

**APPENDIX I**  
**PROTOCOL AND CORRESPONDENCE**



## State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

AIR COMPLIANCE & ENFORCEMENT

Mail Code 401-04B

P.O. Box 420

401 E State Street, 4<sup>th</sup> Floor East

Trenton, NJ 08625-0420

Phone # (609) 633-7288 FAX # (609) 292-9938

CHRIS CHRISTIE  
*Governor*

KIM GUADAGNO  
*Lt. Governor*

BOB MARTIN  
*Commissioner*

June 9, 2010

Mr. Peter Haid  
Environmental Director  
Amerada Hess Corporation  
One Hess Plaza  
Woodbridge, New Jersey 07095

RE: Letter of Understanding – Cyanide Compound Emission Testing

Dear Mr. Haid:

Amerada Hess (Hess) developed with the Department a compliance plan to evaluate, among other things, operational characteristics and equipment reliability considerations that may influence cyanide compound emissions from the Fluidized Catalytic Cracking Unit (FCCU). The compliance plan also included an evaluation of implementation of the United States Environmental Protection Agency (EPA)'s draft conditional test methodology for measuring cyanide compound emissions from certain types of industrial processes (Conditional EPA Method 033). While Hess conducts the stack emission test program for cyanide compounds, the Department will use its discretion not cite and/or penalize Hess for any cyanide compound emission exceedances that may occur.

This discretion for cyanide compounds emissions will go through September 30, 2010. Enforcement of all other air emission limits specified in the Title V permit will remain in effect during the testing program.

If you have any questions, please contact me.

Sincerely,

Edward M. Choromanski  
Administrator

C: William O'Sullivan, Director, Division of Air Quality



*State of New Jersey*

DEPARTMENT OF ENVIRONMENTAL PROTECTION

JON S. CORZINE  
Governor

MARK N. MAURIELLO  
Acting Commissioner

June 8, 2009

Mr. Thomas Ruddy  
Senior Environmental Engineer  
Amerada Hess – Port Reading Refinery  
One Hess Plaza  
Woodbridge, NJ 07095

RE: Amerada Hess – Port Reading Refinery  
Stack Emission Test Program – FCCU initial test and Study Conditions 1 and 2.  
APC ID No. 17996  
BOP No. 060006  
TST No. 050002

Dear Mr. Ruddy:

This letter is an update of my May 14, 2007 letter to you wherein this Bureau presented our findings of the referenced stack emission test report, dated September 18, 2006 and prepared by GE Energy.

One of the parameters sampled during that test program was hydrogen cyanide. Testing and analysis were performed using the CARB 426 method. The results were accepted as demonstrating compliance. Recent investigations and review of this method has caused us to reassess that finding. We have come to the conclusion that the CARB 426 method, as currently written and performed at Amerada Hess in July of 2006, greatly biases emissions lower than actual for FCCU stacks because the method's pH criteria is insufficient to ensure capture of all the hydrogen cyanide.

As such, these tests should be repeated using a new protocol. Unless otherwise approved, testing must be performed using EPA CTM-033 following (but not limited to) the suggested methods in Section 4.1 of the method to ensure that the impinger pH remains above 12 during and at the conclusion of sampling. It has been shown that increasing the volume of NaOH per impinger to 500 ml for the first three impingers and increasing the normality of the NaOH solution to 6N should allow you to accomplish this. Additionally, the protocol must include procedures to correct the measured sample volume for the amount of carbon dioxide removed in the impingers.

Should you have any questions regarding our renewed findings, please call me at (609) 530-4041.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael A. Klein". The signature is fluid and cursive, with a long horizontal stroke at the end.

Michael A. Klein  
Section Chief  
Bureau of Technical Services

c. William O'Sullivan  
Edward Choromanski  
John Jenks  
Trish Conti  
Max Friedman

### Modified CTM-033 Guidelines for FCCUs

The following modifications have been shown to work at a refinery FCCU to measure HCN. Additional modifications may or may not be necessary based upon actual site-specific conditions.

