Sabine Environmental Services, LLC

NORM Waste, Containers, Equipment, Material and Personnel Management

Revision: 3, Date: July 27, 2009

NORM Manual
Radiation & Contamination Surveys
Storage Area Inspections and Surveys
Waste Receipt, Inventory and Processing
Laboratory Inspections and Surveys

Sabine Environmental Services, LLC
P. O. Box 146
Broussard, LA 70518
Phone: (318) 269-5652
Facsimile: (318) 269-5653

Table of Contents

1.0 Waste Receipt & Inspection

Upon receipt of a NORM Shipment, the following actions shall be promptly taken:

1.1 Administrative Review

The RSO or administrative personnel shall conduct an administrative review of NORM paperwork. The following items shall be reviewed:

- A valid oil and gas operator is listed. Texas operators must be verified against Texas Railroad Commission records. Louisiana operators must have a General License number.
- A valid waste source, such as a well, lease, field, etc. must be identified. Texas sources must be verified against Texas Railroad Commission records.
- Signatures and dates must be present for the Generator and the Transporter.
- Quantities, types, and radiation levels.

NORM wastes cannot be accepted if a valid Operator and waste source identification is not available. Signatures and dates must also be available. If waste quantities and types or signatures and dates are not documented, the Operator must be contacted and accurate information obtained.

1.2 Shipment Inspection and Survey

Upon arrival, the RSO must inspect and survey the NORM shipment as follows:

- Verify that the Type and Number of containers reflects what is on the manifest or shipping documents.
- Visually inspect all NORM containers to ensure there are no leaks and that lids, caps, seals, etc. are tight. If container integrity is not satisfactory, inform the Sales Manager and/or the Corporate RSO, if applicable.
- Perform a radiation survey of the NORM containers and truck bed. If the container readings are different from the manifest levels, inform the Sales Manager and/or the Corporate RSO, if applicable.
- Perform a loose contamination survey of the containers and truck bed if signs of leakage are present. If the wipes are above background, immediately contact the Sales Manager and/or the Corporate RSO, if applicable, and commence decontamination of the containers and/or truck.

See Section 4.0 below for instructions regarding NORM meters and surveys.

1.3 Waste Containers & Storage

If the Administrative Review and Inspection/Survey are satisfactory, the NORM containers can be removed and placed in a designated area out of normal vehicle, equipment, and personnel traffic. Waste containers shall be managed as follows:

- Absolute control over the NORM containers shall be maintained;
- Non-company personnel shall be kept clear of the NORM containers;
- NORM and/or Radioactive Material signs shall be posted at the access to the container storage;
- Each container shall have affixed a Radioactive Material label;
- Each container shall have affixed a unique identifier traceable to the origin, generator, radioactive material type, physical nature, and radiation levels;
- If necessary to ensure that personnel stay clear of the containers, the containers shall be cordoned off with rope;
- Containers shall be aligned so that a walkway is available between containers and so container markings can be read;
- If radiation levels exceed 2,000 uR/hr, the containers must be roped so that non – trained personnel are not exposed to the 2,000 uR/hr.
- If NORM containers are not processed within 24 hours, the containers shall be logged on the Waste Inventory and Inspection sheet.
- Waste storage areas shall be surveyed and inspected weekly. The survey and inspection shall be documented.

2.0 Pre-Job Checks

Prior to starting the waste processing / disposal, the follow pre-job checks shall be performed.

2.1 Instrument Pre-Use checks

The RSO shall check NORM Meters as follows and per sections 4.2 and 4.3 of these procedures:

- The physical integrity of the meter must be satisfactory: cables not frayed and securely connected, no rust, faceplates in place and secure, no rattling.
- Battery power must be ABOVE the lower level of the battery range.
- Calibration must have been completed within the last 12 months.

2.2 Personnel training

The RSO shall verify that all personnel performing NORM work have been trained within the last year and that documentation is available onsite. Training documentation shall include training certificates or the equivalent and shall reference the date of training and the instructor.

