



## **ENVIRONMENTAL LABORATORY SECTOR**

### **Technical Training Course Curricula for Environmental Laboratory Assessors**

#### **TNI Guidance Document**

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**P.O. Box 2439  
Weatherford, TX 76086  
817-598-1624  
[www.nelac-institute.org](http://www.nelac-institute.org)**

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## Introduction

Volume 2 of the TNI Environmental Laboratory Sector Standard requires that all accreditation body assessors take and pass a course in each technical discipline that the assessor will be evaluating during on-site assessments. This is a guidance that gives recommended course outlines and an examination design.

It is assumed that the assessors will already have bench level experience or familiarity with both the analytical techniques and methods involved with the particular discipline. Therefore, the outlines include prerequisites that reflect this assumption. The course outlines are not designed to make analysts out of assessors but assessors out of technical experts. The course duration recommended in the outlines are based on the amount of time the Committee felt would be necessary to sufficiently cover all the portions of the outline. The Committee acknowledges that not all assessors attending the course will have the assumed experience or prerequisites. This is an opportunity for training providers to determine the needs of their clients and add the necessary material and training days to the curricula to ensure assessor proficiency.

Part of the purpose of the TNI standards is to ensure consistency of the on-site assessment. The spirit of TNI fosters the sharing of expertise. So while the Committee acknowledges that many assessors are already experts in their respective fields, all assessors still need to fulfill the training requirements. Additionally, the course outlines are flexible enough to allow a training provider to promote their course as an advanced or continuing education course where the more fundamental parts of the outline are covered quickly allowing more time to cover other topics and exercises in greater depth. The portions of the outline that the Committee felt should be emphasized with more time dedicated to covering them are highlighted in blue. Some specific topics may be covered by homework assignments and/or handouts supplemented by discussion as needed to fit the material into the time allotted.

This is a living document and as all stakeholders participate in the training process the Committee hopes to receive feedback on the content and effectiveness of the guidance.

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## OUTLINE FOR ASBESTOS TECHNICAL COURSE

### I. Technical Discipline

Polarized Light Microscopy (PLM), Phase Contrast Microscopy (PCM),  
Transmission Electron Microscopy (TEM)

### II. Length of course

The training should be a minimum of three days for PLM and PCM to allow  
adequate time for TEM issues.

### III. Course Prerequisites

1. Basic Assessor Training
2. Familiarity with approved and applicable methods (i.e. *NIOSH 7400*,  
*EPA/600/M4-82-020*, *EPA/600/R-93/116*, *40 CFR Part 763 (AHERA)*, *NIOSH*  
*7402*, *EPA/600/R-94/134 (100.2)*, *EPA/600/4-83-043 (100.1)*)
3. Quality Systems Lab module V1M2
4. Basic knowledge of analytical technology, applications and principles.
5. Experience performing PCM, PLM, TEM

### IV. Specific Analytical and Preparation Technologies

1. Phase Contrast Microscopy
2. Polarized Light Microscopy
  - a. Friable
  - b. Non-friable Organically Bound (NOB)
3. Transmission Electron Microscopy
  - a. AHERA
  - b. EPA Method 100.2
  - c. EPA Method 100.1
  - d. NOB

### V. Relevant Accreditation Procedures and Criteria

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems general, management and technical requirements
3. V1M3 – Asbestos Testing

### VI. Program Specific Criteria

1. Friable building materials, air (PCM & TEM), Non-friable Organically  
Bound building materials (PLM & TEM), drinking water, waste water.
2. Cover what the applicable and acceptable methods are for each program for  
each technology.
3. Discuss soil, vermiculite, and dust testing.