- 1) Impinger Train: Four (4) 2-L impingers  
- Impinger 1: GS with 500 ml of 6.0N NaOH  
- Impinger 2: GS with 500 ml of 6.0N NaOH  
- Impinger 3: MGS with 500 ml of 6.0N NaOH  
- Impinger 4: MGS with 300 g silica gel  
*for R4, Imp 4: 500 ml of 6N Imp 5: SG*
- 2) In order to maintain proper isokinetics, the K-factor needs to be adjusted for the difference in flow needed at the nozzle vs. the flow actually seen at the orifice due to the CO<sub>2</sub> removed in the impingers. To accomplish this, the nozzle selection calculation is performed as if no CO<sub>2</sub> was removed in the impingers, and using a nozzle based on this calculation for sampling. The K-factor is then adjusted by artificially reducing the area of the nozzle actually used by the same percentage that the total sample flow is reduced due to the CO<sub>2</sub> removal, determining the corresponding nozzle diameter, and then using this diameter in the K-factor calculation. The  $\Delta H$  at each sampling point during the test is then determined using the  $\Delta p$  reading and this modified K-factor.
- 3) Preliminary measurements are required to determine the percentage that the total sample flow is reduced due to the CO<sub>2</sub> removal and to confirm that it is relatively consistent (see Item 2 above). EPA Method 3A must be used to monitor the outlet of the dry gas meter for both preliminary and actual measurements.
- 4) Sample volume must be corrected for the CO<sub>2</sub> removed in the impingers.
- 5) The pH of each impinger must be checked and all impingers must remain above 12 at all times. The check at the end of the test run must occur before transfer of the contents out of the impingers. If impinger contents must be changed during a run based on in-run pH checks, it will be with 500 ml of 6.0N NaOH.  
*for R4, added 4th impinger so that pH on first impinger could < 12.*
- 6) Impinger 3 must be recovered and analyzed separately from the first two impingers to ensure no breakthrough has occurred. The concentration in Impinger 3 must be  $\leq 5\%$  of that in Impingers 1 and 2. *All impingers were analyzed separately. Only impinger 1 had reportable quantity of HCN.*
- 7) All quality control requirements of Section 9 of Method CTM-033 (field train blanks, reagent blanks, laboratory method blanks and a field spike) are required. ✓
- 8) Samples must be thoroughly mixed, with dissolution of any solids, prior to analysis. Samples are analyzed per the method by ion chromatography. ✓

Mr. Michael Klein  
Bureau of Technical Services  
Department of Environmental Protection  
PO Box 437  
Trenton NJ 08625

June 4, 2010

Re: Amerada Hess Corporation – Port Reading  
Compliance Test Protocol TST No. 100003  
ID No. 17996; BOP No. 090003  
U1 - FCCU/WGS

Dear Mr. Klein:

On March 19, 2010, we received your letter dated March 18, 2010 regarding the above referenced protocol. Your letter provided a review of the protocol and listed items requiring clarification.

The following *items* correspond to your letter. Our response immediately follows each italicized comment. A copy of your March 18, 2010 letter is attached.

*1. Testing must be conducted at worst-case permitted operating conditions with regard to meeting the applicable emission standards, but without creating an unsafe condition.*

Testing will be completed at the maximum safe operating capacity up to the permit-specified maximum throughput of barrels per day (bpd)

*2. Since the oxygen concentration is expected to be approximately only 1%, a different analyzer should be used to perform the instrumental analyzer stratification check listed in Method 7E.*

We propose using the specified paramagnetic oxygen analyzer during all testing, but will calibrate it over a range of 0 – 5% oxygen. Additionally, we propose using carbon dioxide (CO<sub>2</sub>) concentration measurements for the stratification check. The same criteria, although referenced to CO<sub>2</sub> instead of oxygen, as presented in the protocol will be utilized for evaluating stratification.

*3. Some of the references in your descriptions for instrumental analyzers were out-of-date. Bias correction calculations are now found in Method 7E, not Method 6C (see p. 8) and the NO<sub>x</sub> converter check bag method is now §16.2.2 of Method 7E, not §5.6.1 of Method 20 (see p. 10).*

The noted discrepancies are correct. The bias corrections will be completed per RM 7E. If the bag NO<sub>x</sub> converter check is utilized, it will be per §16.2.2 of Method 7E. Note that an NO<sub>2</sub> standard will likely be used for converter efficiency checks per §8.2.4 of RM 7E.

*4. If a fluorescence based analyzer is used for Method 6C, you must use calibration gases consistent with the Technical Manual 1004 Method 6C template "Applicability and Principle" section. These requirements are also listed on the EPA Emission Measurement Center FAQ page for this method.*

We anticipate using an ultraviolet-based principle of analysis via Western Research /Ametek model 921. If a fluorescence-based analytical approach is employed, the noted calibration gas requirements will be met.

*5. The protocol contained conflicting descriptions of the impinger train that would be used for the combined NJATM1 and Method 202 train. The impinger train described for Method 202 must be used.*

As noted, the impinger train for RM 202 will be used.

