



Successful Stack Testing

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Topics

- > Reasons for Stack Testing
- > Preparations for Stack Testing
- > Keys for Successful Performance Testing
- > Management of Test Results - Strategy and Submittals
- > Management of Test Results - Next Steps

Reasons for Stack Testing

Initial Performance Tests

- > New Source or Modifications to an Existing Source
 - ❖ Plan for test between commencement of operations and operating permit modification
 - ❖ Reach out to test firms early to plan for safe stack access and appropriate ports as a part of original source design
- > New/Revised Rule
 - ❖ NSPS: Typically, test within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility... [40 CFR 60.8(a)]
 - ❖ NESHAP: Typically, test within 180 days of the compliance date [40 CFR 63.7(a)]



5



Purpose of Test

- > Routine Tests:
 - ❖ Compliance with permit condition, compliance with an underlying rule, response to an Agency request
 - ❖ Retest frequency based on permit conditions or regulatory requirements
 - ❖ Retest when operating conditions change or change to equipment or control device
- > Informal Tests:
 - ❖ Engineering diagnostic testing
 - ◆ Experimental trial, temporary operation, new/proposed limits
 - ❖ Choosing size/design features of a control device to be added
 - ❖ Demonstrate conformance with a manufacturer's guarantee



6



Documenting Compliance Status

- > Pollutants of interest:
 - ❖ Solids: PM/PM₁₀/PM_{2.5}, some metals, condensable PM
 - ❖ Gases: NO/NO₂, NO_x, CO, SO₂, VOC, NMNEHC, THC, some metals, GHG, organic HAP, HCl, NH₃, D/F
- > Types of permit limitations:
 - ❖ Concentration - flow not considered in calculation
 - ❖ Mass - flow is critical to results
 - ❖ Mass/unit production
 - ❖ % reduction - test inlet / outlet simultaneously



7



Quantifying Emissions 1971 versus NOW



8



Preparations for Stack Testing

Keys to Success

- > Testing is a short duration and intense event.
- > Preparation is key to success
 - ❖ **Communication is a key part of Preparation!**
- > What defines success?
 - ❖ On Time
 - ❖ On budget
 - ❖ Quality Data
 - ❖ No surprises
 - ❖ In Compliance!

Why is Preparation Important?

- > Testing is expensive
 - ❖ Time
 - ❖ Money
 - ❖ Production
- > Failed tests can have costly implications
 - ❖ Cost to re-test
 - ❖ Cost in penalties

Initiating a Testing Project

1. Develop Test Plan (not protocol) - *more complicated testing requires a more detailed plan*
 - a) Identify all Test Deadlines, allow time for failed or postponed testing due to process upsets, weather, etc.
 - b) Identify Test Methods - probably in the permit
 - c) Determine Need for Preliminary Engineering Tests
 - d) Determine who needs to be present during the test
 - e) Establish Preliminary Test Schedule

Who Needs to be Involved?

1) Management, 2) Operations and 3) Sales

- > Identify and communicate key operating parameters
 - ❖ Product types and implications on emissions
 - ❖ Production rate
 - ❖ Temperature
 - ❖ Flow rate
 - ❖ Batch time/cycle
- > Review production and sales schedules
 - ❖ Scheduled maintenance
 - ❖ Expected equipment (production or control equipment) construction or modification
 - ❖ Scheduled changes in product type
 - ❖ Expected product demand variations
 - ❖ Is anything else potentially impacted by testing?



13



Initiating a Testing Project

2. Obtain Support Contracts

- a) Develop & Solicit Requests for Quotes for Stack Test Contractors and Test Management Services
- b) Evaluate Proposals and Select Service Providers
- c) Schedule Site Visit(s) for the Testing Team



14



Initial Site Visit

- > Opportunity for test firm to understand site/process logistics
- > Gather protocol info
- > Identify potential show stoppers
 - ❖ Sample location / Sample location access
 - ❖ Equipment lay-down
 - ❖ Electrical
 - ❖ Safety
- > Process operation
- > Key personnel



15



Finalizing the Testing Project

1. Update Test Plan
 - ❖ Communicate key changes to the Testing Team
2. Complete Preparations
 - ❖ Modify stack access, ports, and anything else identified during Site Visit
 - ❖ Verify that equipment, spiking materials and contractors, process sampling equipment/supplies and personnel are scheduled/ordered
3. Update Testing Schedule
 - ❖ Confirm production schedules and staff availability
4. Prepare and Submit Stack Test Protocol
 - ❖ Your support contractors can help

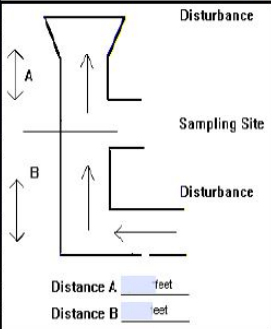


16



COMPLIANCE TEST PROTOCOL
 state Form 55003 (5-12)
 Indiana Department of Environmental Management
 Office of Air Quality, Compliance Data Section
 INSTRUCTIONS: Please complete this form and mail it back to: 100 N Senate Avenue, Mail Code 61-53, IGCN 1003, Indianapolis, IN 46204-2251;
 or fax it to: (317) 233-6865; or e-mail it to: Test_Protocol@idem.IN.gov.