### VII. Understanding and Assessing the Test (This section should include problems associated with each aspect of the test and how to detect improper practices)

1. Principle
2. Application of method/technology

3. Sample preservation and holding time (water)
4. Analyst: include how the “analyst is the instrument”; discuss bias
5. Equipment: include how maintenance affects test
6. Method validation (special requests)
7. Standard reference materials (NIST)
8. Calibration and calibration verification procedures and frequency
9. Data acquisition and processing
10. Data and quality control reporting
11. SOP
12. Traceability of Measurements
13. Corrective actions when data does not meet acceptability requirements (i.e. blanks, false positives, etc.)
14. Computer and software
15. PT results

### VIII. Assessment Methods and Techniques

(Note: This section should include exercises so participants can practice and instructor can evaluate assessor’s competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab’s quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence
  - a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - b. Observing the lab perform the tests
    - i. Preparation
    - ii. Analysis and analyst’s competency (Extremely important – the analyst is the instrument. Are they fumbling? Are the necessary charts and graphs easily available?)
  - c. Reviewing records of the testing including the final report
    - i. Include exercise of reviewing a report and its raw data down to the bench-sheet level. Demonstrate how full analysis (esp. for PCM) is required. Demonstrate what to look for to determine if “short cuts” are being taken in analysis. Include review of any statistics.
    - ii. Devise interview questions specific to data issues found in report and conduct interview
    - iii. Write report of findings
4. Inappropriate Practices – include common issues such as inappropriate field counts (esp. PCM); excessive workload; improper use of solvents, oils, acid, etc. (PLM); “standardized” Refractive Indices; improper recording of fiber characteristics (RI, morphology, etc.); lack of full calibration (PLM, PCM, & TEM) and eucentricity adjustment (TEM); appropriate EDX and SAED determination of asbestos type (TEM); and inadequate QC prior to release of results. Also include inappropriate preparation issues such as lack of rotating

stage in carbon evaporator, close proximity of air sample prep areas to bulk handling/prep areas.

IX. **Question and Answer Session**

X. **Examination** Guidance on the type of questions is provided in another section



# OUTLINE FOR INORGANIC NON-METALS AND MISCELLANEOUS TECHNIQUES TECHNICAL COURSE

## **I. Technical Discipline**

Inorganic Chemistry non-metals and miscellaneous techniques

## **II. Length of course**

The training should be a minimum of three days

## **III. Course Prerequisites**

1. Basic Assessor Training
2. Familiarity with applicable methods (i.e. EPA, ASTM Standards, Standard Methods)
3. Quality Systems Lab module V1M2
4. Basis knowledge of analytical technology, applications and principles

## **IV. Specific Analytical Technologies**

1. Spectrophotometry
2. Colorimetry (Color)
3. Infrared Spectrometry (IR)
4. Titrimetry (TITR)
5. Ion Chromatography (IC)
6. Gravimetric Methods (GRAV)
7. Potentiometry (POT)
8. Total Organic Carbon and Total Organic Halides (TOC/TOX)
9. Chemical Oxygen Demand/Biochemical Oxygen Demand (COD/BOD)

## **V. Relevant Accreditation Procedures and Criteria**

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems general, management and technical requirements
3. V1M4 – Applicable sections of chemical testing

## **VI. Program Specific Criteria**

1. Drinking water, wastewater, solid and hazardous waste, Superfund, RCRA etc.
2. Cover what the applicable and acceptable methods are for each program for each technology (i.e. standard methods, EPA Method series 100, 300, 400, vs. 9000 series, ASTM, USGS etc.)
3. Cover which methods allow modifications and what modifications are allowed (Include 40 CFR part 136.6)
4. Cover Standard Methods Quality Assurance and Quality Control, Part 1000, 2020,4020 and 5020

## **VII. Understanding and Assessing the Test**

(This section should include problems associated with each aspect of the test and how to detect improper practices.)