6. *For CTM-027, the use of an out-of-stack filter is acceptable, but you must follow the Technical Manual 1004 CTM-027 template "Special Situations" section. Rinse volumes for sample recovery will be per the template.*

The probe and filter will be maintained at or above 275°F, which will provide an adequate temperature to eliminate any moisture condensation.

Rinse volumes will be per the template and will be brought to 230 ml for each sample container. Should any one sample fraction exceed 200 ml (impinger 1 possibly due to high moisture catch), the fraction will be transferred to multiple containers and each container will be brought to 230 ml. All containers will be appropriately labeled.

7. *For Method 8, the protocol contained conflicting descriptions of the sample train. For clarity, the filter holder and filter are located between the 1st and 2nd impingers and a filter must be used, not a glass wool plug (see p. 19).*

As noted, a filter holder and filter will be located between impingers 1 and 2. No glass wool plugs will be used.

8. *The Method 18 probe must be heated to prevent condensation. Adsorption tubes must be kept vertical during testing to prevent channeling.*

The Method 18 probe will be heated. Sorbent tubes will be oriented vertically during sampling.

9. *BTS noted that the requirement for nickel renewal tests were TBD based upon the initial tests. BTS further noted that the initial nickel results were an order of magnitude below the de minimus reporting threshold. It is the facility's option to request the removal of the nickel testing requirement from Permitting.*

This issue has been resolved. Nickel testing will not be required.

10. *Method 29 glassware preparation should include a final rinse with acetone. All Method 29 fractions must be analyzed separately. For clarity, all Method 29 protocol references to the impinger between the HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> and KMnO<sub>4</sub> impingers should be Impinger 4 (since there will not be any KMnO<sub>4</sub> impingers). Finally, the following likely typos were noted:*

- *The last sentence on p. 22 should say "0.1 grams" not "015 grams."*
- *Under "Blanks" on p. 23 the third bullet should say "10% H<sub>2</sub>O<sub>2</sub>" not "10% H<sub>2</sub>SO<sub>4</sub>."*

All RM29 glassware will, as part of preparations for use, receive a final rinse with acetone.

The RM 29 front half and back half fractions will be analyzed separately. The front half fraction will consist of the filter and the probe, nozzle, and front filter holder rinses. The back half fraction will consist of impingers 2, 3, and 4 catches and rinses, including rinses of the filter back half and connecting glassware (u-bends).

The impinger train will have five impingers: first empty, second and third with H<sub>2</sub>O<sub>2</sub>/HNO<sub>3</sub>, fourth empty, and fifth with silica gel. The empty fourth impinger will be rinsed and included as part of the impinger catches recovery. As noted, there will be no KMnO<sub>4</sub> impinger used.

You have correctly identified the information as typos. Page 22 should state 0.1 gm; page 23 should state 10% H<sub>2</sub>O<sub>2</sub>.

*11. Please specify the analytical method(s) that will be performed for the metals.*

Both lead and nickel will be analyzed via ICP/MS. The combined (front half value plus back half value) detection limit for lead will approximate 0.5 µg. The combined (front half value plus back half value) detection limit for nickel will approximate 1.2 µg.

*12. Regarding hydrogen cyanide testing, references to the Letter of Understanding (LOU) from Air Compliance and Enforcement are beyond the scope of a protocol approval and have no bearing on the approval of the sampling procedures. Your statements regarding the LOU are noted for informational purposes only. The Permit requires hydrogen cyanide testing prior to renewal.*

Hydrogen Cyanide testing will be completed per the NJDEP-specified method.

*13. The following likely typos were noted (see p. 26) regarding the hydrogen cyanide sampling and were likely remnants from the prior protocol that used CARB Method 426 for hydrogen cyanide sampling:*

- The last bullet under "Sample Recovery" does not belong.
- The last sentence under "Oxidizing Agents" does not belong.

You have correctly identified the information as typos/ remnants of the CARB 426 description. They do not pertain to the hydrogen cyanide sampling methodology for this program.

*14. The hydrogen cyanide samples must be mixed thoroughly, with dissolution of any solids, prior to analysis. The isokinetic criteria will be 90 – 110% with excursions evaluated for the impact on compliance.*

All samples will be thoroughly mixed prior to analysis. It is understood that the isokinetic criteria will be 90-110%.

