TENORM RADIATION SAFETY PROGRAM FOR TECHNOLOGICALLY ENHANCED NATRUALLY OCCURING RADIOACTIVE MATERIAL (TENORM)

BARANKO ENVIRONMENTAL LLC.

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1.0 Purpose

The purpose of this document is to establish minimum requirements and expectations for handling and management of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) and to ensure that all reasonable precautions will be taken to protect workers who are, or might be, required to work with TENORM.

This practice provides guidelines to ensure employees and workers are fully knowledgeable of the correct procedures to be followed for worker protection, that the environment is protected from potential contamination and that TENORM impacted materials are managed within all applicable waste regulations.

2.0 Scope

This practice applies to all Baranko Environmental LLC employees, contract employees, contractors and other visiting personnel conducting work on Baranko Environmental LLC premises and temporary worksites.

This radiation safety program follows the North Dakota radiological health rules. The minimum standards for TENORM management including the following key elements:

- Management control over work practices including supervisory requirements to ensure Radiation Protection (RP) procedures are developed and implemented;
- Personnel qualifications and training;
- Control of occupational and public exposure to radiation;
- External gamma radiation monitoring and protection;
- Contamination monitoring and control;
- Environmental controls; and
- Waste management controls.

In conjunction, the TENORM Radiation Safety Program outlines the appropriate record keeping requirements of the above elements as follows:

- Dose Assessments;
- Training records;
- Screening, contamination and radiation surveys;

- Environmental monitoring; and
- Waste management tracking, transport and manifest documentation.

3.0 Administration

The management of Baranko Environmental LLC administrates the Radiation Safety Program to ensure that:

- TENORM screening surveys are prioritized and conducted as required to identify potential TENORM management issues.
- The TENORM Radiation Safety Program is implemented in the operating area where TENORM has been identified during screening surveys.
- All personnel (employees or subcontractors) required to work or potentially be exposed to TENORM are to understand the Radiation Safety Program requirements, have been trained before starting TENORM work, and has had annual refresher training after initial training.
- All personnel before starting work on temporary job sites regarding the use of tracer material will be trained to encompass tracer material safety, handling, use, and disposal.
- Identify and support resources needed in each area to oversee and control all TENORM radiation safety and TENORM waste management requirements. This team may consist of trained and experienced employees and/or a network of contractors who specialize in TENORM Management on an as needed basis. The Environmental Health and Safety (EHS) Team will consist of a designated TENORM Corporate Radiation Safety Officer (RSO), TENORM Supervisors and on-site TENORM Technicians.
- Updates to the TENORM Radiation Safety Program are completed as required.

4.0 Personnel Training

Training and awareness are a major part of a TENORM management program. The core knowledge requirements and training for personnel include the following:

4.1 TENORM Workers

Workers need to be provided TENORM awareness training which includes the following topics:

- Sources of TENORM radioactive contamination.
- Hazards of radiation and the necessary controls to mitigate.
- Hazards present in the work environment not associated with TENORM
- The risks associated with radiation to which the worker may be exposed in the course of his or her work.
- Comparisons of other radiation sources personnel are exposed to everyday.
- Safe work procedures including selection of TENORM and site specific Personal Protective Equipment (PPE), respiratory protection requirements and use of radioactive contamination control zones and personnel decontamination procedures.
- Tracer material operations and safety
- Emergency response

4.2 TENORM Technicians

All TENORM worker training plus the following:

- Survey instruments
- TENORM regulatory requirements including the applicable radiation dose limits for incidentally and occupationally exposed workers
- Survey documentation
- Sampling operations
- Tracer material operations and safety
- Air sampling
- Types of laboratory analysis
- Area posting and signage requirements
- Radiation monitoring procedures before working with TENORM impacted equipment or waste including managing control areas and fixed and removable contamination surveys.
- A practical session involving the actual survey for TENORM

4.3 TENORM Supervisor

All TENORM workers and TENORM technician training plus the following:

- Waste management handling and storage procedures
- Surveying plans and schedules
- Record keeping requirements including documentation of dose exposure levels.
- Shipping and transportation of radioactive materials. Class 7 TDG training.
- The Annual Limit on Intake (ALI) and Derived Working Limits (DWL).
- Disposal options and management of TENORM impacted waste and equipment.
- Liability minimization
- Tracer material operations and safety

4.4 TENORM Radiation Safety Officer (RSO)

All TENORM worker, technician, and supervisor training plus the following:

- Formal RSO training and certification that includes
  - Workplace inspections and audits
  - Biological and health effects of radiation exposure
  - Radiation detection, instrumentation and calibration
  - Transport of radioactive materials
  - Regulatory agencies and standard-setting organizations
  - Licensing of nuclear substances and radiation devices
- Detailed knowledge and practical abilities necessary to implement and monitor a Radiation Protection Program.
- A thorough review and understanding of all applicable federal, state and company regulatory requirements.
- Tracer material operations and safety
- Extensive practical experience with TENORM surveying, worker radiation protection and risk communication.

5.0 TENORM Formation

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) has been recognized as a potential hazard in industries that produce our natural resources. These include oil and gas, mining, refractory brick and ceramics manufacture, fertilizer, water treatment, and power generation industries.

The origin of TENORM in the oil and gas industry is primarily through the concentration of Radium (Ra226 or Ra228) associated with produced water production. These radio-nuclides are daughters of uranium and thorium which are incorporated in the Earth's crust and form part of the earth's natural background radiation.

Generally, TENORM materials exist in low concentrations in rock formations and generally pose little radiological concern. However, as part of industrial activities such as oil and gas production, TENORM radionuclides can be transported to surface and concentrated to levels that may pose a hazard to human health and the environment. For example, barium or calcium scale precipitated from oil recovery brine may concentrate radium at much greater concentrations than the original produced water source itself.

While there is potential to exceed allowable external radiation doses as a result of larger accumulated volumes and concentration of TENORM, in most cases, **the radiological concern to workers is from the inhalation or ingestion of TENORM materials. TENORM hazards are easily mitigated and controlled by implementing TENORM safe work procedures.** As a result, special precautions are needed for handling, storing, transporting, and disposal of material, by-products, end-products or process equipment containing TENORM.

6.0 Radiation Hazards

Two types of radiation hazards may be encountered: external hazards and internal hazards. The difference is whether the hazard is outside the body (an external hazard) or inside the body as the result of inhalation or ingestion of radioactive material (an internal hazard).

6.1 External Radiation Hazard

External radiation exposure occurs when personnel are exposed to gamma radiation from sources outside the body. **Typically external TENORM radiation hazards in the oil and gas industry are extremely low.** Although, generally not necessary, external radiation doses can be controlled by applying the radiation control principles of time, distance and shielding. Operations will be conducted so that individual members of the public and

incidental workers will not exceed 100 mrem Total Effective Dose Equivalent (TEDE) annually.

6.2 Internal Radiation Hazard

Internal radiation exposure occurs when TENORM gets into the body, and is far greater concern than external radiation exposure. Some radioactive isotopes may not be eliminated from the body for several decades and a very large cumulative dose may build up as a result.

- Internal contamination is prevented by avoiding the inhalation or ingestion of radioactive materials.

- Inhalation is a common route of entry. All feasible measures must be taken to prevent TENORM particles from becoming airborne. Industrial operations, such as welding, grinding or cutting can create an inhalation hazard. Possible controls include using water to prevent materials becoming airborne, using engineered ventilation controls, utilization of HEPA air filtration units, good housekeeping, and closure of emission points. If the dust cannot be controlled through these measures, workers must use respiratory protection. A properly fit tested half mask respirator will also eliminate the potential for inhalation.

- Ingestion of TENORM may occur when contaminants are deposited on clothing, PPE, or equipment and then transferred into the body. Possible controls include the use of disposable PPE and setting up control areas where workers are surveyed for contamination prior to leaving the control area. A half mask respirator will also eliminate the potential for ingestion. Good housekeeping, personal hygiene, restrictions on eating, drinking, and smoking in workplace areas where contamination may be present will further reduce the risk.

7.0 Worker Protection & Exposure Control

7.1 ALARA Principle

The basic philosophy of worker protection from all radioactive materials, including TENORM, is to maintain all exposures “As Low as Reasonably Achievable” (ALARA). In other words, if it is practical to avoid unnecessary exposures to above TENORM background levels, that is the preferred objective.