RESET FORM

Date Prepared: _____ Proposed Test Date: _____ Plant Address: _____ Plant Location: _____																												
1. SOURCE INFO: ID/Permit No.: _____ Company: _____ Mail Address: _____ City, State, ZIP: _____ Company Contact: _____ Telephone: _____																												
2. TEST COMPANY INFORMATION Name: _____ Address: _____ City, State, ZIP: _____ Contact: _____ Telephone: _____																												
3. PROCESS INFORMATION (submit a separate form for each unit to test.) Unit to Test: _____ Maximum Rated Capacity: _____ Proposed Operating Speed: _____ 3a. Describe method used to determine operating level: _____ _____ _____ Pollution Control Equipment: _____ 3b. Process Description: Fuel Type: _____																												
4. TEST INFORMATION <table border="1"> <thead> <tr> <th>Method</th> <th>No. Runs</th> <th>Time</th> </tr> </thead> <tbody> <tr><td>Method 1-4</td><td></td><td></td></tr> <tr><td>Method 5</td><td></td><td></td></tr> <tr><td>Method 6</td><td></td><td></td></tr> <tr><td>Method 7</td><td></td><td></td></tr> <tr><td>Method 9</td><td></td><td></td></tr> <tr><td>Method 201/201A</td><td></td><td></td></tr> <tr><td>Method 202</td><td></td><td></td></tr> <tr><td>Other:</td><td></td><td></td></tr> </tbody> </table>		Method	No. Runs	Time	Method 1-4			Method 5			Method 6			Method 7			Method 9			Method 201/201A			Method 202			Other:		
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Method 202																												
Other:																												
5. Check Applicable Program: FESOP: <input type="checkbox"/> SSOA: <input type="checkbox"/> MSOP: <input type="checkbox"/> Other: <input type="checkbox"/> Specify: _____ AGENCY USE ONLY: Title V: <input type="checkbox"/> Inspector: _____ Reviewer: _____ Date Received: _____ Approval Date: _____ Comments: _____																												
6. SAMPLE SITE LOCATION 																												
7. REASON FOR TEST Operating Permit: <input type="radio"/> Yes / <input type="radio"/> No Construction Permit: <input type="radio"/> Yes / <input type="radio"/> No If yes, Unit Start Up Date: _____ State Agreed Order: please include No. _____ Title V: _____ Compliance with 40 CFR: <input type="radio"/> Yes / <input type="radio"/> No Subpart: _____ Other (EPA, CD, State, 114): _____																												
4a. Describe any deviations from standard test method: _____ _____ _____																												
326 IAC 3-6-2(a) requires this completed form to be submitted 35 days prior to the proposed test date to the above address. 326 IAC 2-1.1-7(6)(B) requires any applicable test fee to be submitted with the protocol. (FEE NOT APPLICABLE IF PROGRAM IS FESOP, TITLE V OR VE TESTING ONLY.)																												

Required Agency Notifications

- > *Intent to Test Notification/Protocol*
 - ❖ IDEM - Provide notice to IDEM at least 35 days prior to the testing event; Provide notice to IDEM of the actual test date at least 14 days prior to the testing event [326 IAC 3-6]
 - ❖ NSPS - Provide IDEM/EPA at least 30 days prior notice [40 CFR 60.7(d)] and 30 days prior notice of opacity observations [40 CFR 60.7(a)(6)]
 - ❖ NESHAP - Notify IDEM/EPA at least 60 calendar days before the performance test [40 CFR 63.7(b)(1)]
- > *Notification of delay*
 - ❖ NSPS - Notify as soon as possible of any delay of the test date - at least 7 days notice or by arranging a rescheduled date [40 CFR 60.7(d)]
 - ❖ NESHAP - As soon as practicable and without delay and specify the rescheduled date [40 CFR 63.7(b)(2)]

Watch out for that Consent Decree Language!