*15. Regarding Method 15 sampling, it was noted that the claimed COS detection limit was essentially equal to the allowable. The facility is responsible for being able to demonstrate compliance if emissions are below detection. You must be able to show that the system has eliminated CO and CO2 interferences per §4.2 of the method. A filter is required in the train, per §6.1.2 of the method. The citrate scrubber shall be as specified per §6.1.3 of the method and the scrubber solution replaced if sampling exceeds 3 hours. Calibrations will be per §10.2 of the method, with a minimum of three injections per standard. Post-test calibration drift must be determined per §8.3.2 and meet the method criteria. The entire system must be conditioned with sample for 15 minutes prior to beginning analysis.*

The detection limit for the method does roughly approximate the in-stack concentration that results in the allowable emission rate. It is our understanding, however, that Method 15 is the best and most appropriate method for the source and that lower detection limits are not possible. If you are familiar with an alternate acceptable method or know of modifications available for this method that will reduce the detection limit, we are interested in evaluating the approach. This situation was in place during the last test program and RM15 was (presumably) successfully implemented during that program.

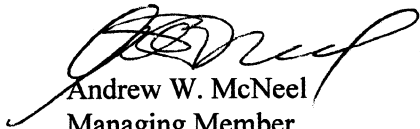


*16. A NJ Certified laboratory must complete all analytical work for all affected methods. For additional details, please refer to NJAC 7-18, "Regulations Governing the Certification of Laboratories and Environmental Measurements" which can be found at [www.nj.gov/dep/oqa/labcert.html](http://www.nj.gov/dep/oqa/labcert.html).*

Laboratory analyses for the sampling program will be completed by Arrow Environmental Consulting, LLC, Enthalpy Analytical, and Maxxam Analytical, all of which are NJ-certified laboratories.

We believe the above responses provide adequate information for the protocol to be approved. Please contact me with any questions or concerns.

Sincerely,



Andrew W. McNeel  
Managing Member,  
Arrow Environmental Consulting, LLC.

cc: Thomas Ruddy Hess



*State of New Jersey*

DEPARTMENT OF ENVIRONMENTAL PROTECTION  
BUREAU OF TECHNICAL SERVICES

P.O. BOX 437

TRENTON, NJ 08625-0437

TEL#: (609) 530-4041 FAX#: (609) 530-4504

CHRIS CHRISTIE

*Governor*

KIM GUADAGNO

*Lt. Governor*

BOB MARTIN

*Acting Commissioner*

March 18, 2010

Mr. Andrew McNeel  
Arrow Environmental Consulting, LLC  
PO Box 3658  
Easton, PA 18043

RE: Amerada Hess Corporation – Port Reading  
Compliance Test Protocol  
ID No. 17996  
BOP No. 090003  
TST No. 100003

Dear Mr. McNeel:

We are in receipt of the sampling and analytical protocol dated February 3, 2010 submitted on behalf of the above referenced facility. In reviewing the proposed procedures, the following item(s) were found to require additional clarification and/or inclusion into the protocol.

1. Testing must be conducted at worst-case permitted operating conditions with regard to meeting the applicable emission standards, but without creating an unsafe condition.
2. Since the oxygen concentration is expected to be approximately only 1%, a different analyzer should be used to perform the instrumental analyzer stratification check listed in Method 7E.
3. Some of the references in your descriptions for instrumental analyzers were out-of-date. Bias correction calculations are now found in Method 7E, not Method 6C (see p. 8) and the NOx converter check bag method is now §16.2.2 of Method 7E, not §5.6.1 of Method 20 (see p. 10).
4. If a fluorescence based analyzer is used for Method 6C, you must use calibration gases consistent with the Technical Manual 1004 Method 6C template "Applicability and Principle" section. These requirements are also listed on the EPA Emission Measurement Center FAQ page for this method.
5. The protocol contained conflicting descriptions of the impinger train that would be used for the combined NJATM1 and Method 202 train. The impinger train described for Method 202 must be used.