1. Principle and summary of each analytical technology
2. Scope and application of method/technology
3. Sample preparation
4. Equipment
5. Method validation: assess adequacy of records
6. Standard/reference materials
7. Calibration and calibration verification procedures and frequency
8. Data acquisition and processing (cover integration for ion chromatography)
9. Data and quality control reporting
10. SOPs
11. Traceability of Measurements: Assessing technical validity of reference standards
12. Corrective actions when data does not meet acceptability requirements
13. Computer and software
14. PT results
15. Uncertainty measurement

#### **VIII. Assessment Methods and Techniques**

(Note: this section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence
  - a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - b. Observing the lab perform the test (include QC checklist for that technique/method)
  - c. Reviewing records of the testing including the final report
    - i. Include exercise of reviewing a report and its raw data including statistical analysis performed by lab
    - ii. Devise interview questions specific to data issues found in report and conduct interview
    - iii. Write report of findings

#### **IX. Question and Answer Session**

#### **X. Examination**

Guidance on the type of questions is provided in another section

## **OUTLINE FOR METALS TECHNICAL COURSE**

### **I. Technical Discipline**

Inorganic Chemistry - Metals

### **II. Length of course**

The training should be a minimum of three days

### **III. Course Prerequisites**

1. Basic Assessor Training
2. Familiarity with applicable methods (i.e. EPA, ASTM, Standard Methods)
3. Quality Systems Lab module V1M2
4. Basic knowledge of analytical technology, applications and principles

### **IV. Specific Analytical Technologies**

1. Atomic Absorption – Cold Vapor Spectrometry (CVAAS)
2. Atomic Fluorescence – Cold Vapor Spectrometry (CVAFS)
3. Atomic Emission – Direct Current Plasma Spectrometry (DCP-AES)
4. Differential Pulse Polarography (DPP)
5. Atomic Absorption – Flame Spectrometry (FAAS)
6. Atomic Emission – Flame Spectrometry (FAES)
7. Atomic Absorption – Graphite Furnace Spectrometry (GFAAS)
8. Atomic Emission – Inductively Coupled Plasma Spectrometry (ICP-AES)
9. Mass spectrometry – Inductively Coupled Plasma Spectrometry (ICP-MS)
10. X-Ray Fluorescence Spectrometry (XRF)
11. X-Ray Transmission Spectrometry (XRT)

### **V. Relevant Accreditation Procedures and Criteria**

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems general, management and technical requirements
3. V1M4 – Applicable sections of chemical testing

### **VI. Program Specific Criteria**

1. Drinking water, wastewater, biosolids, solid and hazardous waste
2. Cover what the applicable and acceptable methods are for each program for each technology (i.e. *Standard Methods*, EPA 200 vs. 7000 series) Include quality assurance and master methods applicable to the program (i.e. *Standard Methods* section 1000, 3020 and 3030)
3. Cover which methods allow modifications and what modifications are allowed (i.e. recent changes to 40 CFR Part 136.6)

**VII. Understanding and Assessing the Test** (this section should include problems associated with each aspect of the test and how to detect improper practices)

1. Principle
2. Application of method/technology
3. Sample preparation
  - a. Microwave digestion
  - b. Hydrides
  - c. TCLPs
  - d. Hot plate/block digestion
  - e. QC samples
4. Equipment (cover maintenance, gases)
  - a. Maintenance
  - b. Gases
5. Method validation
  - a. Method required IDC vs. requirement of TNI standard
  - b. IDLs
  - c. MDLs
  - d. Spectral interferences
  - e. MQL
6. Standard/reference materials
7. Calibration and calibration verification procedures and frequency
8. Assessing instrument responses
  - a. for blanks (both positive and negative responses)
  - b. interference indicators (i.e. negative responses)
9. Data acquisition and processing
10. Data and quality control reporting
  - a. effect of dilutions on reporting limits
  - b. data qualifiers
11. SOP
12. Traceability of Measurements
13. Corrective actions when data does not meet acceptability requirements
14. Computer and software
15. PT results
16. Uncertainty measurement