2.3 Dosimetry

Records of Sabine Environmental's personal monitoring from 1998 to 2008 indicate it is not likely those working with NORM onsite will receive greater than 10% of the annual limit. Dosimetry is no longer required, however, it is required that radiation and contamination surveys be documented so that dose estimates may be performed if needed.

3.0 NORM Processing & Equipment/Material Monitoring

The following actions / precautions shall be taken when performing NORM work:

3.1 Personnel Protection

Protective Clothing

Protective clothing shall be worn when work is performed with loose contamination. Protective clothing will include, as a minimum, work boots, gloves, and coveralls or work clothes. Additional protective clothing may be prescribed by the RSO, such as face shields, rubber boots, specific coveralls, etc. Additional safety equipment may also be prescribed by the RSO, such as safety glasses, hard hats, etc.

Radiation Work Permits

A radiation work permit (RWP) will be completed and reviewed with personnel prior to commencing NORM processing. The RWP will include information such as:

- Planned work activities;
- Worker assignments;
- Radiation and contamination levels and locations;
- Entry and exit routes'
- Prescribed protective clothing;
- Use of dosimetry;
- Contamination controls; and
- Surveying, monitoring, and frisking procedures

Personnel Frisking

All personnel exiting a posted area will perform a frisk in accordance with these procedures. As a minimum, personnel shall perform a hand and foot frisk while personnel having worn protective clothing shall perform a whole body frisk. The RSO shall be immediately contacted if loose contamination is detected so that decontamination and follow up frisking can be performed. No one will exit the work site contaminated.

Personnel Decontamination

If loose contamination is detected on personnel, that loose contamination shall be removed. Simple washing or wiping of the affected area is usually sufficient to remove the contamination. The RSO shall be contacted if loose contamination is detected to assist with the decontamination and subsequent frisking. No one will exit the work site contaminated.

General Work Procedures

- Eating, drinking, chewing gum or tobacco, smoking or any practice that increase the probability of hand-to-mouth transfer of material is prohibited in any posted area
- Hands and face must be thoroughly washed upon leaving the work area.
- No facial hair which interferes with a satisfactory fit of the mask-to-face seal is allowed on personnel required to wear respirators.
- Contact with contaminated or suspected contaminated surfaces should be avoided when possible.

Area Control – Signs and Barriers

Signs and stations shall be placed at the access to the work area while exposed NORM is being offloaded and/or processed. Signs shall include the conventional tri-foil and radioactive material letters or 'NORM'.

3.2 NORM Jobs

When conducting NORM jobs, perform the following:

1. Perform pre-job checks per section 2.0;
2. Conduct pre-job safety meeting. Complete Radiation Work Permit. Ensure workers understand the need to survey all equipment and personnel prior to removal from work area. Brief personnel on radiological conditions and the prescribed ppe;
3. Obtain sample of NORM waste. Obtain at least ½ liter of sample and label container with Operator and date;
4. Deploy stations with signs saying NORM or, alternately, Radioactive Materials;
5. Perform radiological surveys as necessary to assess (i) the magnitude and extent of radiation levels; (ii) concentrations or quantities of radioactive material; and (iii) the

potential radiological hazards. The extent of the survey shall be commensurate with the levels of radiation;

6. Maintain control over the work area to (1) ensure NORM is not spread, (2) non-norm personnel do not enter work area, and (3) all equipment and personnel are frisked prior to exit from work area. Ensure all equipment, material, and personnel are surveyed prior to finally exiting the controlled work area;
7. Perform air sampling as directed by the Sabine Environmental contract Corporate RSO or, if airborne NORM is likely, in accordance with section 4.8 of this procedure . Onsite RSO shall confer with the Corporate RSO for unusual waste types, operations, or radiological levels;
8. Frisk all personnel prior to allowing their final exit from the work area.
9. Perform surveys for contact gamma and surface contamination (fixed and loose) of all equipment and material prior to its release for unrestricted use;
10. Document all NORM surveys;
11. Perform Post Job NORM Survey to include radiation and loose contamination measurements.
12. As necessary, clean the NORM meters. Restore.