6. For CTM-027, the use of an out-of-stack filter is acceptable, but you must follow the Technical Manual 1004 CTM-027 template "Special Situations" section. Rinse volumes for sample recovery will be per the template.
7. For Method 8, the protocol contained conflicting descriptions of the sample train. For clarity, the filter holder and filter are located between the 1<sup>st</sup> and 2<sup>nd</sup> impingers and a filter must be used, not a glass wool plug (see p. 19).
8. The Method 18 probe must be heated to prevent condensation. Adsorption tubes must be kept vertical during testing to prevent channeling.
9. BTS noted that the requirement for nickel renewal tests were TBD based upon the initial tests. BTS further noted that the initial nickel results were an order of magnitude below the de minimus reporting threshold. It is the facility's option to request the removal of the nickel testing requirement from Permitting.
10. Method 29 glassware preparation should include a final rinse with acetone. All Method 29 fractions must be analyzed separately. For clarity, all Method 29 protocol references to the impinger between the HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> and KMNO<sub>4</sub> impingers should be Impinger 4 (since there will not be any KMNO<sub>4</sub> impingers). Finally, the following likely typos were noted:
  - The last sentence on p. 22 should say "0.1 grams" not "015 grams."
  - Under "Blanks" on p. 23 the third bullet should say "10% H<sub>2</sub>O<sub>2</sub>" not "10% H<sub>2</sub>SO<sub>4</sub>."
11. Please specify the analytical method(s) that will be performed for the metals.
12. Regarding hydrogen cyanide testing, references to the Letter of Understanding (LOU) from Air Compliance and Enforcement are beyond the scope of a protocol approval and have no bearing on the approval of the sampling procedures. Your statements regarding the LOU are noted for informational purposes only. The Permit requires hydrogen cyanide testing prior to renewal.
13. The following likely typos were noted (see p. 26) regarding the hydrogen cyanide sampling and were likely remnants from the prior protocol that used CARB Method 426 for hydrogen cyanide sampling:
  - The last bullet under "Sample Recovery" does not belong.
  - The last sentence under "Oxidizing Agents" does not belong.
14. The hydrogen cyanide samples must be mixed thoroughly, with dissolution of any solids, prior to analysis. The isokinetic criteria will be 90 – 110% with excursions evaluated for the impact on compliance.

15. Regarding Method 15 sampling, it was noted that the claimed COS detection limit was essentially equal to the allowable. The facility is responsible for being able to demonstrate compliance if emissions are below detection. You must be able to show that the system has eliminated CO and CO<sub>2</sub> interferences per §4.2 of the method. A filter is required in the train, per §6.1.2 of the method. The citrate scrubber shall be as specified per §6.1.3 of the method and the scrubber solution replaced if sampling exceeds 3 hours. Calibrations will be per §10.2 of the method, with a minimum of three injections per standard. Post-test calibration drift must be determined per §8.3.2 and meet the method criteria. The entire system must be conditioned with sample for 15 minutes prior to beginning analysis.
16. A NJ Certified laboratory must complete all analytical work for all affected methods. For additional details, please refer to NJAC 7-18, "Regulations Governing the Certification of Laboratories and Environmental Measurements" which can be found at [www.nj.gov/dep/oqa/labcert.html](http://www.nj.gov/dep/oqa/labcert.html).

The facility is responsible for providing a safe work area (including safe access to that work area) for Department personnel observing the stack test. Failure to do so will result in termination of the test and will subject the facility to enforcement action for a failure to stack test violation. Furthermore, the facility is responsible for identifying all personal protective equipment (PPE), including but not limited to respiratory protection and fall protection equipment, necessary for Department personnel to observe this test program. Positive pressure sample locations must be identified. This information must be provided in writing prior to or at the time of scheduling the stack test program.

The facility is responsible for ensuring that this office receives a written response within 30 days of the date of this letter. If a response is not received in this time period the facility may be subject to enforcement action.

If you have any further questions, please feel free to contact me at (609) 530-4041.

Sincerely,



Michael A. Klein  
Section Chief  
Bureau of Technical Services

c. Thomas Ruddy – Hess



HESS CORPORATION  
1 Hess Plaza  
Woodbridge, NJ 07095

Thomas Ruddy  
SR. SPECIALIST  
(732) 750-7845/FAX (732) 636-0932  
TRUDDY@hess.com

TJR/10/002  
February 3, 2010  
**Overnight Mail**

Mr. Michael Klein  
NJDEP - BTS  
Air Quality Permitting Program  
380 Scotch Road  
Trenton, NJ 086287

**SUBJECT: Compliance Test Protocols – U1, U4, and U19  
FCCU, Boiler, and H2 Unit Stack Testing  
Program Interest Number 17996  
Permit Activity Number: BOP090002**

Dear Mr. Klein:

Enclosed please find enclosed three emission compliance test protocols for the Hess Corporation Port Reading NJ Refinery. The protocols cover Emission Units U1 – FCCU Wet Gas Scrubber, U4 – Boilers, and U19 – H2 Process Heater. The compliance tests will satisfy requirements in the Title V Operating Permit to perform stack testing prior to the renewal of the permit. The Operating Permit expires on April 15, 2011. The application for renewal is due April 15, 2010.

Once we have received notification of your Department's approval of these protocols, we will contact your office to schedule mutually agreeable test dates. If you have any questions, or require additional information, please call me at (732) 750-7845 or Mr. Andrew McNeel of Arrow Environmental at (610) 597-1770.