In addition to the principle of ALARA, maximum TENORM exposure or dose limits to workers and members of the public have been developed as outlined in section 11.2. The maximum allowable dose limit for members of the public and incidentally exposed workers is

100 mrem Total Effective Dose Equivalent (TEDE).

7.2 Radiation Exposure Limits

Doses to members of the public, and workers will be estimated by conducting a radiation survey of the workplace/worksite. The survey could include evaluations of survey results by using a radiation survey meter, airborne radioactivity as required, and/or dose monitoring badge. At a minimum surveys using a radiation meter will be used.

Initial surveying of area using a radiation survey meter will determine areas that will be restricted to the general public. Areas restricted to the general public will be established at or below twice background radiation exposure levels, and/or in combination with historical dose history if consistent confirming areas are below general public dose. Access for individuals will be limited to people with TENORM Awareness Training.

Workers with estimated doses in excess of 100 mrem are classified as occupationally exposed workers. Any dose levels above 30 mrem will require a dose assessment and radiochemical analysis of TENORM impacted materials if TENORM is present.

Occupation Health and Safety Regulations requires monitoring and exposure control plans if workers are potentially subject to elevated radiation levels. Estimates of the effective dose to workers and the public must consider the following exposure pathways:

- External gamma exposure.
- Ingestion of TENORM-containing materials.
- Inhalation of TENORM-containing dust.
- Inhalation of radon gas and its radioactive decay products.

Table 1 outlines radiation exposure limits for different types of workers and the public. These limits are in addition to natural background exposures and include both internal exposures and external exposure pathways.

Incidentally exposed workers are employees whose regular duties do not include exposure to TENORM sources of radiation. They are considered members of the public who work in an occupational exposure environment.

The occupational dose to individual adults shall be controlled to the following dose limits:

i. An annual limit, which is the more limiting of:
(1) The total effective dose equivalent being equal to 5 rem (5000 mrem); or
(2) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rem (50,000 mrem).

ii. The annual limits to the lens of the eye, to the skin, and to the extremities which are:
(1) A lens dose equivalent of 15 rem (15,000 mrem);
(2) A shallow dose equivalent of 50 rem (50,000 mrem) to the skin or to any extremity

The annual occupational dose limits for minors are 10 percent of the annual occupational dose limits specified for adult workers. The occupational exposure of a declared pregnant woman must not exceed 0.5 rem (500 mrem).

Table 1
Radiation Dose Limits

Affected Group	*Annual Limit*
Occupationally TEDE Limits for Adults	5 rem (5000 mrem)
Incidentally Exposed Workers & General Public	100 mrem

7.3 Derived Working Limits (DWLs)

Derived Working Limits (DWLs) have been determined from the annual radiation dose limits to assist in dose assessments. The DWL's provide an estimate of dose that can be directly measured in the workplace. Table 2 outlines the incremental radiation dose rate in the workplace for each classification group and the steps required to maintain a high level of health and safety for the workers and the public.

Table 2
Derived Working Limits – Dose Rate Thresholds

TENORM CLASSIFICATION	THRESHOLD DOSE mSv/a	DERIVED WORKING LIMIT - (above background)	THRESHOLD REQUIREMENTS
Investigation Threshold	< 30 mrem	<0.015 mrem/hr for 2,000 exposure hours	- Public and worker access unrestricted.
TENORM Management Threshold	> 30 mrem to 100 mrem	>0.015 mrem/hr for 2,000 exposure hours per annum	- Public access restricted and incidentally exposed worker access unrestricted. - Implement TENORM Safe Work Practices. - TENORM shipping and material management procedures.
Dose Management Threshold	> 100 mrem to 500 mrem	>0.05 mrem/hr for 2,000 exposure hours per annum	- Occupational worker access only - Registration of workers with an approved radiation dosimetry program.
Radiation Protection Management Threshold	>500 mrem to 5000 mrem	>0.25 mrem/hr for 2,000 exposure hours per annum	- Introduce a formal radiation protection program. - Ensure that workers do not exceed the annual occupational dose limit of 5,000 mrem in one year. - Limit up to 1250 mrem per quarter. - Reporting of worker doses to appropriate authorities past 5 rem (5000 mrem) TEDE. - TEDE Limit of 5 rem from Nuclear Regulatory Commission (NRC) under 10 CFR 20.1201.

7.4 Action Levels

In order to maintain doses ALARA, site specific action levels and administrative control levels must be implemented based on the anticipated hazards and the projected worker dose estimates. These levels must be set such that protective measures are initiated so as to maintain worker doses below the projected doses and well below the limits outlined in Section 7.2.

To ensure that the public and incidentally exposed workers do not exceed the annual dose limit of 100 mrem, the International Commission on Radiation Protection (ICRP) and the International Atomic Energy Association (IAEA) suggest the use of a dose constraint. A dose constraint allows for exposures from other sources without the annual limit being exceeded. ICRP suggests that for the control of public exposure an appropriate value for the dose constraint is 30 mrem in a year. In keeping with this suggestion, 30 mrem is the action limit at which TENORM safe work procedures are implemented.

8.0 Worker Dose Mitigation

The mechanisms for worker dose commitment are via external gamma radiation, inhalation of radioactive dust during work activities, and, to a lesser extent, inadvertent ingestion of TENORM. The following procedures will be implemented to mitigate worker exposure levels.

- To the extent practical, process or other engineering controls, such as, containment, decontamination or ventilation will be used to control the concentrations of radioactive material in air.
- When it is not practicable to apply process or other engineering controls to control the concentrations of radioactive material in air to values below those that define an airborne radioactivity area, a control area must be created in the immediate area where work on TENORM contaminated materials is performed. Signs shall be erected around the perimeter of the contaminated work area to notify personnel of the TENORM hazard and to restrict access to unauthorized personnel.
- All personnel who may come into contact with TENORM contamination must wear appropriate PPE and be advised of the hazards associated with the TENORM contaminated materials.
- Seal open ends of pipes or equipment with plastic, welded plates, or, at a minimum, duct tape, to prevent undue spreading of TENORM.

- Spread ground covers (heavy duty tarpaulins, drip trays, etc.) to capture TENORM contaminated materials when there is a likelihood of contaminating the ground.
- Where possible, keep material damp, but not wet, to prevent dust generation while minimizing the volume of contaminated wastewater.
- Contaminated gloves, respirators, coveralls, boots, cleaning rags and tools shall have surface contamination surveys conducted and shall be decontaminated as necessary prior to disposal. If decontamination on site is not possible, the material must be sealed, labeled, and sent to a licensed decontamination facility.
- All contaminated equipment or material must be properly contained and sealed for storage or disposal.
- TENORM contaminated waste shall be placed in storage bins that are suitable to contain all TENORM waste such as metal waste boxes, filter bins or heavy gauge polyurethane hazmat drums. All containers should be placed in a suitable monitored and secure TENORM storage area. The container shall be tagged with TENORM warning labels, contents, origin, date, dose rates and activity levels if possible.
- Eating, drinking, chewing, and smoking is not permitted in TENORM contaminated areas.
- All personnel must be surveyed for TENORM contamination prior to leaving the TENORM controlled work area. Personnel shall observe good personal hygiene and wash face and hands to prevent any possible ingestion of TENORM contaminated material.

8.1 Personal Protective Equipment

Inhalation can deliver most of the radiation dose in many TENORM work environments. Respirators equipped with cartridges approved for radionuclide dust must be worn whenever there is the potential to come in contact with TENORM. A high protection factor can only be obtained if there is an effective respirator selection, service and fitting program.

Air sampling, as directed by the Radiation Safety Officer, must be completed to identify the potential hazard, permit proper equipment selection, and estimate doses if there is potential for airborne contamination.

The cartridges used must be High Efficiency Particulate Arrestor (HEPA) P100 cartridges. These cartridges are typically color-coded magenta. These cartridges are only to be used as a minimum; some situations may require a positive pressure breathing apparatus. If additional hazards exist with the waste being handled, respirators with dual cartridges may be required.

It is not necessary to dispose of masks if they are clean and in good condition. Masks shall not be shared for hygiene reasons.

All respiratory equipment must comply with the company's fit testing program.