3.3 Monitoring Site Equipment and Material

As a consequence of the receipt of NORM waste and Non-NORM but radioactive waste, facility equipment and material may become contaminated. Prior to the offsite disposal of equipment or material, the RSO shall survey and/or sample the items to ensure they are below regulatory limits. As a minimum, equipment and material must be less than the limits listed below; however, lower levels may be appropriate, such as for scrap destined metal or recyclable material. Equipment and material surveys and sampling for release shall be documented.

Category	Criterion	Regulatory Reference
Soil & Land Areas	(a) 30 picocuries per gram (pCi/gm) or less of radium-226 or radium-228 - Or (b) 150 pCi or less per gram of any other NORM radionuclide	25 TEXAS ADMINISTRATIVE CODE §289.259 (d) (1) – Exemptions
Equipment, Structures & Material	50 uR/hr maximum including background (contact gamma)	25 TEXAS ADMINISTRATIVE CODE §289.259 (d)(3) – Exemptions
	Accessible Surfaces: 1,000 dpm / 100 cm^2 Removable And 5,000 dpm / 100 cm^2 Average And 15,000 dpm / 100 cm^2 Maximum	25 TEXAS ADMINISTRATIVE CODE §289.259 (w) – Acceptable Surface Contamination Levels for NORM

4.0 NORM Surveys

4.1 Types, Purposes, and Frequencies

Sabine Environmental commits to the following types and frequencies of radiation and contamination surveys. Sections 4.2 thru 4.9 provide general instructions for particular survey techniques.

Survey/Monitoring Type	Purpose	Required Frequency
Personal Frisk	Ensure personnel are not contaminated	Upon exit from work area
	Ensure contamination is not spread beyond the work area	
Beta, Gamma Dosimetry Monitoring	Monitor for worker occupational dose	Discontinued but as directed by Corporate RSO
Work area radiation and loose contamination survey	Evaluate levels to convey to workers	At least once per client-job
	Monitor for worker occupational dose	
	Evaluate spread of contamination	
Work area/Storage area boundary radiation survey	Ensure levels are less than 2000 uR/hr	Not less than weekly
	Monitor for public dose exposure	
Work area air sample	Evaluate airborne conditions	Per the Corporate RSO
Worker breathing zone air sample	Evaluate worker internal dose exposure	Each time a respirator is worn
		When it is likely airborne levels will exceed 10% of one DAC
		Per the Corporate RSO
Work area boundary air sample	Evaluate internal exposure potential to public	Per the Corporate RSO
	Ensure effluent concentration limit is not exceeded	

Equipment/material loose contamination	Ensure no contamination is spread	Prior to releasing for unrestricted use
Equipment/material fixed contamination	Ensure no contamination is spread	Prior to releasing for unrestricted use
Post job survey of work area (Release survey)	For comparison to pre-job survey to ensure contamination has not been spread	Upon completion of NORM work for the client
Equipment and Material	Ensure NORM is not present prior to release for unrestricted use or offsite disposal	50 uR/hr maximum including background (contact gamma) and Accessible Surfaces: 1,000 dpm / 100 cm^2 Removable And 5,000 dpm / 100 cm^2 Average And 15,000 dpm / 100 cm^2 Maximum

4.2 Survey Meter Operating Procedures

1. Each day before use, inspect the meter for damage to the probe, cable, meter face, etc.
2. Verify that the batteries have adequate power to operate meter.
3. Verify the audible response is working properly by turning it on and off.
4. Verify that “S” (slow) and “F” (fast) response circuit is working by checking the meter with a check source. With the meter in the slow position, it should take approximately 25 seconds for the meter to read full response from background. In the fast position, response time should be approximately 5 seconds.
5. Verify that the meter responds appropriately at each scale position.
6. Document operational checks performed prior to performing survey.
7. Protect the instrument from contamination, falls and inclement weather.
8. Clean survey meter, probe and cable and inspect for damage before storing.