Sincerely,

Thomas Ruddy  
Sr. Specialist

Enclosures

Daniel Storchak/BTS  
PR Air File

COMPLIANCE TEST PROTOCOL

FOR THE OUTLET OF  
**U1 WGS/FCCU**  
PORT READING REFINERY  
WOODBIDGE, NEW JERSEY

FACILITY ID 17996  
PERMIT NUMBER: BOP090002

Prepared for  
HESS CORPORATION  
Port Reading Refinery  
1 Hess Plaza  
Woodbridge, NJ 07095  
Attn: Thomas Ruddy

Submitted to  
Chief, Bureau of Technical Services  
Department of Environmental Protection  
PO Box 437  
Trenton, NJ 08625

Prepared by  
Andrew W. McNeel  
Arrow Environmental Consulting, LLC

February 3, 2009

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U1 WGS/FCCU

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## ATTACHMENTS

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| 1 | AIR PERMIT INFORMATION |
| 2 | PORT LOCATIONS         |

## 1.0 INTRODUCTION

In order to comply with the facility's Title V operating permit, Hess Corporation will have an emission test program performed on the U1 Fluid Catalytic Cracking Unit heater at its Port Reading, Woodbridge, New Jersey facility. Hess Corporation currently operates U1 FCCU and will test to comply with the 5-year emissions testing requirement contained within BOP 090002. A copy of the relevant portion of the facility's air permit BOP 090002 is attached.

This protocol document is submitted to address the sampling, operating, and reporting requirements for the U1 FCCU emissions test. In summary, the U1 FCCU will be tested under normal operations at approximately the permitted limit and emissions of particulate (TSP), PM<sub>10</sub>, volatile organic compounds (VOC), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub> as NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), sulfur trioxide and sulfuric acid mist (SO<sub>3</sub>/H<sub>2</sub>SO<sub>4</sub>), ammonia (NH<sub>3</sub>), cyanide compounds (-CN), hydrogen sulfide and carbonyl sulfide (H<sub>2</sub>S/COS), benzene, and multi-metals (Ni, Pb) will be determined.

### 1.1 FACILITY INFORMATION

Hess Corporation  
Port Reading Refinery  
1 Hess Plaza  
Woodbridge, NJ 07095

Contact: Thomas Ruddy  
Phone: (732) 750-7845  
Fax: (732) 636-0932  
Email: [truddy@hess.com](mailto:truddy@hess.com)

### 1.2 CONSULTANT INFORMATION

Andrew W. McNeel  
Managing Member  
Arrow Environmental Consulting, LLC.  
PO Box 3658  
Easton, PA 18043

Phone: (610) 597-1770  
Fax: (610) 258-2470  
E-mail: [andrewmcneel@rcn.com](mailto:andrewmcneel@rcn.com)

### 1.3 PERMIT INFORMATION

Facility ID 17996, Permit BOP 090002  
Facility Designation: U1 FCCU; Emission Point PT1  
A copy of the permit is included as Attachment 1.

### 1.4 PLANT SAFETY AND ENTRANCE REQUIREMENTS

The plant safety policy requires personnel to wear Nomex, safety-toe work shoes, hard hats, and safety glasses. A valid ID, with picture, is required to gain access to the facility. (A driver's license is acceptable.)



## 2.0 PROCESS INFORMATION

The process will be operated between 95% and 100% of the rated feed rate during testing or maximum achievable rate on the day of the testing. Process information and operating parameters consisting of feed rate in barrels per day will be compiled by plant personnel and included in the final test report.

### 2.1 FCCU DESCRIPTION

Hess operates the FCCU for catalytic cracking of heavy to lighter hydrocarbons.

### 2.2 PROCESS DATA

During the emissions test program, process data will be recorded at 10-minute intervals. Process data collection will begin at the start and conclude at the end of each test run. At a minimum, the following data will be collected: feed rate to the FCCU in BBL/Day (barrels per day), sulfur content, and carbon residue.

### 3.0 SAMPLING LOCATIONS

The test ports for the FCCU exhaust are accessible from a ladder and a platform permanently attached to the wet gas scrubber (WGS) stack.

#### 3.1 U1 FCCU/WGS

A schematic of the sampling location for the FCCU/WGS is in Attachment 2. All measurements will be field-verified. A description of the sampling locations follows:

Test ports are approximately 108 feet above grade. Emissions measurement will take place in the vertically oriented circular flue, having an inside diameter of 91 inches. The coplanar test ports (2) are separated by 90° and are located at least 182 inches downstream (U.S. EPA Distance "B"  $\geq$  2.0 duct diameters) and at least 46 inches upstream (U.S. EPA Distance "A"  $\geq$  0.5 duct diameters) of flow disturbances.