**VIII. Assessment Methods and Techniques**

(Note: This section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence

- a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
- b. Observing the lab perform the test (include QC checklist for that technique/method)
- c. Reviewing records of the testing including the final report
  - i. Include exercise of reviewing a report and its raw data including any statistical analysis performed by lab
  - ii. Devise interview questions specific to data issues found in report and conduct interview
  - iii. Write report of findings

**IX. Question and Answer Session**

**X. Examination**

Guidance on the type of questions is provided in another section

## OUTLINE FOR MICROBIOLOGY TECHNICAL COURSE

### I. Technical Discipline

Microbiology - coliform bacteria, *E. coli*, enterococci, *Salmonella*, coliphage, viruses, protozoa

### II. Length of Course

The training should be a minimum of three days. Four days is strongly recommended with the fourth day used for final examination and discussion of the exercise report

### III. Course Prerequisites

1. Basic knowledge of microbiology and microbiology methods
2. Basic assessor training
3. Quality Systems Lab Module V1M2

### IV. Specific Analytical Technologies Discussion

1. Quantitative vs. qualitative
2. Identification by definition
3. Fermentation vs. filtration
4. Future – molecular techniques, rapid methods, flow cytometry
5. Coliform Bacteria
6. *E. coli*
7. *Salmonella*
8. Enterococci
9. Coliphage
10. Viruses
11. Protozoa

### V. Relevant Accreditation Procedures & Criteria

1. V2M3 – Accreditation Body Onsite Assessment
2. V1M2 – Quality Systems general, management and technical requirements
3. V1M5 – Microbiological Testing

### VI. Program Specific Criteria

1. Drinking water, ground water, wastewater, sewage sludge, biosolids, ambient water, and marine waters
2. Applicable methods, sample preservation and holding times for each matrix
3. Notification of positive results and poor samples
4. Method modifications allowed and process for alternate test methods
5. Legal requirements of the various programs

### VII. Understanding and Assessing the Test

(Note: This section should include problems associated with each aspect of the test and how to detect improper practices)

1. Sampling

2. Sample handling including holding time
3. Laboratory facility
4. Equipment/instruments
5. Calibration & maintenance
6. Supplies, including media
7. Cleaning
8. Reagent water & sterility testing
9. Media preparation including sterilization and sterility testing
10. Reference materials for QC and positive and negative culture controls
11. Validation for new or non-standard methods
12. Method verification
13. Reading and recording analytical results
14. Data qualification, recording and corrective action
15. Record retention
16. SOPs
17. PT results
18. Health & safety issues, biosafety levels
19. Calculations

#### **VIII. Assessment Methods and Techniques**

(Note: This section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence
  - a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - b. Observing the lab perform the test (include QC checklist for that technique/method)
  - c. Reviewing records of the testing including the final report
    - i. Include exercise of reviewing a report and its raw data including any statistical analysis performed by the lab
    - ii. **Include a real plate sample as an example**
    - iii. Devise interview questions specific to data issues found in report and conduct interview
    - iv. Write report of findings

#### **IX. Questions and Answers Session**

#### **X. Examination**

Guidance on the type of questions is provided in another section

## OUTLINE FOR ORGANIC CHEMISTRY COMPOUNDS

### I. Technical Discipline

Volatile and Semi-volatile Organic compounds including pesticides, PCBs, herbicides, explosives, petroleum hydrocarbons and Dioxins

### II. Length of course

The training should be a minimum of three days to allow adequate time for the exercises

### III. Course Prerequisites

1. Basic Assessor Training
2. Familiarity with applicable methods (i.e. EPA, ASTM, Standard Methods)
3. Quality Systems Lab module V1M2
4. Basic knowledge of analytical technology, applications and principles