Wear protective boots, gloves and disposable coveralls to minimize contact with TENORM contaminated material or equipment. Whenever possible use easily washable or disposable PPE. Modifications to the PPE requirements may be made by the RSO or TENORM Supervisor depending on local conditions. For example, if the material being excavated is found to be wet and poses no airborne hazard – and no airborne radioactivity is detected in field monitoring – the requirement for the P-100 mask may be waived.

A radiation technician shall be available to assist with the proper donning and doffing of PPE, provide contamination monitoring and ensure everyone entering the area has the appropriate dosimeters (i.e. electronic or Thermoluminescent Dosimeter "TLD badge" if required.

8.2 Contamination Control Areas

Of primary importance in the prevention and spread of contamination is the delineation and maintenance of defined, secure working limits. Work involving the handling of TENORM shall be confined to areas designated as Contamination Control Areas (control areas). These control areas will be delineated and access to and egress from the areas will be restricted and controlled.

The TENORM Supervisor and TENORM Technician will ensure that tracking through the area is prevented and shall control traffic by means of prescribed access points and ensure all employees working in a controlled area has received appropriate instructions about the nature of the radiation hazard in the area.

Workers leaving the Controlled Area will be monitored for contamination. Equipment within the Controlled Areas will be cleaned prior to leaving the area. Equipment will subsequently be monitored by a TENORM Technician for unrestricted release after cleaning.

PPE must be removed in the control area if it is found to have any surface contamination on it above background levels. If contamination is below 200 CPM (using a Ludlum 44-9 pancake probe or equivalent) and loose contamination removed, it can then be bagged and disposed of as regular oilfield waste. If the PPE is found to have contamination over 200 cpm, then it must be contained in hazmat drums or suitable containment device for decontamination or TENORM waste disposal. All equipment must be decontaminated prior to removal from the control area or sealed and sent to a licensed decontamination and/or disposal facility.

Records of the results of the contamination monitoring of the contamination area must be kept by the TENORM Supervisor.

8.3 Personal Hygiene

The transfer and ultimate ingestion pathway of TENORM is one of the hardest to control. All personnel who come into contact with TENORM contaminated materials must complete personal frisking with a Ludlum 44-9 pancake probe and implement good hygiene practices.

The following procedure may be used for decontamination of skin. Continue with each step of the procedure until no contamination is detected:

- Monitor skin carefully to determine contamination level and location;
- Wash with tepid soap and water. Leave soap lather on for two to three minutes before rinsing. Re-monitor; do not use harsh cleansers or abrasive techniques for washing.
- Wash skin with a mild detergent. Scrub carefully with a soft bristly brush, soap, and water. Stop if skin reddens. Re-monitor.
- If contamination persists, consult the on-site TENORM Technician or TENORM Supervisor staff. The removed material (along with any wash water) will be placed into a container and will be labeled, inventoried and deposited into the onsite TENORM waste storage area.
- The TENORM PPE required during active cleanup work will include disposable clothing such as tyvek suits and gloves. Disposable clothing will be removed prior to leaving the control and bagged for disposal in the closest onsite waste storage area.

8.4 Personnel Dosimetry Requirements

A licensed dosimetry service will be used to measure the radiation doses to occupationally exposed workers who have a reasonable probability of receiving an effective dose greater than 100 mrem in a one-year dosimetry period. TLD badges (and associated control dosimeters) will be kept in an area at background radiation levels and not the area of active

work. All workers engaged in TENORM activities will be supplied with a personal TLD badge as required, clearly identified (for example, with the person's name) and will be required to wear these daily. Workers must pick up their TLDs from the designated rack at the beginning of each day and wear it at all times. At the end of each day, workers must return their badges to the designated rack. Several non-labeled badges will be available for visitors and additional personnel. Generally, visitors would not be required to wear badges unless required by the TENORM Supervisor. If a badge is to be used on a continuing basis by a worker, they will be assigned their own TLD. The reporting period for the TLDs is quarterly.

Each quarter, the TLDs will be replaced with new ones and those which have been worn, the controls, and any unused TLDs will be returned by management to the licensed dosimetry company for measurement. Workers will be notified of their accumulated doses once the results have been received (these are typically posted in a readily accessible area to all workers, such as the lunch room).

Workers are not to share or trade TLDs. Air monitors will be worn by certain workers designated by the TENORM Supervisor (for example, when beginning intrusive work into materials known to contain radioactive material the air monitor may be used to measure daily doses). The air monitor will be given to the worker in each team that is likely to receive the highest dose in a certain activity as determined by the TENORM Supervisor. The worker may change depending on the activity that day. The air monitor will be read and recorded at the time interval determined by the TENORM Supervisor.

Workers will be provided with appropriate dosimeters at the beginning of each day. It is the responsibility of the workers to:

- Ensure the TLD badge is worn on their upper or mid body. TLD badge shall be always worn on the outside of pocket or outer clothing while working. This ensures that the TLD badge measures the deep, eye, and shallow dose radiation exposure of the individual. Be mindful of badge location while wearing and do not loose badge.
- Ensure TLDs are returned to the proper rack at the end of each day or prior to leaving the site.
- Air monitors are worn by designated workers at the same location as the TLD and that the air monitor is returned at the end of the day or when leaving the site. The TENORM Supervisor or designate will record readings at the time interval specified.

A lost or missing TLD is to be reported immediately to the TENORM Supervisor and RSO and a replacement will be provided as quickly as possible.

The results of radiation field surveys, the recorded TLD dose from a co-worker engaged in similar activities and any air monitoring results will be used to estimate a maximum probable dose received by the worker during the time period the lost TLD was worn. This will be included in the record along with a note indicating that this is an estimate.

Dose from dust inhalation will be estimated from air monitoring results as required. This average concentration will be used with the time spent in the area, the worker inhalation rate, and the appropriate dose conversion coefficients to determine the dose received from inhalation. Implementation of good work practices (such as washing hands and face when exiting works areas and before eating and drinking) will eliminate the ingestion pathway.

The RSO will investigate within 30 days the cause of any personnel exposure that is anomalous or which exceeds the applicable administrative control level. If warranted, the RSO will take corrective actions to ensure that unnecessary exposures are halted and recurrence is prevented. A report of each investigation and the actions taken, if any, will be recorded and maintained for inspection purposes.

If an action limit is exceeded, the RSO will:

- Conduct an investigation to establish the cause for reaching the action level;
- Identify and take action to restore the effectiveness of the implemented radiation protection program; and
- Notify senior management.

If appropriate, an ALARA review will be performed.

If a regulatory dose limit is exceeded, the following will be performed:

- Immediate notification of the person and the State Authority of the dose;
- Removal of the person from any work that is likely to add to the dose;
- Conduct an investigation to determine the magnitude of the dose and to establish the causes of the exposure;
- Identify and take any action required to prevent the occurrence of a similar incident; and immediately report the results of the investigation to the appropriate government authority or on the progress that has been made in conducting the investigation

9.0 Radiation Monitoring Equipment

Gamma survey meters, typically NaI scintillation types, will be used for monitoring gamma radiation fields. The exact type and make will be determined by the Radiation Safety Officer (RSO) prior to the commencement of any TENORM work and the personnel using the instrumentation will be provided appropriate training.

Contamination meters sensitive to alpha and beta contamination (likely a Geiger Mueller (GM) pancake type) will be used for routine contamination control activities.

Dust samples will be completed as required and directed by the RSO. A constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 0.1 millisievert (10 mrem) per year from these emissions.

All instruments must be calibrated annually or according to the manufacturer's specification and tested by check source prior to use.

Note: Most radiation survey equipment is not intrinsically safe. An appropriate safe work permit and gas check will be required prior to conducting radiation surveys.

10.0 TENORM Surveys

10.1 TENORM Survey Requirements

Only personnel who are adequately trained in the hazards of TENORM and the calibration, testing, and use of radiation monitoring equipment will conduct testing for TENORM.

The testing equipment must be a radiation survey meter capable of operating in either rate meter or scalar mode with the ability to accurately measure gamma radiation exposure rates in micro-roentgens per hour (μR/hr) or equivalent and contamination levels in counts per minute (CPM). The survey meter should have both a gamma scintillation probe and pancake GM contamination probe. A Ludlum 3-97 with 44-2, and 44-9 probes or equivalent is recommended. Testing equipment must be calibrated annually or according to the manufacturer's specifications.

In addition to testing the equipment's regular calibration, the survey meter must be checked against a known source before each survey to ensure the equipment is in proper working order.