During all PM<sub>10</sub> testing, a total of twelve traverse points (six points/port) will be utilized.

During all isokinetic testing (including particulate, sulfur trioxide and sulfuric acid mist, ammonia, cyanide compounds, and multiple metals), a total of twenty-four traverse points (twelve points/port) will be utilized.

During any non-isokinetic traverses for flowrates, a minimum of sixteen traverse points (eight points/port) will be utilized.

Note that the minimum number of traverse points may be changed (per USEPA RM1) if EPA distances A and B are such that a lesser or greater number of traverse points are required.

#### 3.2 STRATIFICATION TRAVERSES

RM 7E section 8.1.2 will be used to determine stratification. A three (3) point gaseous stratification test will be performed prior to the commencement of compliance testing. The traverse points will be spaced at 16.7, 50.0, and 83.3 percent of the measurement line. Oxygen concentrations will be used to evaluate the presence of stratification.

If stratification is not present ( $\leq 5\%$  of mean or  $\leq 0.3\%$  O<sub>2</sub> difference) then a single point sample that most closely represents the mean of the 3-point traverse will be used. If the source is minimally stratified ( $> 5\%$  or  $> 0.3\%$  O<sub>2</sub> and  $< 10\%$  or  $0.5\%$  O<sub>2</sub> difference), then 3-point sampling will be performed. If the source is stratified ( $> 10\%$  or  $> 0.5\%$  O<sub>2</sub> difference), then twelve (12) point sampling will be performed, six (6) points per port. Sample points will be located per Table 1-1 or Table 1-2 of RM 1.

### 4.0 TEST METHODS, DURATIONS, AND DETECTION LIMITS

The parameters and methods used for this proposed emission test program are specified in Table 1 on the following page. All proposed test methods will conform to 40 CFR 60, Appendix A test procedures or those of the NJDEP and U.S. EPA. Test conditions, parameters, ranges, and estimated detection limits for FCCU/WGS test condition are outlined in Table 2.

**TABLE 1: UI TEST METHODOLOGIES**

| PARAMETER   | METHOD  |
|---|---|
| Flow rates  | U.S. EPA Method 1, "Sample and Velocity Traverses for Stationary Sources"   |
|   | U.S. EPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)"   |
| Moisture  | U.S. EPA Reference Method 4, "Determination of Moisture Content in Stack Gas"   |
| Multiple Metals (Pb and Ni)                           | U.S. EPA Reference Method 29, "Determination of Metals Emissions From Stationary Sources"   |
| Particulate/PM <sub>10</sub>                          | New Jersey Air Test Method 1, "Sampling and Analytical Procedures for Determining Emissions of Particles From Manufacturing Processes and from Combustion of Fuels" and U.S. EPA Method 202, "Determination of Condensable Particulate Emissions From Stationary Sources" (Combined sample train) |
| Oxygen and Carbon Dioxide                             | U.S. EPA Reference Method 3A, "Determination of Oxygen and Carbon Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"  |
| Volatile Organic Compounds (VOC)                      | U.S. EPA Reference Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" and US EPA RM 18 for methane, if required.  |
| Carbon Monoxide (CO)                                  | U.S. EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"  |
| Nitrogen Oxides (NO <sub>x</sub> as NO <sub>2</sub> ) | U.S. EPA Reference Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)"  |
| Sulfur Dioxide (SO <sub>2</sub> )                     | U.S. EPA Reference Method 6C, "Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"   |
| Sulfur Trioxide and Sulfuric Acid Mist                | U.S. EPA Reference Method 8, "Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources"   |
| Ammonia   | Conditional Test Method (CTM)-027, "Procedure for Collection and Analysis of Ammonia in Stationary Sources"   |
| Cyanide Compounds                                     | Modified Conditional Test Method (CTM)-033, "Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources"  |
| Benzene   | U.S. EPA Reference Method 18, "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography"   |
| Hydrogen Sulfide and Carbonyl Sulfide                 | U.S. EPA Reference Method 15, "Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources"   |

