Inactive Hazardous Sites Program

Guidelines for Addressing Pre-Regulatory Landfills & Dumps

August 2012

Department of Environment and Natural Resources
Division of Waste Management
Superfund Section
Inactive Hazardous Sites Branch
Pre-Regulatory Landfill Unit

217 West Jones Street
1646 Mail Service Center
Raleigh, North Carolina 27699-1646
Telephone: (919) 707-8200
http://www.portal.ncdenr.org/web/wm/sf/ihshome

Table of Contents

SECTION	PAGE
General	1
Document Requirements	1
Remedial Investigation-First Phase Work	2
Remedial Investigation-Contaminant Delineation Phase Work	3
Remediation	7
Public Comment	8
Remedial Action Completion Report	8
Contaminant Delineation, Remedial Action Work Plan and Report Certifications	8
Appendix A: Sensitive Environments	A-1
Appendix B: Laboratory Analyses	B-1
1. Non-Gas Samples	B-1
2. Gas Samples	B-2
Appendix C: Standard Field Protocols	C-1
Appendix D: Definitions	D-1

General

This document provides a **general** outline for addressing pre-1983 non-industrial landfills and dumps (landfills that ceased accepting waste prior to January 1, 1983) that are not subject to the North Carolina Division of Waste Management's Solid Waste Rules 15A NCAC 13B post-closure regulations administered by the Solid Waste Section. In 2007 the legislation established funding for management of assessment and remedial measures at qualified landfills and dumps by the Pre-Regulatory Landfill Unit (Unit) in the Inactive Hazardous Sites Branch (Branch). If a landfill meeting the above definition is identified, the Branch should be immediately notified. A site notification form can be found at: http://portal.ncdenr.org/web/wm/sf/ihs/sitenotification

Due to the wide range of conditions encountered at pre-regulatory landfills, these guidelines will not address every conceivable situation. Sites where assessments are conducted by local governments, the environmental consultant for the local government may need to consider additional analyses and sample collection based on existing site-specific conditions and future land use.

Separate work plans, cost estimates and proposed schedules are required for each phase of investigation and must be approved by the Unit prior to implementation. Questions about the guidelines should be directed to the Unit staff at (919) 707-8200. Updated information may be found at: http://portal.ncdenr.org/web/wm/

Document Requirements

Final documents should be submitted in PDF. Documents larger than about 20 megabytes (mb) should be separated into sections to accommodate the 20 mb size requirement. For details on specifications for electronic document submittal, please see the Inactive Hazardous Sites Branch Electronic Document Submittal Section at: http://portal.ncdenr.org/web/wm/sf/ihshome

Remedial Investigation - First Phase Work

The first phase of remedial investigation should include, at minimum, the items listed below. A work plan will need to be prepared for review and approval by Unit staff. Generally, landfills and dumps included in the pre-regulatory landfill inventory have a site summary report (first phase environmental site assessment) on file. Note that if any of the items listed below are already on file in the NC Superfund Section, then these items do not need to be duplicated. File documents may be available on the web portal at: https://edm.nc.gov/DENR-Portal/ and include the most current NC Superfund Section file documents; At a minimum, items included in 1 through 6 are required for new site discoveries.

1. A summary of historical operations including, but not limited to, a chronological listing of owners and operators, written documentation and interviews with individuals with historical knowledge to provide verification of time operated, types of waste received, other relevant information about disposal operations and current property use.

2. Review of historical aerial photography and Sanborn Fire Insurance maps; if available provide aerial photography showing the site from pristine land, during the active life of the landfill and present conditions.

3. If historical research indicates that the landfill received a large amount of industrial waste (i.e. more than expected at a municipal solid waste landfill of that time period) or if known or suspected areas of hazardous substance disposal exist (i.e. hot spots) contact the Unit. Waste characterization may be required prior to any other investigation activities.

4. During the initial site visit, GPS coordinates (if not available from NC Superfund Section files) should be collected at the site entrance and at points delineating the suspected extent of waste disposal area. All coordinates should be reported in the State Plane Coordinate System in meters using the North American Datum of 1983 (NAD83) format to sub-meter accuracy using differential corrections in thousandths of a meter (listed clockwise around the perimeter of the waste disposal area beginning with the northern point).

5. Provide current United States Geological Survey topographic maps showing coverage within 1,000 feet of the center of the waste disposal area (at disposal areas greater than 8 acres, 1,000 feet from the edge of estimated waste disposal area).