All survey data should be recorded. Background levels must be determined before each survey to ensure monitoring results are comparable to previous surveys.

10.2 TENORM Gamma Radiation Surveys

Monitoring equipment that can detect gamma radiation must be used and the results should be recorded in µR/hr or cpm.

If monitoring propane, ethane or NGL systems where radon contamination is suspected, the equipment must have been running for at least two hours before monitoring begins. This will allow the short lived gamma ray producing radon daughters to be generated and therefore allow gamma rays to be measured. Approximately 85% of the gamma rays produced by radon daughters are from the short-lived isotopes.

Exposure rate measurements taken on the outside surfaces of suspected equipment shall be considered as potentially TENORM contaminated if the rate exceeds background radiation levels. A sample must be taken for laboratory analysis to determine if the waste meets or exceeds unconditional release limits where applicable.

Exposure rate measurements should be taken within 1 cm of the equipment walls at locations where TENORM scale or sludges are suspected to build up (typically at the vessel's bottom).

Consideration should be given to equipment wall thickness and the distance the survey meter is from the suspected TENORM contamination.

Derived Working Limits must also be determined on all equipment identified with elevated gamma signatures. A dose rate must be obtained for the typical work area around the identified equipment for this calculation.

10.3 TENORM Contamination Surveys

When surface dose rates measured on the equipment's outside surfaces exceed background levels, worker protection requirements must be specified in relation to surface contact, airborne particulate, and vessel entry. This monitoring should be conducted by suitably qualified and trained personnel.

Monitoring equipment that can detect surface contamination levels including gamma rays and alpha and beta particles shall be used during internal inspections.

Average fixed surface contaminated equipment or PPE intended for release to third parties or sent for disposal must meet the unrestricted release criteria of 5,000 dpm/100 cm^2 (83.33 Bq/cm^2 averaged over 100 cm^2). This is equivalent to 166 CPM for a Ludlum 3-97 scintillation detector with a 44-9 GM pancake probe.

Equipment with removable contamination must be cleaned prior to release to levels less than 1,000 dpm/100 cm^2 (16.67 Bq/cm^2 averaged over 100 cm^2).

When conducting ground and waste surveys compare the survey readings to background radiation levels. Readings at above background radiation levels indicate the material may be contaminated with TENORM. Surveys will be utilized to check ground/waste contamination levels and written on the survey to help identify areas that need clean-up or assessment actions. Readings will be performed in µR/hr and/or cpm. When surveying walk slowly over grounds and use a suitable grid method to cover area.

11.0 Regulatory

This practice is subject to the following regulatory requirements:

11.1 Federal

Wastes containing technologically enhanced naturally occurring radioactive materials (TENORM) are generally not regulated by federal agencies. However, one area in which TENORM-containing wastes are regulated at the federal level is transportation.

TENORM-containing wastes that have a specific activity greater than 270 pCi/g are subject to the U.S. Department of Transportation (DOT) regulations governing transport of radioactive materials. These regulations are contained in the Code of Federal Regulations, Title 49, Chapter 1, Part 173, Subpart I, "Class 7 (Radioactive) Materials," § 173.401 - 173.476.

11.2 North Dakota

TENORM-Specific Regulations:
None -- subject to the general radiation control regulations as outlined in the North Dakota Administrative Code, Article 33.1-10-23, "North Dakota Radiological Health Rules.".

12.0 TENORM Waste Management

The management of TENORM wastes encompasses all aspects of initial characterization, handling, storage, transportation, processing, treatment, and disposal practices from the point of generation to the final disposition. This practice provides recommendations based on the radiological properties of TENORM. In determining an acceptable material management option, other hazardous properties such as chemical toxicity must be considered. In some cases, the non-radiological hazardous properties of TENORM materials are the critical selection criteria for the preferred TENORM material management option.

This practice outlines Unconditional Derived Release Limits (UDRL) for diffuse and discrete TENORM wastes. All TENORM impacted materials above UDRL limits must be stored in a designated and signed TENORM storage area in appropriate containers until the TENORM Supervisor arranges for transfer to a licensed disposal site.

Please see "Baranko Environmental LLC Decon Facilities 08/11/23" Map in Appendices (Appendix B).

- List of Current Facilities:
  - Wet Decon
  - Sucker Rod Decon
  - Dry Decon
  - West Containment
  - East Containment
  - Barrel Storage
  - Center Decon Containment
  - Yard Breakroom and Office
  - East Containment #2
  - Guard Shack
  - Bucking Unit
  - Sucker Rod Guide Breaker

12.1 Diffuse TENORM Sources

Table 3 – North Dakota Unconditional Derived Release Limits (UDRL's) Diffuse TENORM Sources

TENORM RADIONUCLIDE	*SOLID (pCi/g)*
North Dakota	5

12.2 Discrete TENORM Sources

Limits for surface contamination on equipment, tools and scrap surfaces intended for unconditional release are listed in Table 4. These limits are applicable to fixed surface contamination. Loose surface contamination must be completely removed or all accessible surfaces cleaned prior to release to levels less than 1,000 dpm/100 cm^2 (16.67 Bq/cm^2 averaged over 100 cm^2).

Table 4 – Unconditional Derived Release Limits (UDRL's) Discrete TENORM Sources

Property	*Limit*
Exposure Rate (metal recycling)	Best practice is at or below background radiation levels in µR/h
Fixed Surface Contamination	5000 dpm/100cm^2 (83.33 Bq/cm^2 averaged over 100 cm^2)

Labeling of TENORM Impacted Equipment

All equipment identified as TENORM contaminated by testing for TENORM on the equipment's outside surfaces, shall be tagged or labeled as:

This equipment may contain "Technologically Enhanced Naturally Occurring Radioactive Material – TENORM"

Special precautions are required before the equipment is opened for repair, maintenance, or inspection. All equipment will be surveyed before general maintenance so it's not above twice background levels prior to working on equipment.

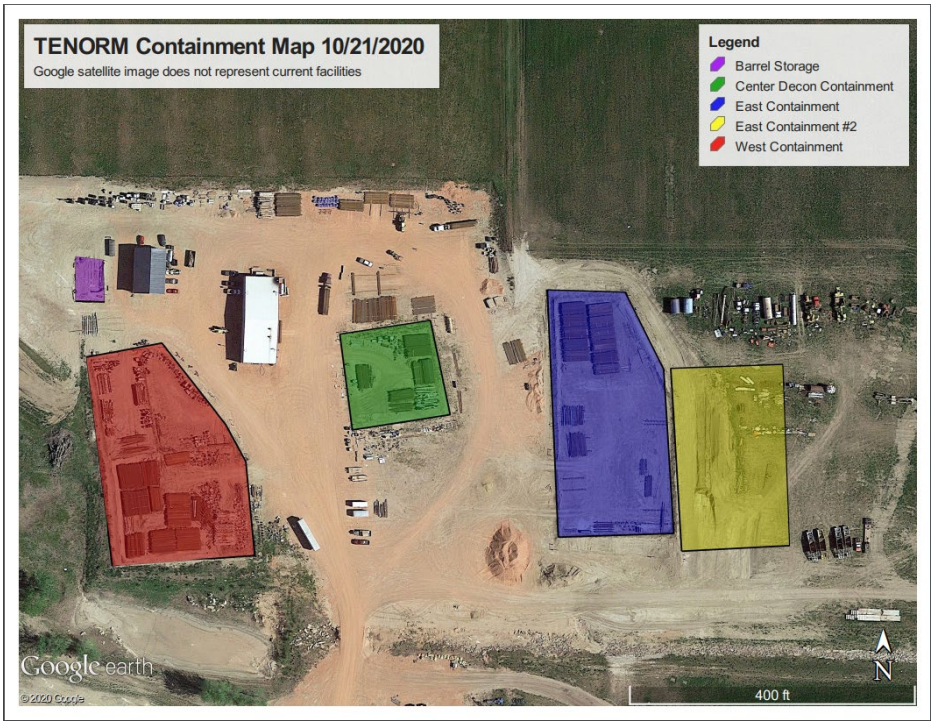
12.3 Storage of TENORM Impacted Materials