4.3 Meter Calibration

1. All survey instruments shall be calibrated by qualified vendors at intervals not to exceed one (1) year, or after each servicing or repair (excluding battery change);
2. Calibration records shall be retained indefinitely. A copy of the calibration certificate should be kept in the instrument’s storage case and at the temporary jobsite;
3. Calibration of each instrument should be at energies and radiation levels appropriate for use with NORM;

4. An accuracy within plus or minus 20% of the true radiation level shall be demonstrated on each scale.

4.4 Equipment Surveys (Fixed contamination – Geiger Mueller pancake probe)

1. Prior to performing a survey, background radiation levels should be established by surveying an area un-impacted by human activity. Typically, the lowest radiation level observed from an adjacent area is considered to be the background radiation level. Average background levels in Louisiana typically range from 4 to 12 microRoentgen per hour. Any background radiation levels outside this range should be investigated.
2. Hold the probe within one (1) centimeter of the surface. Ensure the audible response is on.
3. The fast response mode should be used when performing surveys for NORM. The survey rate should be slowed when an increase in audible response is heard.
4. When performing release surveys, ensure that 100% of all accessible surfaces are surveyed.
5. When surveying for NORM, always survey areas where NORM is most likely to be found first.

4.5 Land and Area Surveys (NaI Scintillation detector)

1. Native background levels should be established as described in the section on surveying equipment.
2. When screening soils and lands for NORM, always ensure that the probe is held within one (1) centimeter of the ground surface and the audible response mode of the instrument in the on position.
3. All survey results and findings must be documented in an orderly fashion to ensure that all suspected items and areas have been surveyed.

4.6 Personnel Frisking (Geiger Mueller pancake probe)

1. All personnel exiting a posted and/or controlled area will perform a personal frisk.
2. If personnel have worn protective clothing, a whole body frisk is required. A hand and foot frisk may be performed if protective clothing was not worn
3. Setup the frisker in an area with as low a background as possible. Frisking in background areas of 100 cpm or greater should be discouraged. If necessary and if personal contamination is not expected, workers may walk outside the work area to an area of lower background to perform the frisk.
4. To prevent contamination of the probe, individuals will perform the frisk by moving the probe over the surface of their body at a distance not to exceed ½".
5. The probe should be moved at a rate not to exceed two (2) to three (3) inches per second.
6. In the event of a whole body frisk, special attention will be given to the: head and hair; face (especially the nasal and mouth area); hands (especially the fingernails); feet (especially the soles); knees and elbows; and the buttocks. This frisk should take at least 5 minutes;

7. Frisking shall be performed using a properly calibrated survey meter with a Ludlum Model 44-9 pancake probe.
8. During all frisking procedures, the audible response on the meter will be used.
9. Any levels above background require immediate notification of the RSO.

4.7 Wipe Test (Loose Contamination - Geiger Mueller pancake probe)

1. Wipe tests may be performed over 100 cm^2 or in what is sometimes referred to as a "large area smear" (LAS). Either a commercially designed wipe pad or any absorbing type cloth may be used to perform the wipe.
2. Wipe either 100 cm^2 or as much of the area as desired (LAS) by applying moderate pressure.
3. Using a Ludlum model 3 with a 44-9 probe, or an equivalent, count the wipe or LAS in an area with a background as low as possible. Attempt to count wipes in backgrounds less than 100 cpm.
4. Hold the wipe within ½" of the detector probe, being careful not to contaminate the probe.
5. If counts are detected either through meter face response or audibly, loose contamination is present and the equipment/material shall not be removed from the work area.
6. Log the results of the wipe test.
7. If required, the wipe may need to be analyzed using either a scalar or by submitting the wipe to a laboratory for analysis. If required to be submitted to a laboratory, document the date, time, name of sample collector, the location and size of the area where the wipe test was collected from on paperwork t accompany the wipe.