6. Conduct a water source survey that may include potable water sources, visual inspection, available maps, online resources and local utilities as required for developing an accurate survey within 1,000 feet of the waste disposal perimeter. If a surface water body is identified, provide information regarding the type of water body (e.g. stream, lake, storm water ditch; perennial or intermittent) and flow direction.

7. Generate a water source survey map showing the location of all water sources within 1,000 feet of the waste disposal perimeter. Delineate the 500 feet and 1,000 feet distances on the map from the waste disposal perimeter. List current water source owners and users (if other than the owner) and addresses in a table and cross reference to

the map.

8. Collection and analysis of samples from these waters may be required based on site conditions.

9. Preparation of a site map(s) identifying areas of the site property/properties that are paved or landscaped, including the type and extent of ground cover, general surface conditions, structures, sumps, septic systems, storm water conduit and other underground utilities present (use multiple maps if necessary to **clearly** show all required information). All maps should be drawn to scale with a bar scale *(in feet*), legend, and north arrow.

10. Preparation of a vicinity map(s) identifying property lines and zoning classifications on the site and adjacent properties not including roadways and easements; and within 500 feet of the waste disposal perimeter, and underground utilities. If a surface water body is identified, provide information regarding the type of water body (e.g. stream, lake, storm water ditch; perennial or intermittent) and flow direction.

11. Preparation of a table that includes contacts, responses and any documented potential sensitive environment within 500 feet of the waste disposal perimeter. If necessary provide a map(s) to clearly show all required information (**comply with Appendix A, Sensitive Environments).**

Note: If a sensitive environment is identified (as defined in Appendix A), then it is necessary to conduct an evaluation to delineate the sensitive environment boundary, determine if any special sampling is required and whether site remediation may do more harm than good.

12. The delineation of the horizontal extent of waste using geophysical methods. If a site has been redeveloped or waste is considered to be in contact with groundwater, then the vertical extent of waste should be determined using geophysical methods. Collect GPS points of the waste limits for a site survey plat (to be prepared and certified by a professional land surveyor during subsequent work phases). The geophysical survey figures should be drawn to scale with a bar scale *(in feet),* legend and north arrow.

13. A description of local geologic, hydrogeologic and soil conditions.

Remedial Investigation - Contaminant Delineation Phase Work

After the remedial investigation-first phase, an investigation delineating the extent of contamination must be conducted. Appendices B and C of this document provide an outline of sample analysis and field protocols. Investigation goals for each work phase/task are to identify and delineate contamination in each affected environmental medium.

The contaminant delineation work phase(s) must be planned to include at a minimum, the items described below. Large sites require a phased approach and separate work plans for each phase that will include a combination of the listed tasks. A contaminant delineation work plan, cost estimate and schedule for each phase of work should be submitted to the Unit for review and

approval and include the following relevant information:

1. Proposed boring locations and depths for purposes of confirming the edge and thickness of waste based on results from previous investigations.

2. A site map that indicates the locations of the soil samples, soil borings and any additional media sampling for each phase of work. Include boring locations, monitoring points and anticipated screened intervals when the installation of monitoring wells is required. Well installation must comply with the most current 15A NCAC 2C well construction standards.

3. Comprehensive sampling and analysis for all target media (see Appendix B - Laboratory Analyses, Laboratory Analytical Parameters) and include quality assurance/quality control measures.

4. A description of procedures used to manage drill cuttings, purge water and decontamination water.

5. A schedule for site activities and reporting.

6. Conduct an evaluation of above ground air space near the landfill surface to determine the risk of outdoor exposure and subsurface evaluation from within the waste to determine the potential for vapor release at unacceptable levels at the surface. A subsequent evaluation may be required to determine the potential for subsurface vapors from wastes or contaminated groundwater to migrate into existing or future structures.
    a. Readings must be collected across the landfill on a grid with spacing dependent on site conditions (a maximum 100 foot spacing) using field instrumentation. Measurements of methane, hydrogen sulfide, total volatile organic compounds (VOCs) and mercury must be recorded at each grid point. Barometric pressure readings should be recorded at least every hour during the screening. Screening should not be performed on a rainy day or an exceedingly windy day. If any compounds are detected or if the survey was conducted during a period of rising barometric pressure, a second confirmation survey will need to be conducted on a later day. Background readings should be recorded upwind of, but in close proximity to, the landfill area. Flagging should be placed at all grid points with detectable concentrations of any of the contaminants listed above. GPS readings should be recorded in those locations as well.