Outdoor storage areas should have appropriate security fencing, positioned such that the annual exposure to members of the public does not exceed a dose equivalent of 30 mrem at the perimeter. Access to the storage area should be restricted and work practices established so that the annual exposure to incidentally exposed workers does not exceed 100 mrem. In addition, TENORM impacted materials must be stored under the following requirements:

- Containers and equipment in storage containing TENORM shall be stored in a fenced, signed, monitored and secure area with limited access.
- TENORM materials should be stored on a sealed and dyked pad.
- Provisions must be in place for secondary containment (e.g., an impervious barrier or liner) where liquid TENORM wastes are being stored.
- Wherever possible, materials with higher radiation levels should be stored near the center of the area to reduce radiation levels at the storage area perimeter.
- Containers and equipment containing TENORM material must be recorded and secured against unauthorized removal from the storage area.
- An accurate inventory of materials must be maintained including originating location, date, activity levels and package contents. Dose levels within the storage area must be recorded monthly and inspections shall be performed to identify leaking or corroded containers, which must be immediately repacked or sealed.
- Loose TENORM such as scale and sludge shall be stored in sealed and drums on pallets or racks. Larger volumes may be stored in specially designed 25cy roll-off bins prior to disposal.
- All openings on stored equipment or tubing containing TENORM shall be capped, plugged or wrapped in plastic to prevent the spread of TENORM.
- TENORM contaminated PPE, rags, etc. should be placed into drums.
- Personnel who enter TENORM storage areas shall be informed of the presence of radioactive materials, the safety hazards associated with the material and the methods of controlling exposures.
- The boundary and all entrances to TENORM storage areas shall be identified with a sign bearing the three-bladed trefoil radiation symbol and the words “CAUTION, TENORM RADIOACTIVE MATERIAL STORAGE AREA”. If the storage area has a dose rate of greater than 500µR/hr employees must contact their supervisor for a review of the area.

- Records shall be maintained to document at least the following information:
  - Generator information – location, address and contact.
  - Container identification code.
  - The storage location.
  - Type of material in storage (scale, sludge, PPE etc.).
  - The date the material entered storage.
  - The original location of material or equipment and type of service.
  - Measurement data that reflects the radioactivity of each container (exposure readings in µR/hour and/or activity concentration in pCi/gram).

- The TENORM Containment Map at Baranko Environmental LLC is pictured below.



12.4 Transport of TENORM

The transport of oilfield TENORM, with radioactivity below 270pCi/g is not subject to federal transportation regulations and falls under the jurisdiction of each state regulator.

Prior to shipment, the TENORM material must be assessed to determine the activity concentration.

All TENORM shipments, even if not subject to Federal Transport Requirements, are still required to have a manifest shipped with the TENORM contaminated materials. The manifest must contain the descriptor **"Technologically Enhanced Naturally Occurring Radioactive Material – TENORM"**. Do not affix radioactive placards or labels on the transport vehicle or on the exterior surfaces of the packaging.

Equipment with TENORM should be appropriately contained to prevent the release of radioactive material during transportation. All openings where potential TENORM contamination could escape must be sealed prior to transport; heavy polyurethane and duct tape is usually sufficient. The objective is to seal the TENORM contamination within equipment ensuring that there are no leaks or spills during the loading, transport or unloading of the TENORM contaminated items. Tubing and piping should have pipe protectors installed or the ends sealed. The shipment should also be tarped to provide secondary containment and in case the ends get knocked off during loading or transport.

All packaged equipment and containers should be labeled with the wording **"Caution-Radioactive Material"** and marked such that the contents and/or contamination levels are readily identifiable from the outside. This prevents unnecessary handling and opening of packages for identification at a later date and is a prudent worker safety measure.

Shipments of oilfield TENORM Ra226, and Ra228 with activity above 270pCi/g fall under the federal jurisdiction and are therefore subject to the requirements of federal regulations, including U.S. Department of Transportation (DOT) regulations.

All personnel are to obtain approval from the Corporate Radiation Safety Officer prior to shipping materials that falls under federal jurisdiction.

12.5 Disposal

As noted above, most provinces and states have established specific regulatory programs that define what materials must be managed as regulated TENORM and sent to appropriate TENORM licensed decontamination or disposal facilities.

TENORM impacted equipment including tubing, wellheads, casing, pumps, vessels, heat exchangers, pipeline inspection tools and other miscellaneous items must be cleaned for unrestricted release at a TENORM licensed decontamination facility. Bulk diffuse TENORM waste material is collected and sent for licensed TENORM disposal.

Diffuse TENORM waste disposal options currently allowed in several jurisdictions include burial at licensed TENORM landfills or low-level radioactive waste (LLRW) disposal facility and underground injection into a subsurface salt cavern or TENORM licensed disposal well.

All decontamination and disposal of TENORM waste must be coordinated the corporate RSO to ensure complete permitting, regulatory approval, documentation and supervision for the transportation and disposal of TENORM contaminated wastes and equipment.

Disposal options for TENORM waste must be reviewed in consultation with Baranko Environmental LLC, Environment & Regulatory Group and approved by Senior Management.

13.0 NORM/TENORM Temporary Job Sites

13.1 NORM/TENORM Temporary Job Site Operations

Temporary Job Site operations will be conducted mirroring safety guidelines and practices indicated in the Baranko TENORM Radiation Safety Program. As a TENORM waste processor and TENORM decontamination provider Baranko Environmental LLC will conduct TENORM operations at temporary jobsites within the State of North Dakota. Temporary job site operations would consist of TENORM decontamination and TENORM waste processing. TENORM waste processing will be done with the goal of separating solids from liquids using waste processing techniques to aid in preparing waste for handling and/or disposal. TENORM Decontamination services will be conducted to restore equipment and grounds to acceptable decontamination standards.

13.2 NORM/TENORM Temporary Job Site Work Plan

A work plan will be created prior to temporary job site work illustrating the requirements needed to perform the job in a safe and effective manner. Depending on the site and conditions, a standard work plan may include Introduction; Contact Information; Scope of Work; Description of waste processing/decontamination procedures, Safety and PPE; Surveys and Testing; Waste Transportation; Disposal; and any other appropriate item to be addressed prior to work start date. The work plan will be submitted to the DEQ prior to the start date.

Plan Before Work is Conducted:

- Land and onsite equipment related to the working area will be surveyed using a radiation survey meter prior to the conduction of onsite TENORM processing / decontamination activities. Information gathered will consist of onsite equipment with the potential to be involved in the work performed, wastes, and the working area. Information gathered of onsite equipment and grounds will be in the form of photos, surveys, and descriptions of working area/equipment. An initial site report will be made to refer to as the project progresses.

Report After Work is Conducted:

- All equipment and grounds associated with the temporary job site will be surveyed and summarized in an after-action report when project is completed. If surveys and information gathered indicate more work is to be done re-work in these areas will be performed and noted in the report. The after-action report will summarize initial findings in relation to post work findings to illustrate accomplished goals of the project.

Temporary Storage and Securement of Waste:

- Waste that is gathered during onsite TENORM operations will be placed in appropriate containers identified to be suitable as determined by the initial findings report. As work progresses more suitable forms of waste containerization may be identified and implemented dependent on waste and work conditions.
- Temporary onsite storage may be used if worksite conditions allow to prevent contamination from spreading or when loading wastes. Options for waste storage include but not limited to are: roll-offs, dumpsters, totes, and drums. Other onsite storage may take the form of trailers or containerized transport if left onsite temporarily.
- A temporary storage location will be identified onsite. Containers will be labeled, inspected, and taken out of service if found to be compromised. When storing waste an appropriate storage area will be selected by using TENORM survey readings and a review of areas not easily accessible to the public. A TENORM storage area will be selected to prevent exposure to the general public and be considered a controlled area. The area will only be accessible to authorized workers and have some form of barrier or way to show the area is being used for temporary TENORM storage such as cones, caution tape, fence, signage, berms, ect…. A temporary storage area boundary will be established at an area where radiation exposure readings are at or below twice natural background for storing TENORM wastes.
- Inventory of wastes will be conducted prior to work and illustrated in the work plan. Wastes leaving site will be tracked by keeping a record of waste disposal and hauling tickets/manifests.

- If waste is considered TENORM it will be reported on the DEQ Quarterly TENORM Transportation Report required by all state approved TENORM licensed transporters to complete the end of each month following the reporting quarter period. The transport report is to be completed by the licensed transporter hauling the TENORM waste.
- A summary of the waste removed in units (ex. barrels, tons, yards) disposed and name of disposals used will be included in the final work report.
- Waste containers will be secured when necessary utilizing tarps, lids, or devices used to keep waste contained in containers.