Facility Responsibilities During the Test

- > Meetings
 - ❖ Who: Operations, Testing, Spiking and Sampling personnel
 - ❖ What: verify all know what is expected of them
- > Process Monitoring
 - ❖ Ensure production equipment and control equipment are operating at test conditions and stable
 - ❖ Monitor operating parameters during testing for stable operation and compliance with operating parameters
 - ❖ Collect operating data and production sampling as required by protocol. (Data periods must match test run periods!)
- > Safety: Monitor safety of testers, samplers, spikers, etc.
- > Data/Samples
 - ❖ Verify samples comply with preservation and chain of custody requirements and arrive at lab on time.

Keys for Successful Performance Testing

How a Test Happens

1) Prepare, 2) Mobilize, 3) Test, 4) Return, 5) Clean-up

- > Test programs staffing and duration very widely
- > Project Manager or Field Team Leader supervises technicians, runs sample train and deals with client and/or regulatory personnel
- > Travel and set-up at site usually in one day
- > Sample acquisition typically lasts 1-2 days, sometimes up to 10 days or more
- > Test days can run long: 12+ hours
- > Sample teams of 2-3 people are typical. Some teams number 7 or more
- > Technicians run sample trains; multiple samples are run simultaneously



21



Test Day

- > Three test-runs per test parameter
- > Most test runs are one hour. Some tests are 2, 3, 4 or more hours
- > Measure all parameters simultaneously, if possible. Depends on sample location
- > Time between runs to turnaround. Fifteen minutes to one hour depending on methods used.
- > Send testing firm necessary plant data



22



Murphy's Law Stack Testing Version

*"Anything that can go wrong,
will go wrong..."*

especially if you have scheduled a stack testing project."



23



Common Pitfalls

- > Electrical Power Availability
- > Stack Set-up
- > Process Operations
- > Site Safety



24



Electrical Power Availability

Disclaimer: All Mobile Laboratories are not created equal... check with your tester to verify their power requirements.

- > How close is power supply to the mobile laboratory staging location?
- > Is 480 power available? 240 power? 120 power?
- > Can generators be used as an alternative to plant power?
- > Is 120 power available on the stack or in close proximity to the sampling location?



25



Stack Setup & Access

Test ports located a minimum of 0.5 duct diameters (2 diameters is preferred) upstream of the nearest flow disturbance. Stack exit = flow disturbance.

Test ports located a minimum of 2 duct diameters (8 diameters is preferred) downstream of the nearest flow disturbance. Disturbance = contraction, bend, damper, etc.

Note: For rectangular ducts stack equivalent diameter = $(2 \times \text{Depth} \times \text{Width}) / (\text{Depth} + \text{Width})$



26



Process Set Up

- > Operation Parameters
 - ❖ Process Operations
 - ❖ Control Device(s)
 - ❖ Data Collection and Monitoring

Test Site Safety

- > Testing Team Safety
 - ❖ Safe location to conduct testing & access to test ports - ladder, stairs, manlift, elevator, platform, scaffolding
 - ❖ How high are the handrails? Are handrails cut?
- > Bystander Safety
 - ❖ Area below the testing location must be clear
- > Any site specific safety issues?
 - ❖ heat stress, respiratory concerns
 - ❖ Are there and work area conditions to monitor due to plant operations?
 - ◆ hot/cold areas; protrusions; process vents

Test Day Readiness Checklist

- ☑ Has the official test date(s) been scheduled with the regulatory agency?
- ☑ Do the plant personnel know the test date, what to expect and what's expected of them?
- ☑ Is the process ready to go?
- ☑ Is there enough production? 3 one-hour runs = 8 hours
- ☑ Has the pollution control device been checked-out?
- ☑ Are the test ports accessible, open and clean?
- ☑ Is an electrician ready to hook-up the test lab's power?
- ☑ Do you know what/how often production/process/pollution control info has to be documented?
- ☑ Is the plant neat/tidy?
- ☑ Has this checklist been visited far enough ahead of the test to take corrective action?



29



Improving the Odds (1/2)

1. Pre-test site visit
2. Negotiate the best protocol
 - ❖ Protocol should specify the most cost-effective and accurate test methods acceptable to the regulatory agency.
3. Complete a mock compliance test.
 - ❖ Screen emissions to set instrument operating ranges
 - ❖ Reveal potential process/production problems before the official compliance test.
 - ❖ Giving facility personnel a flavor for what to expect during the official compliance test helps ensure a smooth test program.
 - ❖ Generally less costly than official compliance test



30



Improving the Odds (2/2)

4. Shake-down the monitoring and process instrumentation
 - ❖ Ensures proper operation
 - ❖ Ensures process/CEM data availability/quality
5. **Get good laboratory work**
 - ❖ Does the lab need to be certified by or registered with the state?
 - ❖ Bad analytical work or use of an uncertified/unregistered lab threatens the entire project after it's nearly complete!
6. Submit a complete final test report **on-time** to the regulatory agency.