7. Conduct a subsurface evaluation for landfill gas. The following activities should be performed after groundwater and above ground landfill vapor screening have been completed so that results of those activities can be used to target suspect areas. Subsurface gas samples must be collected from within the waste as part of the evaluation to determine the potential for vapor release at unacceptable levels at the surface. Gas probes must be installed at a minimum of one probe every two acres across the landfill and tested for all the parameters in Section 6.a. along with oxygen and carbon dioxide. At landfills less than two (2) acres in size, one (1) or more probe locations may be required. The probe(s) must be screened within the waste. The probe(s) should be sealed

at least five feet below ground surface and the screen bottom must be at least two feet above groundwater (if encountered). If groundwater is encountered in the waste, a shallower seal depth may be needed so that the screen bottom will be two feet above groundwater. Readings can be collected with field instrumentation. **Any area containing known chemical disposal or relatively high groundwater concentrations of volatile hazardous substances should receive this screening.** Probes should also be located in areas where detectable concentrations of measured vapors are identified during the vapor screening process (as described above in Section 6.a.). The probes must be installed in a manner that ensures no short-circuiting of air from the surface.

a. Areas exhibiting odors, stressed vegetation, or bubbling water should be investigated.

b. Evaluation of potential for vapor intrusion into existing or future structures will not be necessary when –

   The landfill has no volatile contaminants (any compound with a Henry's law constant greater than 1×10^{-5}, not just VOCs) in groundwater;
   A 500 foot buffer exists on the property around the edge of the waste;
   No structures currently present on the landfill disposal area;
   and
   Land use restrictions will be employed at the property so that no structure will be allowed on the landfill or within 500 feet.

Additional information is included in the *Supplemental Guidelines for the Evaluation of Structural Vapor Intrusion Potential* can be found at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide

Otherwise proceed as described below.

c. A vapor intrusion potential evaluation will include laboratory analysis of air samples from within the waste along with subsurface air samples collected at the landfill perimeter. These samples will be used to determine the potential for vapors from the waste or contaminated groundwater to migrate into existing or future buildings on the property or surrounding properties. Hot spots of groundwater contamination, contaminant detections during the above ground vapor screening steps in Section 6.a., and plans for development of the property will govern where the in-landfill samples are collected. If land use restrictions will be employed at the property so that no structure will be allowed on the landfill, the initial vapor intrusion evaluation can be limited to the perimeter of the landfill. The probe(s) should be sealed at least five feet below ground surface and the screen bottom must be at least two feet above groundwater (if encountered). If groundwater is encountered in the waste, a shallower seal depth may be needed so that the screen bottom will be two feet above groundwater. The Branch has additional guidance on vapor intrusion evaluation methodology.

d. Following collection of laboratory samples, the gas probe(s) should be tested for methane, hydrogen sulfide, oxygen, and carbon dioxide using field instrumentation, if the sampling point was not part of the previous field screening

in Section 6. If methane is detected, readings should also be recorded for mercury.

e. If the results of the soil gas testing fail indoor air vapor intrusion screening criteria, additional air testing may be required.

8. If other water sources (wells, springs and/or seeps) are located within 500 feet of the waste disposal area, samples should be collected from these water sources and analyzed for complete analytical scans (see Appendix B - Laboratory Analyses, Laboratory Analytical Parameters).

9. If surface water features traverse or adjoin the waste disposal area, surface water and sediment samples should be collected and analyzed (see Appendix B - Laboratory Analyses, Laboratory Analytical Parameters). At a minimum, one set of samples must be collected immediately downstream (of the waste disposal area), then one set from where the stream traverses or contacts the site and one set immediately upstream (of the waste disposal area). Note that samples should be collected in a downstream to upstream progression.

10. A groundwater contour and flow map, land surface topography, monitoring well locations, and screened intervals will need to be provided in the report summarizing the results of this phase of the investigation. Boring logs, well completion logs for temporary wells, permanent well construction records (non-residential well construction record form GW-1) and field notes should also be provided.

11. Additional contaminant delineation work phase(s) for identifying the extent of impacted media that may include soil, sediment, surface water, groundwater and landfill gas. Include a site map that indicates the locations of the surface soil samples, soil borings, sediment, and surface water sampling. Include monitoring points and boring locations and anticipated screened intervals when the installation of monitoring wells are required. Well installation and abandonment must comply with the most current 15A NCAC 2C well construction standards.