4.8 Air Monitoring

1. Using standard air sampling equipment (such as and F & J LV-1 air sampler) and glass fiber particulate filters, obtain an air sample of no less than 2.0 X 10^6 ml. Air samples obtained to evaluate effluent concentrations during NORM activities should be of larger volumes, as possible. Effluent concentration air samples may be run for several hours.
2. Air samples obtained to evaluate worker internal exposure should be taken as close as possible to the worker's "breathing zone". Air samples obtained to evaluate effluent concentrations (boundary air samples) should be taken at the perimeter of the work area. Boundary air samples should be taken downwind of source activities, as possible.
3. Once the air sample has been collected, the particulate paper should be carefully removed and placed in a ziploc bag or equivalent container.
4. The following information should be recorded for the air sample:
    a. sample volume (sample start and stop time and flow rate);
    b. sample location - worker "breathing zone", general area or effluent (boundary) sample;
    c. sampler's name or initials;
    d. sample flow-rate;
    e. isotope of concern (normally radium 226/228);

5. Care should be given to documenting the appropriate isotope of concern. Oil industry isotopes of concern are usually radium 226 and radium 228. Gas industry isotopes of concern, however, are more likely to be lead-210.

4.9 Beta – Gamma Monitoring (Dosimetry)

1. Tlds or film badges should be obtained from companies accredited through the National Voluntary Laboratory Accreditation Program (NVLAP).
2. Tlds and film badges are received from the manufacturer with a "control" badge. The "control" badge is used to subtract background radiation doses from the badges issued to workers. The "control" badge should be stored (1) in a central location away from NORM materials, (2) out of direct sunlight, and (3) in a temperature controlled area. Badges not being worn by workers should be stored with the "control" badge.
3. Each worker should be issued his own badge. Records should be maintained of which badge is assigned to whom. Badges may be ordered from the manufacturer with worker's social security numbers labeled on the badge. Over time, especially in hot, moist or wet working environments, the badge labels may fade or dislodge. Tape should not be applied to the badge.
4. Badges should be issued to each worker at the beginning of the day and retrieved at the end of the day. The badges should then be stored with the "control" badge until reissued to the worker.
5. Badges should be worn within the worker's trunk area.
6. Badges will be exchanged on a quarterly basis.

5.0 Radiation Protection Program

5.1 Radiation Protection Program

Sabine Environmental herby:

- Establishes these procedures as the adopted radiation protection program;
- Adopts these procedures and engineering and process controls to maintain worker and public dose levels as low as reasonably achievable (ALARA);
- Commits to annually review the content and implementation of this radiation protection program; and
- Air emissions, while typically negligible with Oil and Gas NORM, will be evaluated and controlled so that the highest dose to any member of the public does not exceed 10 millirem/yr.

5.2 Respiratory Protection

Respiratory protection will be used when process or other engineering controls are impracticable or ineffective in limiting airborne concentrations of radioactive materials and only as specified by the Sabine Environmental contract Corporate RSO. Respiratory protection requirements and commitments include:

1. Respirators will be used in accordance with a written respiratory protection procedure.
2. Only NIOSH/MSHA approved respirators will be approved.
3. Only respirator will be used whose filters have been approved for use for radio particulates or radionuclides, as described on the filter label.
4. If half-face respirators are worn, a qualitative fit test using irritant smoke or an aroma test shall be performed prior to each use.
5. Workers will be provided initial and annual physicals and fit tests.
6. A written respirator policy statement shall be issued regarding.
   a. the use of process or other engineering controls, instead of respirators;
   b. the routine, non-routine, and emergency use or respirators.
   c. the length of periods of respirator use and relief from respirator use.

See the attached Respirator Policy Statement

When appropriate, the Corporate RSO shall assign a respirator that provides a protection factor greater than the multiple by which peak concentrations of airborne radioactive materials in the working area are expected to exceed the DAC values specified in Appendix B, Table II, Column 3.

