrument background count rate.

NOTE:	**Do NOT touch the probe with a smear as this can contaminate the probe.**

B. **Hold** the smear within ½ inch from the probe with the contaminated side up.

C. **Determine** the activity in dpm by subtracting the background count rate from the gross count rate, and then multiplying by the probe correction factor of 10.

7.1.11 IF using a ion chamber to count smears,

THEN **proceed** as follows:

A. **Obtain** an open-window reading in mrem/hr.

B. **Multiply** the meter reading times 100,000 dpm to determine activity in dpm/100 cm^2.

7.1.12 IF using the Ludlum 2000 to count smears,

THEN **proceed** as follows:

A. **Place** smears in planchet with contaminated side up.

B. **Count** smears for a minimum of 2.5 minutes using the Ludlum 2000 IAW RPIP 1550.

7.2 Masslinn/Wipe Survey Method

7.2.1 **Wipe** the Masslinn/Wipe cloth over surface to be surveyed (ie. floor, wall, ladder).

7.2.2 IF the survey is to release an area from a Contaminated Area to a Clean area,

THEN **ensure** representative Masslinns/Wipes are taken on any walls, equipment and piping in the area.

7.2.3 **Count** Masslinn/Wipe(s) in the TEM.

7.2.4 IF the TEM alarms with Masslinn/Wipe,

THEN **resurvey** the area as necessary.

7.2.5 IF the TEM alarms at 100 nCi or greater with Masslinn/Wipe,

THEN frisk the Masslinn/Wipe to check for Discrete Radioactive Particles.

7.3 Equipment / Material Survey

7.3.1 IF surface area is greater than 5 ft^2,

THEN **wipe** item with Masslinn/Wipe and count in the TEM.

7.3.2 **Take** representative amount of smears on item and count on Protean.

7.3.3 IF there are no alarms on the the TEM and the smears are less than release criteria in RPIP 1120 for a clean area,

THEN **release** the item to the clean area of the RCA.

7.4 Clean Area Surveys should include Step Off Pads, area around Contaminated Area Boundaries, and around equipment containing radioactive fluids.

7.5 Survey of Materials Received from Another Facility

7.5.1 WHEN radioactive materials are received from another facility and are likely to have alpha contamination,

THEN **conduct** an alpha smear survey.

7.5.2 IF the materials have a higher Alpha Level than the area where they are to be used,

THEN **request** that the materials be decontaminated to the Alpha Level of the area where they are to be used.

8.0 DOCUMENTATION OF SURVEY RECORDS IN VSDS

8.1 Document surveys using the Visual Survey Data System (VSDS) per RPIP 1112, Visual Survey Data System (VSDS) Survey Preparation.

9.0 DOCUMENTATION OF SURVEY RECORDS, IF VSDS IS NOT USED

9.1 **Complete** a PINGP 258 survey coversheet, and **attach** all information related to the survey (ie survey map, protean printout).

9.2 All pages should be numbered and initialed by the surveyor.

9.3 **Document** the survey (and all copies) in the following manner:

9.3.1 General Area dose rates should be written at the location they were taken on the map.

9.3.2 Contact dose rates should be denoted with an asterisk and followed by the 30 cm dose rate.

9.3.3 **Document** the beta dose rates as mrad/hr (or rad/hr) to differentiate from gamma dose rates.

9.3.4 Smears should be documented as a number in a circle.

9.3.5 Masslinn/Wipe surveys should be documented as a number in a circle with an arrow coming out from it to show the area that was surveyed.

9.3.6 Neutron dose rates should be documented as a number followed by the "η" symbol.

9.3.7 All area postings and boundaries should be denoted on maps.

9.3.8 IF using an ion chamber to count smears,

THEN **record** the smear activity in dpm/100 cm^2 per step 7.1.11 above.

9.3.9 Air Sample results should be documented as a number inside a triangle.

9.3.10 IF radiological conditions in the area have changed, THEN inform the Access or Containment Lead, as applicable.

9.3.11 Forward the original survey document for review by RP Lead.

10.0 SURVEY EVALUATION

10.1 IF radiological conditions in the area have changed,

THEN **inform** the Access or Containment Lead, as applicable.

11.0 SURVEY DISTRIBUTION

11.1 **Make** copies of survey map and distribute to the following locations:

11.1.1 Access (or Containment) Control Briefing Books.

11.1.2 IF there is a local map posted for the area surveyed,

THEN **post** a copy locally in the area.

12.0 ROUTINE SURVEYS

For surveys performed on elevated structures, such as scaffolding or roof tops, **ensure** the proper tag is hung at the work location documenting results.

13.0 HOT SPOT SURVEYS

13.1 Hot Spots should be surveyed as part of routine surveys.

13.2 Hot Spots that are outside of posted HRA or LHRA should be surveyed per the scheduler and kept in the Hot Spot Log at Access.

13.3 Each Hot spot should be posted with a sign and a designator number.

13.4 **Notify** RP Supervision of any unposted areas that meet the definition of a Hot Spot.

14.0 X-RAY MACHINE SURVEY

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14.1 **Select** a survey instrument capable of identifying gamma / x-ray dose rates less than 0.5 mrem/hr.

14.2 **Measure** and **document** the area background dose rate.

14.3 **Activate** the x-ray beam in a unit.

14.4 WHEN the x-ray is activated,

THEN **measure** contact dose rates on the unit housing.

14.5 **Deactivate** the x-ray beam and document the dose rate readings.

14.6 **Repeat** steps 14.3 through 14.5 for the other x-ray unit.

14.7 IF any measured dose rates are greater than 0.5 mr/hr,

THEN **notify** the RP Supervisor.

14.8 **Document** completed survey in VSDS or if not available per Step 9.0.