### IV. Specific Analytical and Preparation Technologies

1. Gas chromatography (GC)
2. High Performance Liquid Chromatography (HPLC)
3. Ultraviolet (UV)
4. Fluorescence (FL)
5. Electrochemical (ELEC)
6. Mass Spectrometry (MS)
7. High Resolution Mass Spectrometry (HRMS)
8. Flame Ionization Detection (FID)
9. Photo-ionization Detector (PID)
10. Electron Capture Detection (ECD) and Electrolytic Conductivity Detectors (ELCD)
11. Fourier Transform Infrared (FTIR)
12. Nitrogen Phosphorus Detection (NPD)
13. Flame-photometric detector (FPD)
14. Purge and trap
15. Extraction
16. Derivatization
17. Waste Dilution
18. Solid Phase Extraction (SPE)
19. Biological Tissue

### V. Relevant Accreditation Procedures and Criteria

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems general, management and technical requirements
3. V1M4 – Applicable sections of chemical testing



## **VI. Program Specific Criteria**

1. Drinking water, wastewater, solid and hazardous waste, Superfund, RCRA, biological tissue, etc.
2. Cover what the applicable and acceptable methods are for each program for each technology. Include drinking water 500 series methods, wastewater 600 series methods, and solid and hazardous waste SW-846 3000 series and TCLP sample preparation and 8000 series analytical methods.
3. Cover which methods allow modifications and what modifications are allowed
4. Specifically cover SW-846 chapters one and four (QC and Organics respectively) as well as Method 8000. Cover Applicable portions of the *EPA Manual for the certification of Laboratories Analyzing Drinking Water: Criteria and Procedures Quality Assurance*. Also cover applicable air methods and some of the major departures such as the averaging done for calibration curves.

## **VII. Understanding and Assessing the Test** (this section should include problems associated with each aspect of the test and how to detect improper practices)

1. Principle
2. Application of method/technology
3. Sample preservation and holding time
4. Sample preparation
5. Equipment and instrumentation: include how maintenance affects test
6. Method validation
7. Standard/reference materials
8. Pre-calibration checks: chromatography and MS tuning
9. Calibration and calibration verification procedures and frequency
10. Data acquisition and processing (cover chromatography, integration and qualitative interpretation, confirmation i.e. second column)
11. Data and quality control reporting
12. SOP
13. Traceability of Measurements
14. Corrective actions when data does not meet acceptability requirements (i.e. method blanks and calibration verifications)
15. Computer and software
16. PT results
17. Uncertainty measurement

## **VIII. Assessment Methods and Techniques**

(Note: this section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).

3. Assessing Technical Competence
  - a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - b. Observing the lab perform the test (include QC checklist for at least one MS method and one other detector)
  - c. Reviewing records of the testing including the final report
    - i. Include exercise of reviewing a report and its raw data down to the electronic level. Demonstrate how to review integration. Demonstrate how re-calculating a result from raw data to report can reveal problems. Include statistical analyses performed by lab.
    - ii. Devise interview questions specific to data issues found in report and conduct interview
    - iii. Write report of findings
4. Inappropriate Practices – include common issues such as mis-integration, time travel, file swapping, multiple calibrations, dropping points from the middle of the curve, extrapolating above or below the curve, and hiding blank contamination. Include inappropriate preparation issues such as a) extracting soil samples in water prior to analysis by purge and trap, b) using non-water miscible solvents in spiking solutions, c) spiking surrogate and QC samples after extraction. Be sure to cover headspace and vial limitation issues for volatile compound analyses. Also cover limitations to software.

#### **IX. Question and Answer Session**

#### **X. Examination**

Guidance on the type of questions is provided in another section

# RADIOCHEMISTRY TECHNICAL COURSE OUTLINE

## **I. Technical Discipline**

Radiochemical Testing

## **II. Length of course**

The training should be a minimum of three days

## **III. Course Prerequisites**

1. Basic Assessor Training
2. Familiarity with applicable methods (i.e. EPA, ASTM, Standard Methods)
3. Quality Systems Lab module V1M2
4. Basic knowledge of analytical technology, applications and principles