12. A site survey plat (prepared and certified by a professional land surveyor, N.C.G.S. 47-30 and also meets the requirements of the county Register of Deeds) including: scale, benchmarks, north arrow, locations of property boundaries, disposal areas delineated by geophysical or other methods, wells, and identification of all adjacent property owners.

Remediation

If contaminants are identified during the remedial investigation, all or a portion of the following remedial action requirements may apply:

1. Permission from the property owner to conduct a risk based remedy and includes provisional consent of the site's owner to the imposition of land use restrictions document (Appendix E).

2. A summary of the results of the remedial investigation; the discussion should include the media contaminated, contaminants of concern, and the extent of the contamination.

3. At landfills with less than 100,000 cubic yards of waste (approximately two (2) acres on average) non-containment remedies will be evaluated in the remedial action plan for the landfill. This is especially important at landfills having groundwater contamination and/or those having the potential for vapor intrusion into structures;

4. Removal and proper disposal of any exposed waste and/or surface debris;

5. Excavation of waste may be required to create a buffer between the waste disposal area and/or other receptors;

6. The installation of an engineered landfill cap;

7. The repair of an existing landfill cap or other barriers as appropriate;

8. The installation of erosion control measures;

9. In remedies where fill material (soil) will be placed on the site, collect composite samples for laboratory analysis of the material to confirm it is clean. The fill material should be divided into segments that are approximately 100 cubic yards, within each segment, use either random or biased selection to locate at least three borings. Samples should be collected from two depths within each boring; a minimum of six samples should be collected per segment.

10. Additional efforts to stop leachate seepage;

11. The development and implementation of a monitoring plan for groundwater, surface water and/or sediment;

12. The development and implementation of a remedial action plan for groundwater, landfill gas, surface water, soils and/or sediment;

13. The development and implementation of a remedial action plan for waste fill (i.e. hot spot removal);

14. Confirmation sampling to ensure remaining material meets protection of groundwater remediation goals.

15. Control of migration of groundwater contamination.

16. Recordation of land use restrictions, and the associated notice, that have been approved by the state (required as part of any remedial action plan that does not involve complete removal of hazardous substances and waste). Instructions for Recordation of Notices can be found at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide ; and

17. Incorporate all applicable permits and approvals in the remedial action plan.

Public Comment

A draft remedial action plan will be made available for public comment prior to implementation. After review of the draft remedial action plan, the Unit will distribute copies to the local health director and the public library in the county closest to the site location. A standard notice will be mailed to persons that have requested to be on the mailing list for the site (N.C.G.S. 130A-310.4(c)(2)) and for three consecutive weeks in a local newspaper. If the division director determines that there is significant public interest in a site, the Unit may hold a public hearing. The Unit will evaluate and consider all public comments before approving the remedial action plan.

Remedial Action Completion Report

A remedial action completion report will present the results of the remedy, as built drawings, post confirmation sampling and monitoring requirements.

Contaminant Delineation Work Plan, Remedial Action Plan and Report Certifications

1. A signed and notarized certification by the consultant responsible for the day to day remedial activities stating, "I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete."

2. Any work that would constitute the "practice of engineering" as defined by G.S. 89C shall be performed under the responsible charge of, and signed and sealed by, a professional engineer registered in the state of North Carolina. Any work that would constitute the "public practice of geology" as defined by G.S. 89E shall be performed under the responsible charge of, and signed and sealed by, a geologist licensed in the state of North Carolina.

3. For units of local government seeking remedial investigation reimbursement and developers performing voluntary remedial investigations under direct state oversight, the following certification is required: A signed and notarized certification by a representative of the remediating party stating, "I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete."

***Appendix A*: Sensitive Environments**

An evaluation on the site and within 500 feet of the site perimeter (not including roads and right of ways) for the existence of any of the environmentally sensitive areas listed below. Refer to Appendix C of the Inactive Hazardous Sites Program's guidance document for contacts that should be made in order to identify these areas. The most current edition of the *Inactive Hazardous Sites Program Guideline for Assessment and Cleanup* may be found at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide. The information received through these contacts should be outlined in the remedial investigation first phase work plan. In many cases, none of these areas will be present. Knowledge of the presence of these sensitive environments is necessary to determine if any special sampling (such as aquatic toxicity testing) is required and whether site remediation may do more harm than good (for example, excavation and destruction of a wetland versus leaving in place residual contamination which will not significantly impact the wetland environment).