Waste Information, Waste Coordination, Transportation:

- Depending on job scope, the customer may want waste to be removed or stored onsite for later disposal. Baranko Environmental LLC will work with the customer to determine waste storage and disposal options. Waste disposal options will be discussed in the work plan and options will be assessed prior to disposal activities.
- Waste will be hauled to disposal by a licensed waste hauler holding a Waste Transportation Permit #, TENORM Transportation License, and any other appropriate transportation requirement as determined by the waste type. Please see section “12.4 Transport of TENORM” for more information.

Waste Disposal Determination:

- Initial radiation surveys, field screening, generator knowledge, Safety Data Sheets, and Lab analysis of waste will be used to determine suitable disposal options. Applicable waste profiles / acceptance criteria will be done in work planning phase and before transportation to waste disposal facilities. Please see section “12.5 Disposal” for more information.

TENORM Radiation Survey Equipment and Usage:

- Survey meters with the ability to detect Gamma, Alpha, and Beta radiation will be used to aid in work performed on the job site. Gamma radiation results will be measured in µR/hr and surface contamination results will be recorded in CPM (Counts Per Minute). If other applicable units are used they will be noted on the survey sheet and explained in the work plan or report. Baranko Environmental LLC primarily uses meters manufactured by Ludlum Manufacturing Inc. based out of Sweetwater, Texas.

- Meters to perform work will be in-specification meaning that they read correctly within 20% of the reading when compared to the meters check source and the survey meter be calibrated within one year of its last calibration date. When surveys are completed, the meter will be inspected during each use to determine it meets operating specifications. A different survey meter will be used if the meter is determined to not meet operating specifications. If a meter does not meet operating specifications, it will be taken out of service, calibrated, and if needed repaired.
- Personnel using radiation surveying equipment will have TENORM Awareness Training giving them the knowledge to conduct surveys effectively.
- TENORM surveys when conducted at temporary job sites may consist of surveys of grounds, equipment, waste, and areas associated with the job site. Common readings used in surveys may consist of µR/hour, mR/hr, cpm (counts per minute), and dpm (disintegrations per minute). Survey sheets are used to gather information on sources of radiation, relation of items in the working environment, and location where readings are taken. A map will be used if applicable and a note of scale to help determine context of area covered. If items are not to scale note on survey sheet.
- Radiation surveys are used to show items or areas that have radioactive properties (radiation above background radiation) and areas or items that don't exhibit radioactive properties (at or below background radiation). Lab analysis may be used in conjunction with surveys to help identify areas or items containing radiation.
- Radiation surveys will be done to help plan before starting work, during work, and to help with determining that work goals are met before job is considered concluded. During work radiation survey information will be used and help identify any changes to operations at the temporary work site to prevent peoples exposure to TENORM.
- A background radiation reading will be taken initially at the beginning of the survey and compared to items and grounds when conducting a radiation survey. When taking a background radiation reading stand away from potential radiation sources to get a background that is accurate. When distance is doubled from the source of radiation exposure to gamma radiation drops by 4 times its initial reading as described in the inverse square law. Background radiation levels are made up of naturally occurring radiation.
- Surveys will be used in conjunction with work activities with the goal of achieving the principle of ALARA (As Low as Reasonably Achievable).
- TENORM Surveys and sampling will be overseen or also conducted by Radiation Safety Officers and/or the Corporate Radiation Safety Officer.

Overseeing Temporary Job Site Activities:

- Temporary Jobsite activities will be overseen by a Baranko Environmental Radiation Safety Officer (RSO) and/or the Corporate Radiation Safety Officer (CRSO).

13.3 NORM/TENORM Temporary Job Site Employee Safety Training and Onsite Safety

Employees that will be working around TENORM materials on temporary jobsites will be given company TENORM Awareness Training by a trained Radiation Safety Officer before beginning work. Training, badges, and surveys will be tracked during and after site activities end and all reports will be retained by Baranko Environmental LLC. The work plan will include more detailed information on safety and monitoring procedures per job site.

Temporary Job Site Training:

- Training on temporary jobsites, for those that have not yet received training will be conducted by a trained Radiation Safety Officer (RSO). Training will include an awareness level understanding of TENORM safety, TENORM meter usage, survey techniques, waste handling, and background on TENORM wastes and radiation properties.

Temporary Job Site PPE:

- Standard PPE required at temporary jobsites may include the use of any and all PPE listed such as: hard hat, tyvek suit, boot covers, respirator, eye protection, 4 gas monitor (LEL, H2S, oxygen, carbon monoxide), rubber/nitrile gloves, impact gloves, dosimetry badge, and fire resistant clothing.
- Standard PPE will be based off onsite customer safety requirements in addition to PPE needed to perform TENORM decontamination and processing activities.
- Standard PPE protection depending on work performed include customer site PPE requirements and the PPE listed below dependent on these TENORM exposure levels:
    - Immediate contact with TENORM wastes:
        - Tyvek suit, respirator if waste is airborne such as dust, dosimetry badge, rubber/nitrile gloves, eye protection, boot covers or steel toe rubber boots, onsite customer safety PPE requirements or other determined hazards not related to TENORM.

- Extended time working around TENORM but not in contact with TENORM:
  - Dose badge, rubber/nitrile gloves, eye protection, and onsite customer safety PPE requirements or other determined hazards not related to TENORM.

- Support services limited to brief non-contact TENORM exposure determined not to go over general public dose limits:
  - Onsite customer safety PPE requirements or other determined hazards not related to TENORM.
  - Will not go in restricted area without training and proper PPE.
  - Will not go into areas of exposure limits above twice background exposure levels.
  - Established areas considered acceptable for members of the general public using radiation surveys will be discussed in the job specific work plan. Readings as close to background levels are encouraged at restricted area boundaries of the controlled area.

➢ Please see sections "7.0 Worker Protection and Exposure Control" and "8.0 Worker Dose Mitigation" for additional information to review when planning temporary worksites.

Emergency Response Measures at Temporary Job Sites:

Emergency response requirements are described in section "14.0 Emergency Response and Spills". For Temporary Jobsites if any spills or emergencies were to occur stop work would be implemented and Baranko/customer safety leadership will be contacted immediately.

14.0 Emergency Response and Spills/Fire

14.1 Emergency Response

First priority is human life and ensuring employees are alright and their health and safety are secure. **TENORM does not pose a significant short term health risk.** As a result, all emergency response plans must address immediate health and safety concerns as first priority.

For fires/spills that occur on Baranko Environmental property refer to the emergency contact list below. If an emergency occurs at a temporary job site, the customer and any other applicable parties will be additionally notified.

Emergency Response Information

EMERGENCY RESPONSE CONTACTS		
Dickinson Fire Department		911
Stark County Sheriff		911 or 701-456-7610
Stark County Disaster Emergency Management		701-456-7605
National Response Center		1-800-424-8802
US Environmental Protection Agency, Region 8		303-312-6312
BARANKO ENVIIRONMENTAL CONTACTS		
Glenn Baranko, Owner	Office	701-483-5868
	Cell	701-290-0087
Jason Hicks, Chief Operating Officer	Office	701-483-5868
	Cell	701-690-7352
Shawn Hayden, Safety Director	Office	701-483-5868
	Cell	701-690-9589
Scott Hayden, Environmental General Manager	Office	701-483-5868
	Cell	701-690-7279
Dalten Kuhn, Corporate Radiation Safety Officer	Office	701-483-5868
	Cell	701-202-9468
Baranko Environmental 24hr Response Phone #:	Emergency	701-264-5004
ENVIRONMENTAL CONTACTS		
North Dakota Department of Environmental Quality	Office	701-328-5166
	Emergency	1-800-472-2121
North Dakota State Water Commission	Emergency	1-800-472-2121
North Dakota Industrial Commission	Office	701-328-3722
	Emergency	701-328-8020

14.2 Environmental Control Measures

TENORM spills should be prevented where possible by using appropriate drip trays, tarps, sealing equipment openings, and secondary containment. If a spill occurs, the site must be secured, and company personnel and regulatory authorities notified as appropriate. If safe to do so, all reasonable attempts should be made to control and contain the spill. Hazard assessment and implementation of safety controls must be implemented including establishment of control areas and documented site safety meetings.