5.3 Suspected Internal Exposure

While unlikely, the potential exists for workers to receive an internal exposure to NORM. Indications that an internal exposure has occurred include, but are not limited to: (1) airborne radioactive material levels above the limits while not wearing respiratory protection, (2) airborne radioactive material levels above the limits and inadequate respiratory protection (insufficient protection factor), and (3) any indication of occupationally related internal exposure (i.e., any registered counts when performing a breath frisk, un-removable and/or suspicious "skin" contamination, contaminated wounds, etc.),.

In the event the Corporate RSO suspects that an internal exposure has occurred, the worker will be evaluated for internal exposure. This evaluation may include whole body scans (gamma spectroscopy), urine analysis, breath analysis, exposure analysis based on survey and frisk results, blood analysis, or another currently accepted health physics bioassay method.

Complete documentation will be conducted of the "suspected internal exposure" including: the worker's immediately preceding occupational involvements, survey and monitoring results from the worker's involvements, protective measures used, employee statements, the results of the internal exposure evaluation, resultant dose calculations, and any final conclusions gleaned from the investigation.

Given the outcome, follow-up action may be appropriate by the Corporate RSO to revise work or protection practices.

5.4 Forms

The following forms shall be available:

- NORM Training documentation
- Job Specific Safety Meetings and Radiation Work Permits
- Radiation & Contamination Surveys & Inspections
- Post Job NORM Surveys
- Waste Receipt, Inventory & Processing
- Storage Area Inspections and Surveys
- Laboratory Inspections and Surveys

5.5 Notice To Employees

Form "Notice to Employees" shall be posted in a conspicuous place were all workers will readily view the posting each day. The "Notice To Employees" provides information as to where workers can find license and procedure information regarding ASCO activities.

5.4 Training

Radiation Safety Officer (RSO)

The qualifications and training for the RSO includes, but is not limited to, the following:

- Familiarity with the Texas Radiation Protection Regulations;
- Familiarity with Sabine Environmental company requirements and procedures;
- Training in radionuclide handling techniques and safety practices;
- On-the-job experience involving NORM contaminated materials;
- Minimum of 40 hours of instruction in radiation safety & health physics, with annual refresher training;
- Minimum of 3 months experience performing NORM decontamination procedures;

NORM Worker

NORM Worker shall be provided a minimum of 8 hours instruction in radiation safety. Refresher training shall be provided annually.

5.5 RSO Responsibilities

Onsite RSO responsibilities include:

- Maintain thorough familiarity with this procedure;
- Maintain familiarity with basic radiation theory, in particular as related to alpha/beta/gamma characteristics, and instrument use;
- Ensure personnel performing NORM work have been trained within the last year;
- Inspect incoming shipments for integrity and accurate quantities and radiation levels;
- Maintain positive control over NORM waste processing and NORM containers;
- Survey all equipment, material and personnel prior to completing jobs and/or releasing offsite;
- Monitor other site operations for impact by NORM and engage Sabine Environmental management as necessary;
- Document all surveys, inspections and jobs appropriately;
- Inform Sabine Environmental management of (i) potential problems and (ii) the need for additional resources such as instruments, sampling equipment, supplies etc;
- Engage the Corporate RSO if issues or items for clarification and/or direction.

5.6 Signs and Labels

NORM and /or radioactive material signs and labels will be implemented as follows:

- NORM processing tanks will be marked with the word 'NORM' in waterproof paint or ink;
- Tanks and equipment likely to contain NORM will be labeled with Radioactive Material labels or signs;
- Containers of NORM not likely to be processed within 24 hours of receipt or packaging will have Radioactive Material labels affixed;
- Radioactive Material signs shall be posted at the general access point to NORM processing operations.

5.7 Recordkeeping

In addition to the recordkeeping requirements of 25 TAC 289.202(ww)-(zz), records shall be maintained of all radiological surveys and documents used in the implementation of this procedure. Records shall be maintained to at least five (5) years beyond the closure of the facility.