- State Parks
- Areas Important to Maintenance of Unique Natural Communities
- Sensitive Areas Identified Under the National Estuary Program
- Designated State Natural Areas
- State Seashore, Lakeshore and River Recreational Areas
- Rare Species (state and federal Threatened and Endangered)
- Sensitive Aquatic Habitat
- State Wild and Scenic Rivers
- National Seashore, Lakeshore and River Recreational Areas
- National Parks or Monuments
- Federal Designated Scenic or Wild Rivers
- Designated and Proposed Federal Wilderness and Natural Areas
- National Preserves and Forests
- Federal Land designated for the protection of Natural Ecosystems
- State-Designated Areas for Protection or Maintenance of Aquatic Life
- State Preserves and Forests
- Terrestrial Areas Utilized for Breeding by Large or Dense Aggregations of Animals
- National or State Wildlife Refuges
- Marine Sanctuaries
- National and State Historical Sites
- Areas Identified Under Coastal Protection Legislation
- Coastal Barriers or Units of a Coastal Barrier Resources System
- Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters
- Migratory Pathways and Feeding Areas Critical for Maintenance of Anadromous Fish Species within River Reaches or Areas in Lakes or Coastal Tidal Waters in which such Fish Spend Extended Periods of Time
- State Lands Designated for Wildlife or Game Management
- Wetlands

An evaluation on the site and within 500 feet of the site perimeter (not including roads and right of ways) for areas that likely serve as a natural area attractive to terrestrial ecological receptors.

***Appendix B*: Laboratory Analyses**

Laboratory Analytical Parameters

1. Non-Gas Samples

Initially, complete analytical scans for all non-gas samples should include analyses for the parameters listed below. Subsequent delineation work phases can be limited to compounds detected in the first phase and their degradation compounds:

Using the most current USEPA Contract Laboratory Program Target Compound List for Volatile Organic Compounds by Method 8260,
Semi-Volatile Organic Compounds by Method 8270,
Metals (totals) (initially 6020 analysis) antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, and zinc,
Mercury by Method 7470 for water and 7471 for soil,
Thallium by Method 200.7 or 200.8,
Ammonia by Method 350.1 or 350.2 (aka SM-4500-NH3),
Sulfate by Method 300 or 9056,
Nitrate by Method 300, 9056 or 353.2,
And if they are suspected to have been disposed at the landfill: pesticides (Method 8081), herbicides, PCBs (Method 8082), dioxins, cyanide, formaldehyde, phosphorus and any other CERCLA hazardous substances or pollutants should be analyzed by the U.S. EPA method having the lowest method detection limit published in the latest edition of "Standard Methods for the Examination of Water and Wastewater."

At landfills where methane migration is a concern, groundwater sample(s) should also be collected and analyzed for dissolved methane. This non-gas (water) sample should be analyzed by U.S. EPA method 3810. Concentration of methane greater than 10 mg/l but less than 28 mg/l may indicate concentrations are increasing and concentrations greater than 28 mg/l could potentially cause flammable or explosive levels in confined spaces like crawl spaces, well houses or pipes.

The laboratory must be provided a copy of **Appendix B** to ensure appropriate analyte lists are used in the analysis of samples.

The methods used for 15A NCAC 2L standards groundwater must at least achieve detection equivalent standards. Confirmation sampling must be analyzed using U.S. EPA methods with detection limits less than or equal to branch remediation goals, or U.S. EPA methods with the lowest available detection limits for each contaminant of concern.

If chromium is a known or suspected contaminant at a site, samples should also be run for hexavalent chromium analysis. Also, if total non-speciatic chromium concentrations by totals analysis in the contaminate delineation phase samples exceed site specific background levels and the hexavalent chromium soil remedial goal, hexavalent chromium analysis is required. This analysis can be done by collecting sufficient

sample(s) to run hexavalent analysis should the total chromium result exceed the hexavalent soil remedial goals. Alternatively the testing could be performed during the next phase of work.