## **IV. Specific Analytical Technologies**

1. Alpha Spectrometry (AS)
2. Alpha Scintillation Cell Counter (ASC)
3. Fluorometer (FLUO)
4. Alpha/Beta Gas-Flow Internal Proportional Counter (GPC)
5. Gamma Spectrometry-Low/High Resolution (GS)
6. Laser Phosphorimetry (LP)
7. Liquid Scintillation Counter (LSC)

## **V. Relevant Accreditation Procedures and Criteria**

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems General, Management and Technical Requirements
3. V1M6 – Radiochemical Testing

## **VI. Program Specific Criteria**

1. Drinking water, wastewater, hazardous waste etc.
2. Cover what applicable and acceptable methods are for each program for each technology (EPA, SM, ASTM, USGS, DOE, other)
3. Cover changes or adoption of applicable regulations, TNI Standards, Methods (i.e. recent changes to 40CFR 136, EPA Manual for the Certification of Laboratories Analyzing Drinking Water, etc.)

**VII. Understanding and Assessing the Test** (this section should include problems associated with each aspect of the test and how to detect improper practices when applicable)

1. Principle and Summary of each method/technology
2. Scope and Application of method/technology (include discussion of interference)
3. Sample preparation
  - a. Sample preservation

- b. pH verification
- c. Lab sample preparation protocol – the course should emphasize the importance of strict adherence to the preparation methods and techniques.
- d. Role of carriers and tracers in the preparation and analytical process
- 4. Radiation counting instrumentation and preventative maintenance
  - a. Gas- Flow proportional counting system
  - b. Alpha and beta scintillation counting system
  - c. Gamma spectrometer systems
  - d. Scintillation cell system
  - e. Liquid scintillation counting system
  - f. Fluorometer
  - g. Alpha spectrometry systems
- 5. Method validation
  - a. Method required IDC vs. IDC requirement of standard
  - b. Ongoing Demonstration of Capability
  - c. MDA vs. Required Method/Regulatory Method Detection Limit (example MDA vs SDWA detection limit in 40 CFR 141.25 (c))
  - d. The course should emphasis that the detection limit determination is a function of the background of the laboratory as opposed to the sample. If the laboratory does not properly measure the background, all results will be biased.
- 6. Standard/reference materials, sources and lab radioactive materials license, and radioactivity decay review and application of half-life data in calculating concentration of standards
- 7. Calibration and calibration verification procedures (Performance/Efficiency checks) and frequency
  - a. The course should discuss the difference between radiochemistry calibration inorganic/organic calibration with regard to frequency, verification, management and storage of standards, and corrective actions for calibration failures.
- 8. Background checks measurements
- 9. Data acquisition and processing and data calculations including counting error if applicable
- 10. Data and quality control reporting
  - a. Data validation
  - b. Data acceptance and rejection criteria
  - c. Data flags
- 11. SOPs - written vs. actual practice vs. method reference
- 12. Traceability of Measurements
- 13. Measurement of Uncertainty
  - a. Emphasis should be placed on the calculation(s) for the measurement of uncertainty and the control exercised over the calculation technique
    - i. Are spreadsheets controlled to prevent changes to equations and propagation of errors?

- ii. Are calculations verified and documented prior to implementation?
  - iii. Is internally developed software used for calculations properly verified and documented, including version control?
14. Control Charts
  15. Corrective actions when data does not meet acceptability requirements
  16. Computer and software
  17. Radiological Control Program- Prevention of cross contamination and background activity or contamination monitoring
  18. Radiation safety program - Assessors should be trained regarding the basics of a sound radiation safety program. The program should protect the health of all employees as well as serve to deter the cross-contamination of radioactivity within the radiochemistry laboratory and from the radiochemistry laboratory to the general laboratory and non-laboratory areas. Frisking, standards storage and maintenance, personnel monitoring, etc. are all topics to consider.
  19. PT results