Management of Test Results - Strategy and Submittals

After the Test



- > Test Day Documentation
 - ❖ Any deviations from test methods or Protocol?
 - ❖ Any issues on Test Day?
 - ❖ Provide monitored plant data to Testing Contractor
- > Preliminary Data
 - ❖ When will it be available?
 - ❖ Sufficient time to review?



33



Reviewing the Test Report (1/2)

- > Are the test results in same units as limit/standard?
- > Check example calculations to confirm conversions and calculations
- > How do the results compare to prior testing?
- > Are all assumptions sound and documented? (Ex. 8,760 hours for ton per year limits)
- > Are Agency communications included in an appendix?
- > Does report meet reporting requirements in 326 IAC 3-6-4?



34



Reviewing the Test Report (2/2)

- > Key Points to check:
 - ❖ Data (measured & calculated) consistent across all runs?
 - ❖ Manual methods: ISOs 100±10%
 - ❖ RATAs: run times match CEMS? Dilution vs extraction?
 - ❖ Plant data match what you provided?
 - ❖ Did production rate meet specified level in Protocol?
 - ❖ Noted whether inspector was on-site to observe?
 - ❖ Anomalies or deviations from Protocol documented and approval noted?
 - ❖ Pre & Post equipment calibrations within 60 days? Cylinder gases in-date?
 - ❖ For RATAs, was a Qualified Individual required, and is documentation of credentials included?
 - ❖ Audit samples required and passing?



35



Report Submittal



- > Submit to IDEM Compliance Data Section
 - ❖ One copy to EPA Regional office for NSPS / NESHAP (*IDEM may be delegated for some rules*)
- > IDEM - 45 days as specified in 326 IAC 3-6-4(b)
- > NSPS/NESHAP - 60 days, but refer to specific subparts and General Provisions
- > EPA ERT - 60 days

LET IDEM KNOW IF YOUR REPORT WILL BE LATE!

You only have 40 days to notify if a report will be late.



36



Electronic Reporting Tool (1/3)

- > What is ERT?
 - ❖ Electronic submittal of stack test results
(*specific compliance testing and RATAs*)
- > Purpose of ERT:
 - ❖ Revise emission factors
 - ❖ MACT floor development
 - ❖ Assess control devices, etc.
- > How do I get to the ERT?
 - ❖ <https://www3.epa.gov/ttnchie1/ert/>



37



Electronic Reporting Tool (2/3)

- > Do I need to submit data using the ERT?
 - ❖ Check your subpart for applicability
(*constantly adding more*)
 - ❖ Subcontract to your stack test company or consultant
- > How does it work?
 - ❖ Uses Microsoft Access
 - ❖ Input mass-quantities of data
 - ❖ Upload zip file to CEDRI to be approved by Designated Representative



38



Electronic Reporting Tool (3/3)

- > You can search ERT submittals using WebFIRE
 - ❖ search by state, facility, county, report type, etc.
- > Reviewing your ERT Data
 - ❖ Export data to PDF
 - ❖ Check General Info (page 1)
 - ❖ Check data on Emissions Summary
 - ❖ Verify Completeness & Regulatory Review Questions

Management of Test Results - Next Steps

Possible Next Steps

Failed Test

1. Verify test validity
2. Evaluate process stability/compliance with protocol
3. Compare test results to previous tests and test conditions and analyze variables
4. Follow notification requirements / discuss with legal counsel
5. Schedule meeting with IDEM
6. Schedule re-test

Possible Next Steps

Compliant Test

- > Permit Modification
- > Changes to Operating Parameters and recordkeeping
- > Need to re-test, if operating conditions/limitations established by test restrict operations (*if outside protocol parameters*)

Additional Testing Resources

Technical Resources



- > IDEM Source Testing Website
<http://www.in.gov/idem/airquality/2410.htm>
- > IDEM Compliance Test/RATA Notification Protocol Form
http://www.in.gov/idem/5157.htm#oag_compliance_stack
- > 40 CFR Part 60, Appendix A; Part 63 - Applicable subpart
<http://www.ecfr.gov/cgi-bin/text-idx?SID=ac0a7c178d1c53dec8a6abe091a2f120&node=40:8.0.1.1.1&gn=div5>
- > ERT Link
<https://www3.epa.gov/ttnchie1/ert/>

Questions?