Initial groundwater testing using the most current USEPA Contract Laboratory Program Target Compound List must also include a library search (using National Institute of Standards and Technology mass spectral library) to produce a list of tentatively identified compounds (TICs). The library search should identify the largest 10 peaks in each analytical fraction having reasonable agreement with reference spectra (i.e. relative intensities of major ions agree within ± 20%). The list of identified TICs should not include laboratory control sample compounds, surrogates, matrix spike compounds, internal standards, system monitoring compounds or target compounds. Any TICs that have reasonable agreement with reference spectra, and are detected in more than one sample in an area of concern (unless only one sample), should be included in all subsequent analytical work unless the compound is a laboratory contaminant, naturally-occurring or otherwise a non-toxic anthropogenic sourced constituent. Quantification of these specific TICs must be performed before cleanup levels can be determined. For additional information on subsequent analytical requirements, please see the Appendix C for Standard Field Protocols.

2. Gas Samples

Samples should be collected and analyzed for these parameters **only** if they were detected at unacceptable levels during the above ground field screening described in Section 11.,

Volatile Organic Compounds by Method TO-15 using Summa canisters (batch certified)
Mercury by NIOSH 6009
Hydrogen Sulfide

For details on vapor sample collection and analysis procedures, please see the Branch's Supplemental Guidelines for the Evaluation of Structural Vapor Intrusion Potential at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide

For additional information on subsequent phase analytical requirements, please see Appendix C for Standard Field Protocols.

***Appendix C*: Standard Field Protocols**

1. Unless otherwise noted below, field procedures relating to sample collection techniques, sample containers, sample preservation, equipment decontamination and field measurement procedures, should comply with the most current version of the U. S. Environmental Protection Agency (U.S. EPA) Region IV Science And Ecosystem Support Division (SESD) *Field Branches Quality System and Technical Procedures.* This information is available from the U.S. EPA Region IV SESD at: http://www.epa.gov/region4/sesd/fbqstp/

2. In addition to the standard protocols outlined in the U.S. EPA information referenced above, please observe the following procedures:

   a. Field QC samples: (i) minimum of one duplicate sample, per medium, per container type, per field day; (ii) equipment rinsate blanks for volatile organic analysis (VOA), trip blanks are strongly recommended.

   Note: If site conditions warrant more limited QA/QC testing, contact the Branch.

   b. Soil, sediment and waste samples for VOA should be collected directly into sample containers without mixing.

   c. All soil sampling and boring locations should be staked and flagged (GPS point collected or surveyed) until the remedial investigation is complete.

   d. A professional land surveyor, registered in North Carolina, must survey all monitoring point locations.

   e. Filtration of groundwater samples for metals analysis before acid digestion is not permitted. Samples must be prepared using Standard Method 3030C "Preliminary Treatment for Acid-Extractable Metals," *Standard Methods for the Examination of Water and Wastewater*, latest edition. If turbidity is a problem, groundwater samples should be collected using a low-flow purging and sampling techniques. Additional well development may also be necessary.

   f. For surface waters that are very shallow (less than six inches deep) or highly turbid, samples may be collected in a separate collection container and then decanted into the sample container. Samples for organic analysis must be decanted into the sample container immediately. Samples for metals analysis may be allowed to settle for a few minutes prior to decanting. All collection containers must be made of the same materials as the sample container. They must be pre-cleaned and handled in the same manner.

   g. Investigation derived wastes or IDW (may include drill cuttings and muds, sampling materials; purge water, soil and residuals from testing) generated as part of remedial investigation activities may be discharged or stored in the area of

contamination and are not subject to RCRA as long as the material:

Stays on site and remains in the contaminated area;
Is secured;
Does not increase the spread of contamination or concentrations in a particular medium;
Does not cause mobilizations of contaminants;
and
Does not introduce contamination to uncontaminated soil (causing an increase in contaminant concentrations).

In residential and public use areas, IDW will require off-property management. IDW cannot be discharged to another area of concern unless it meets unrestricted use levels and permission from the property owner has been granted.