VIII. **Assessment Methods and Techniques** (Note: This section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of analytical methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence
  - a. Special attention should be paid to assessing the credentials of the radiochemistry department supervisor and the technical manager. These personnel must be technically competent for the radiochemistry laboratory to produce valid data.
  - b. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - c. Observing the lab performs the test (include QC checklist for that technique/method)
  - d. Reviewing test records and final report
    - i. Include exercise of reviewing a report and its raw data including any statistical analysis performed by the lab
    - ii. Devise interview questions specific to data issues found in report and conduct interview
    - iii. Write report of findings

## IX. **Question and Answer Session**

## X. **Examination**

Guidance on the type of questions is provided in another section

## OUTLINE FOR ENVIRONMENTAL TOXICITY TECHNICAL COURSE

### I. Technical Discipline

Whole Effluent Toxicity (WET), Sediment and Soils Toxicity

### II. Length of course

The training should be a minimum of three days, and it is recommended that one day of instruction be in an operating facility.

### III. Course Prerequisites

1. Basic Assessor Training
2. Familiarity with applicable methods (i.e. EPA, ASTM, Standard Methods)
3. Quality Systems Lab module V1M2 & V1M7
4. Basic knowledge of WET technology, applications and principles

### IV. Specific Analytical Technologies

1. Fresh Water Chronic Testing (EPA/821-R-02-013)
2. Salt Water Chronic Testing (EPA/821-R-02-014)
3. Fresh and Salt Water Acute Testing (EPA/821-R-02-012)
4. Sediment Toxicity Testing (various in ASTM, Standard Methods, EPA)
5. Soils Toxicity Testing (various in ASTM, Standard Methods and EPA)

### V. Relevant Accreditation Procedures and Criteria

1. V2M3 - Accreditation Body Onsite Assessment
2. V1M2 - Quality Systems general, management and technical requirements
3. V1M7 – Toxicity Testing

### VI. Program Specific Criteria

1. Wastewater, Dredged Materials Disposal (USACE), Solid Waste
2. Cover what the applicable and acceptable methods are for each program for each technology (i.e. *Standard Methods, ASTM, EPA*)
3. Cover which methods allow modifications and what modifications are allowed (i.e. Recent changes to 40 CFR 122/136)

### VII. Understanding and Assessing the Test

(Note: This section should include problems associated with each aspect of the test and how to detect improper practices)

1. Principle of Toxicity Testing
2. Application of method/technology
3. Test set-up, maintenance, and take down (including consistent environmental conditions)
4. Equipment
5. Method validation
  - a. Test Acceptability Criterion

- b. Positive and Negative Controls
- c. Percent Minimum Significant Difference (PMSD's)

6. Calibration and calibration verification procedures and frequency for support equipment
7. **Organism Culture Procedures, including taxonomic verification**
8. Data acquisition and processing
9. Data and quality control reporting
10. SOP
11. Traceability of Measurements
12. Corrective actions
13. Computer and software
14. PT results

VIII. **Assessment Methods and Techniques** (Note: this section should include exercises so participants can practice and instructor can evaluate assessor's competence)

1. Ensuring consistency and systematic approach (planning to closing)
2. Assuring the lab's quality assurance manual complies with and incorporates the applicable TNI standards and key elements of methods (could be incorporated by reference to Technical Manuals and SOPs).
3. Assessing Technical Competence
  - a. Conducting staff interviews (include exercise of writing technique associated questions and doing an interview)
  - b. Observing the lab perform the test (include QC checklist for that technique/method)
  - c. Reviewing records of the testing including the final report
    - i. Include exercise of reviewing a report and its raw data including any statistical analysis performed by the lab
    - ii. Devise interview questions specific to data issues found in report and conduct interview
    - iii. Write report of findings

#### IX. **Question and Answer Session**

#### X. **Examination**

Guidance on the type of questions is provided in another section

## **Technical Course Examination Guidance**

The purpose of the technical course examination is to determine that an assessor has the technical knowledge, assessment skill in a given discipline, adequate knowledge of the applicable TNI technical module and actively participated in the course. To that end, it is strongly recommended that the following guidance is used in the preparation and administering of the exam.