TENORM related spills should be cleaned up by personnel trained in TENORM safe work procedures and under the supervision of the TENORM Supervisor. All appropriate safe work procedures and personal protective equipment must be worn as outlined in this TENORM Radiation Safety Program.

For small spills, hazmat drums or polyethylene containers can be used to collect the waste. Larger spills may require sealed roll-off containers. All containers and waste materials must be appropriately inventoried and labeled prior to being sent for TENORM storage or disposal. TENORM impacted areas will need to be confirmed cleaned through TENORM radiation surveys and/or radiological sampling.

15.0 Definitions

Activity (Radioactivity): The number of nuclear trans-formations that occur in a quantity of material per unit of time.

ALARA: A principle of risk management according to which exposures are kept as low as reasonably achievable, economic and social factors being taken into consideration. Alara is a guiding principle of radiation protection.

Alpha Radiation (Alpha Decay): A high-energy positively charged particle ejected from the nucleus of an unstable (radioactive) atom, consisting of two protons and two neutrons. An alpha particle is a helium nucleus.

Annual Limit on Intake (ALI): The intake by inhalation, ingestion or through the skin of a given radionuclide in a year by a reference man which would result in a committed dose equal to the relevant dose limit. The ALI is expressed in units of activity.

Atomic Number: The number of protons contained in the nucleus of an atom. This number gives each atom its distinct chemical identity.

Atomic Mass (Mass Number): The total mass of protons and neutrons contained in the nucleus of an atom.

Background Radiation: The radiation to which an individual is exposed arising from natural radiation sources such as terrestrial radiation from radionuclides in the soil, cosmic radiation from space, and naturally occurring radionuclides deposited in the body from foods, etc.

Becquerel (Bq): An SI unit of radioactivity, equivalent to 1 nuclear transformation per second. Used as a measurement of the quantity of a radionuclide since the number of radioactive transformations (disintegrations) is directly proportional to the number of atoms of the radionuclide present. Replaces an earlier unit, the curie (Ci).

Beta Radiation (Beta Decay): The ejection of a high-energy negatively charged subatomic particle from the nucleus of an unstable atom. A beta particle is identical in mass and charge to an electron.

Contamination (Radioactive Contamination): Radioactive material present in excess of natural background quantities in a place it is not wanted.

Committed Dose: The total dose received from a radioactive substance in the body during the remainder of a person's life (assumed as 50 years for adults, 70 years for children) following the intake of the radionuclide.

Controlled Area: A work area where

1. Access is limited to those persons who are required to work, or perform any duty in the area.
2. The boundaries of the area are clearly delineated and are made known to employees.
3. Any person entering the area has received appropriate instructions about the nature of the radiation hazards in the area.

Decay (Radioactive Decay): A process followed by an unstable nucleus to gain stability by the release of energy in the form of particles and/or electromagnetic radiation. TENORM materials decay with the release of alpha particles, beta particles and/or gamma photons.

Decay Series (Radioactive Decay Series): A succession of radionuclides, each member of which transforms by radioactive decay into the next member until a stable nuclide results. The first member is called the "parent", the intermediate members are called "progeny" and the final stable member is called the "end product". In the two TENORM decay series; uranium- 238 and thorium-232 are the "parents," and lead-206 and lead-208 are the "end products".

Derived Working Limit (DWL): A practical working limit derived from regulatory limits. Derived Working Limits can be compared to measured values at the work site to assess compliance with regulatory limits.

Diffuse TENORM: TENORM-contaminated material in which the radioactive concentration is uniformly dispersed. It is generally low in radioactive concentration, and relatively large in volume.

Discrete TENORM: TENORM-contaminated material in which radioactive substances are concentrated, or not uniformly dispersed throughout the material.

Dose Constraint: An upper bound on the annual dose that members of the public or incidentally exposed workers should receive from a planned operation or single source.

Dosimeter: A device for measuring a dose of radiation that is worn or carried by an individual

Equilibrium (Radioactive): In a radioactive decay series, the state that prevails when the rate at which progeny are produced is equal to the rate at which they are decaying. This form of equilibrium may be attained only if the precursor is very long-lived relative to any member of the decay chain. All members of a TENORM radioactive decay series in equilibrium have the same radioactivity.

Gamma Radiation (Gamma Rays or Gamma Photons): Electromagnetic radiation or photon energy emitted from an unstable nucleus in the process of ridding itself of excess energy. Highly penetrating, gamma rays lose energy as they pass through atoms of matter.

Half-life, Radioactive: The time required for a radioactive material to lose half of its activity through radio-active decay.

IAEA: International Atomic Energy Agency.

ICRP: International Commission on Radiological Protection.

Incidentally Exposed Workers: Employees whose regular duties are not expected to result in exposure to TENORM radiation. The public annual dose limit of 100 mrem applies to this category of workers in an occupational exposure environment – the occupational domain.

TENORM (Naturally Occurring Radioactive Materials): TENORM is an acronym for naturally occurring radioactive materials comprising radioactive elements found in the environment. Long-lived radioactive elements of interest include uranium, thorium and potassium and any of their respective radioactive decay products such as radium and radon. Some of these elements have always been present in the earth's crust and within the tissues of all living beings. Although the concentration of TENORM in most natural substances is low, higher concentrations may arise as the result of human activities.

One-year Dosimetry Period: The period of one calendar year beginning on January 1 of the year following the year in which the Radiation Protection Management Program is started, and every period of one calendar year thereafter.

Occupationally Exposed Workers (TENORM Workers): Employees who expect to receive exposure to sources of TENORM radiation as a result of their regular duties. The annual occupational dose limit of 5000 mrem applies to this category of workers in an occupational exposure environment.

Personal Dosimetry Threshold: The annual effective dose above which radiation dosimetry of individual workers is required.

Radiochemical Analysis: Analysis of the radioactive content of a TENORM sample. Radiochemical analysis will identify and quantify the concentration of various radionuclides in the TENORM sample.

Radionuclide or Radioisotope: A particular form of an element, characterized by a specific atomic mass and atomic number, whose atomic nucleus is unstable and decays or disintegrates with a statistical probability characterized by its physical half-life.

Radium-226: A radioactive element with a half-life of 1600 years. It is a particularly hazardous decay product of natural uranium, and is frequently the dominant TENORM nuclide. It decays into the radioactive gas Radon-222.

Radon: The only radioactive gas generated during natural radioactive decay processes. Two radioisotopes of radon are present – radon and thoron – each a decay product of radium. Radon (Rn-222) is found in the uranium decay series while thoron (Rn-220) is found in the thorium decay series.

Radon Progeny: The products of radon (radon-222) or thoron (radon-220) decay with short half-lives. Radon decay products include; Polonium-218 (RaA), Lead-214 (RaB), Bismuth-214 (RaC), and Polonium-214 (RaC'). Thoron decay products include; Polonium-216 (ThA), Lead-212 (ThB), Bismuth-212 (ThC), Polonium-212 (ThC'), and Thallium-208 (ThC").

Rem: A historical unit of human dose equivalent. Rem is an acronym for roentgen equivalent man and was replaced in 1977 by the sievert in the international system of units.

Roentgen (R): The classical unit of radiation ionization in air, frequently misapplied as a unit of exposure in humans. Replaced in international system of units by the "coulomb per kg in air".

Shielding: The reduction of radiation beam intensity by interposing, between the source and an object or person that might be exposed, a substance that absorbs

SI (International System of Units): The "metric" system of units generally based on the meter/kilogram/ second units. Special quantities for radiation include the Becquerel, gray and sievert.

Sievert (Sv): The sievert is the unit of radiation equivalent dose, H, that is used for radiation protection purposes, for engineering design criteria and for legal and administrative purposes. The sievert is the SI unit of absorbed radiation dose in living organisms modified by radiation type and tissue weighting factors. The unit of dose for the terms "equivalent dose" and "effective dose". It replaces the classical radiation unit the rem. Multiples of sieverts (Sv) used in the Guidelines include millisieverts (mSv) and microsieverts (uSv).

Specific Activity (Radioactive Concentration): The number of Becquerel's per unit of mass of a material. Units: Bq/g and kBq/kg.