3. Landfill gas evaluation
   a. General
      - Each field instrument should meet the scope (can quantify levels at or lower than screening concentrations) of the landfill gas vapor evaluation (either above ground or subsurface) according to manufacturer recommendations,
      - Surface screening under ambient air (above ground) conditions may require different instrumentation than required for subsurface oxygen deficient environments, and
      - Calibration gas for the vapor monitoring instruments (using the appropriate calibration gas concentration) should be adjusted to the expected landfill gas concentrations.
      - Please see the IHSB residential Vapor Intrusion Screening Levels at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide

Field instruments to screen for potential landfill gases should be capable of accurately reading the following target landfill gases while maintaining valid upper and lower limits of detection specified by the manufacturer:

- **Common landfill gases:** methane, oxygen, carbon dioxide, using an infrared sensor capable of detecting methane at 2,500 ppm (0.25% by volume, 5% LEL) and barometric pressure.
- **Hydrogen sulfide:** Use a gold film sensor or equivalent for ambient air or an attachment with an infrared sensor instrument for subsurface, the minimum instrument detection limit should meet the most recent minimum acceptable Branch residential vapor intrusion screening levels.
- **Mercury:** Use an instrument with a gold film sensor or equivalent for measuring concentrations in ambient air or a high-frequency driven electrodeless discharge lamp for subsurface vapors. The minimum detection limit should meet the most recent minimum acceptable Branch residential vapor intrusion screening levels.
- **Temperature and humidity**.

Note: The global background concentration for surface methane is about 0.75 ppm. 1% by volume equals 10,000 ppm of methane or 20% LEL.

b. Landfill Gas Quality Assurance

The landfill screening evaluation reports should include an appendix that includes the following for all equipment used:

- The manufacturer, model number, serial number, date of factory calibration and maintenance, set up parameters;
- Detection limit;
- A summary of **field calibration** procedures employed (using those recommended by the manufacturer) and bump test (to verify full calibration and instrument accuracy) before, during and after evaluation, type(s) of calibration gas, expiration date;
- Any additional field calibration conducted as required for changing field conditions.

Field logs should include at least:

- Name(s) of person conducting the evaluation;
- Brief description of weather conditions (possible impacts on data: windy, nearby exhaust from vehicles etc.);
- Date and time began/end;
- Ambient temperature, humidity and barometric pressure readings at least hourly;
- Verification of field instrument calibration;
- Additional field calibration as needed for changing field conditions;
- Duplicate reading of direct read instruments at least one background and two monitoring points;
- Detection limit of each instrument used;
- Table that includes sample location, readings, (note other things that may affect the results like a water trap, filters, increasing barometer pressure, significant change in temperature, etc.).

Report concentration results:
Methane in % LEL, % by volume and micrograms per cubic meter ($\mu g/m^3$)
Hydrogen sulfide, mercury and volatile organic compounds in micrograms per cubic meter ($\mu g/m^3$)

Note: At least two (2) readings must be collected anywhere there is equal to or greater than 2% changes in the reading.

Landfill Gas Probes/Wells:
Subsurface air samples from within the waste and along the landfill perimeter may require the installation of probes/wells. These points will be used to evaluate the potential for vapors associated with waste degradation. Gas probes/wells may be constructed and installed in accordance with the *Solid Waste Section Landfill Gas Monitoring Guidance, November 2010, Section 5-Landfill Gas Monitoring Wells*.
Please see the landfill gas document at:
http://portal.ncdenr.org/web/wm/guidance-and-memos

The probe/well(s) should be sealed at least five feet below ground surface (as a more shallow depth may draw air from the surface) and the screen bottom must be at least two feet above groundwater (if encountered). If groundwater is encountered in the waste, a shallower seal depth may be needed so that the screen bottom will be two feet above groundwater.

At sites where geologic conditions prevent meeting these requirements, flux chambers may be used. The flux chamber should be recessed into the ground surface and sealed with grout or hydrated bentonite. The chamber should utilize air tight fittings that allow connections to either field instruments and/or summa canisters. Record the length of time a calibrated field instrument is connected to the flux chamber when taking a reading so the procedure may be duplicated if re-testing is needed. The results collected from flux chambers are qualitative, not quantitative.

The Branch has additional guidance on vapor intrusion evaluation methodology for existing and future buildings that will require evaluation. Please see the IHSB Supplemental Guidelines for the Evaluation of Structural Vapor Intrusion Potential at: http://portal.ncdenr.org/web/wm/sf/ihs/ihsguide

***Appendix D*: Definitions**

The following definitions apply to this guidance:

Property/Properties: the parcel/parcels that include the waste disposal area/site.

Site: any area where a hazardous substance or waste has been deposited, stored, disposed of, placed, or otherwise come to be located.

Waste disposal area: the estimated or actual area derived from investigation activities of subsurface/surface waste regardless of the number of properties on which it is located.