### **Exam Characteristics**

The exam should have 40-60 questions. The questions can be multiple choice, true/false and/or fill in the blank. No more than 20% of the questions should be true/false. At least 10% of the questions should be fill-in-the blank. However, the questions should be objective. The exam should include questions on calculations and improper practices.

Assessors should be encouraged to refer to the standard and methods in their capacity as assessors, therefore the exam should be an open book exam. Students should be allowed two hours to complete the exam.

While the class exercises are not part of the final score, the instructor should include on the exam questions derived from the exercises that show an understanding and capability of determining what is deficient in an analysis. Include questions that require the interpretation of documents common to the discipline being taught.

A score of 70% is considered passing. A participant will be allowed one retest upon failure of the exam. The retest must be significantly different from the original test.

**The following topics should have a question included on the respective exams.**

### **Asbestos**

Required equipment

Calibration frequency and criteria

Quality control measures

Analysis sequence for bulk

Sub sampling for bulk

Record keeping and bench sheet recording requirements

Fraud indicators

Determination of refractive indices of samples and RI oils

Definition of Fibers in Air

Regulatory issues

TEM data interpretation

Improper practices

Calculations



**Inorganic non-metals**

Proper integration for ion chromatography  
MDL and DOC  
Record keeping and bench documentation  
Calculations  
Calibration and verification  
Preparation  
Critical method techniques  
Routine maintenance  
Improper practices

**Metals**

Frequency and evaluation of QC checks  
Digestion methods and required and/or permitted uses  
Calibration procedures and options  
Routine maintenance  
Problems associated with Mercury analyzers  
Causes of drift and correction  
Common software problems in automated analysis  
Sub-sampling of soil samples  
Problems with in-house preparation of mixed standards  
Common interferences  
Regulatory reporting requirements  
Improper practices  
Calculations

**Microbiology**

Frequency and evaluation of QC checks  
Handling and use of reference cultures  
Production and testing of lab water  
Verification requirements  
Reporting requirements  
Matrix or program required method options  
Media handling, preparation and storage  
Glassware cleaning and testing  
Sample shipping and holding time requirements  
Incubator temperature and time requirements  
Equipment and instrumentation calibration and maintenance  
Colors and characteristics of positive samples  
Handling non typical sample reactions by rejection and re-sampling  
Calculations  
Invalidation of sample results  
Improper practices

**Organic**

Initial calibration and calibration check criteria and frequency

Tuning  
Extraction sample cleanup  
Proper integration  
Peak identification  
Corrective action for failed QC  
Calculations  
Improper practices

**Radiochemistry**

Calibration Frequencies  
Counting time  
Background checks  
Facility requirements and environmental control  
Detection limits  
Method QC  
Calculations and measurement uncertainty  
Improper practices and method modifications

**Toxicity**

Sample receipt requirements  
Test initiation, maintenance and take-down  
Standard toxicant (positive control) interpretation  
Unusual data interpretation  
PMSD  
Species identification  
Environmental controls  
Care and feeding of organisms  
Calculations  
Improper practices

## ACRONYMS

AHERA – Asbestos Hazard Emergency Response Act  
ASTM – American Society for Testing and Materials  
CFR- Code of Federal Regulations  
DOE – Department of Energy  
IDL – Instrument Detection Limit  
M – Module  
MDL – Method Detection Limit  
MQL – Method Quantitation Limit  
NIOSH – National Institute for Occupational Safety and Health  
NIST – National Institute of Science and Technology  
PE or PT – Performance Evaluation or Proficiency Test  
PMSD – Percent Minimum Significant Difference  
QC – Quality Control  
RCRA – Resource Conservation and Recovery Act  
SDWA – Safe Drinking Water Act  
SOP – Standard Operating Procedure  
TEM - transmission Electron Microscopy  
TNI – The NELAC Institute  
USGS – United States Geological Survey  
V- Volume