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM): Naturally occurring radioactive material whose radionuclide concentrations are increased by or as a result of past or present human practices. TENORM does not include background radiation or the natural radioactivity of rocks or soils. TENORM does not include "source material" and "byproduct material" as both are defined in the Atomic Energy Act of 1954, as amended (AEA 42 USC §2011 et seq.) and relevant regulations implemented by the NRC.

Total Effective Dose Equivalent (TEDE): The sum of effective dose equivalent from external exposure and committed effective dose equivalent from internal exposure, thereby taking into account all known exposures.

16.0 References

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Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry, IAEA Safety Reports Series No. 34, Vienna 2003

Waste Management Technical Committee, "Technical Report on the Management of Naturally Occurring Radioactive Material (TENORM) in Waste", July 2009

Appendices

Appendix A: State Contacts and Regulatory Agencies

State Government Agencies

North Dakota

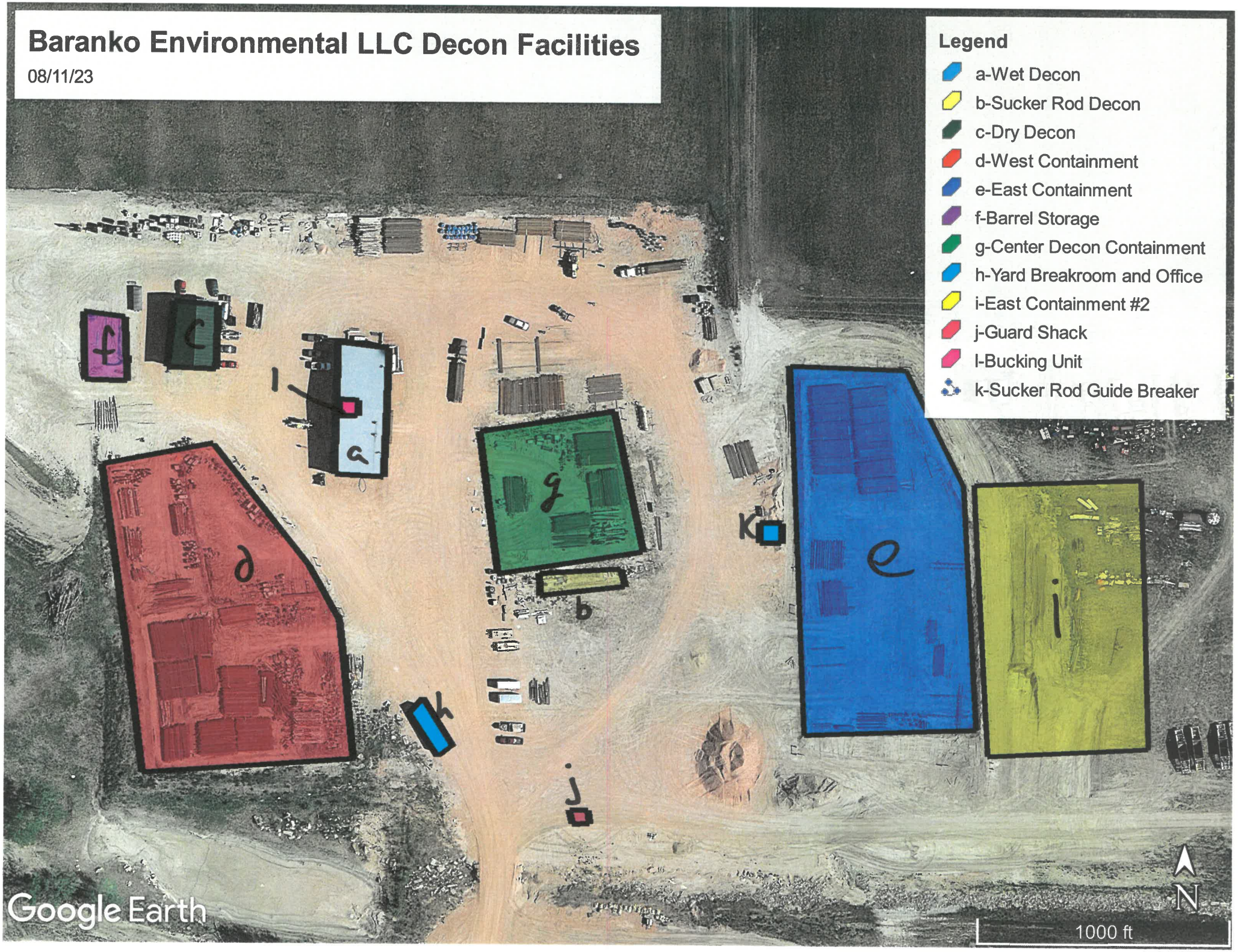
Oil and Gas Agency
North Dakota Industrial Commission
Department of Mineral Resources
Oil and Gas Division
600 East Boulevard Ave., Dept. 405
Bismarck, ND 58505-0840
Phone: (701) 328-8020

Radiation Control Program
Division of Waste Management
4201 Normandy Street
Bismarck, ND 58503-1324
Phone: (701) 328-5166

Appendix B: Maps

Baranko Environmental LLC Decon Facilities

08/11/23



Appendix C: Photos

Baranko Environmental LLC
P.O. Box 0820
Dickinson, ND 58602
Phone: 701.483.5868
Fax: 701.483.5960

New Unit Photos 2023 - Wet Decon

TENORM Safety Program	Project Title / Location	Page No.
8/8/2023	Baranko Yard Bucking Unit - Wet Decon	001

DAILY PHOTO LOG

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Baranko Environmental LLC
P.O. Box 0820
Dickinson, ND 58602
Phone: 701.483.5868
Fax: 701.483.5960

New Unit Photos 2023 - Sucker Rod Decon

TENORM Safety Program	Project Title / Location	Page No.
8/8/2023	Baranko Yard Rod Guide Breaker - Sucker Rod Decon	001

DAILY PHOTO LOG

1

2

3

4

Baranko Environmental LLC
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New Unit Photos 2023 - Sucker Rod Decon

TENORM Safety Program	Project Title / Location	Page No.
8/8/2023	Baranko Yard Rod Guide Breaker - Sucker Rod Decon	002

DAILY PHOTO LOG

5

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7

8

Appendix D: Safety Procedures

Frisk in Frisk Out Procedure
All TENORM Decontamination Facilities
Baranko Environmental LLC
Updated: 05/22/2020

Frisk in Frisk Out Procedure

- Complete a JSA, and Radiation Work Permit; begin Frisk Time Sheets prior to entry into the TENORM Restricted Area. There will be no eating, chewing, or drinking in the restricted area.

- Before working inside of a TENORM Restricted Area a full body frisk taking 5min per individual must be completed to determine baseline personnel readings. Note readings as a range in CPM on the suit with a sharpie. Put your name on the suit.

- When conducting a Frisk check background survey readings using the GM/44-9 Probe. You want to be at or below background survey measurements when conducting Frisk In Frisk Out. Ensure your work environment is clean. If background readings are elevated clean the work area.

- After leaving the TENORM Restricted Area a frisk out will be performed taking 5min per individual. You should read the same as before you went into a TENORM Restricted Area.

- Any sustained reading above background levels is a positive indication of TENORM contamination.

- Personnel found to be contaminated on their skin or clothing shall wipe in the area of contamination with a wet wipe or other appropriate means until the reading is at or below background levels. Throw all wipes with PPE and TENORM Debris in designated marked drums.

- All entrance and exit times are to be shown on the Frisk Time Sheets provided. Add time when upon leaving and entering the TENORM Restricted Area.

- Process is to be repeated if re-entering the TENORM Restricted Area.

PPE will be taken off in the following order:

1. Unzip Tyvek suit.
2. Remove outer gloves revealing your clean inner gloves.
3. While touching the inside of the suit curl it down away from your body moving it to the floor.
4. Remove outer booties being worn.
5. Step out of the suit.
6. Take off respirator with your inner gloved hand. Clean your respirator.
7. Hang up your clean respirator or place in ziplock bag for storage.
8. Hang up your Tyvek suit if still usable in the Frisk in Frisk Out Zone (Dry Decon). Throw away suit if one time use or if it has been damaged.
9. Throw away any un-usable PPE/debris in the PPE Drum located in the Frisk in Frisk Out Zone.
10. Perform a Frisk Out by using the GM Probe (44-9). Must read at or below background readings.