**Table 2: Summary of Ranges, Durations, Volumes, and Detection Limits for U1 FCCU Testing**

| Parameter                                       | Range <sup>1</sup> | Source <sup>2</sup><br>Volumetric<br>Flow (dscfm) | Sample Rate<br>or Total<br>Volume | Test<br>Duration<br>(hours) | Number<br>of Test<br>Runs | Detection Limits           |                      | Allowable                                   |
|---|--------------------|---|-----------------------------------|-----------------------------|---------------------------|----------------------------|----------------------|---|
|   |                    |   |                                   |                             |                           | method                     | emissions<br>(lb/hr) |   |
| OS1- FCCU - 70,000 Barrels/Day Production Rate  |                    |   |                                   |                             |                           |                            |                      |   |
| NO <sub>x</sub>                                 | 0 - 450<br>ppm     | 127,000   | 20 lpm                            | 1.0                         | 3                         | 1<br>ppm                   | 0.9060               | 150 lb/hr<br>150 ppmvd @ 0% O <sub>2</sub>  |
| CO  | 0 - 500<br>ppm     | 127,000   | 20 lpm                            | 1.0                         | 3                         | 1<br>ppm                   | 0.5514               | 160 lb/hr<br>300 ppmvd @ 0% O <sub>2</sub>  |
| VOC   | 0 - 500<br>ppm     | 127,000   | 20 lpm                            | 1.0                         | 3                         | 1<br>ppm                   | 0.3151               | 61.1 lb/hr<br>234 ppmvd @ 0% O <sub>2</sub> |
| SO <sub>2</sub>                                 | 0 - 200<br>ppm     | 127,000   | 20 lpm                            | 1.0                         | 3                         | 1<br>ppm                   | 1.2602               | 80 lb/hr<br>141 ppmvd @ 0% O <sub>2</sub>   |
| Pb  | N/A                | 127,000   | 40<br>dscf                        | 1.3                         | 3                         | 0.5<br>ug                  | 0.0002               | 0.043 lb/hr                                 |
| Ni  | N/A                | 127,000   | 40<br>dscf                        | 1.3                         | 3                         | 1.25<br>ug                 | 0.0005               | TBD <sup>3</sup>                            |
| SO <sub>3</sub> /H <sub>2</sub> SO <sub>4</sub> | N/A                | 127,000   | 30<br>dscf                        | 1.0                         | 3                         | 0.01<br>mg SO <sub>3</sub> | 0.0056               | 12.86 lb/hr                                 |
| NH <sub>3</sub>                                 | N/A                | 127,000   | 30<br>dscf                        | 1.0                         | 3                         | 0.0001<br>gram             | 0.0560               | 13.86 lb/hr                                 |
| Cyanide   | N/A                | 127,000   | 30<br>dscf                        | 1.0                         | 3                         | 40<br>ug                   | 0.0224               | 7.8 lb/hr                                   |
| H <sub>2</sub> S                                | N/A                | 127,000   | 20 lpm                            | 1.0                         | 3                         | 0.16<br>ppm                | 0.1074               | 2 lb/hr                                     |
| COS   | N/A                | 127,000   | 20 lpm                            | 1.0                         | 3                         | 0.16<br>ppm                | 0.1893               | 0.2 lb/hr                                   |
| Benzene   | N/A                | 127,000   | 0.8 lpm                           | 1.0                         | 3                         | 0.1<br>ppm                 | 0.1538               | 0.56 lb/hr                                  |
| PM <sub>10</sub>                                | N/A                | 127,000   | ~ 30 dscf<br>~ 0.5 cfm            | ~ 1.5                       | 3                         | 0.002<br>gram              | 1.1199               | 36 lb/hr                                    |
| TSP   | N/A                | 127,000   | 40<br>dscf                        | 1.3                         | 3                         | 0.001<br>gram              | 0.4200               | 22 lb/hr<br>0.02 gr/scf                     |
| H <sub>2</sub> O                                | N/A                | 127,000   | 30<br>dscf                        | 1.0                         | 3                         | 1<br>gram                  | N/A                  | N/A   |
| CO <sub>2</sub>                                 | 0 - 22<br>%        | 127,000   | 20 lpm                            | 1.0                         | 3                         | 0.1<br>%                   | N/A                  | N/A   |
| O <sub>2</sub>                                  | 0 - 22<br>%        | 127,000   | 20 lpm                            | 1.0                         | 3                         | 0.1<br>%                   | N/A                  | N/A   |

<sup>1</sup> Ranges for NO<sub>x</sub>, CO, CO<sub>2</sub>, and O<sub>2</sub> are proximate. Actual ranges will be defined as equal to the upscale calibration standard.

<sup>2</sup> Estimated flowrates are based upon experience with similar sources.

<sup>3</sup> To be determined.

## 5.0 SAMPLING PROCEDURES

Emissions will be sampled using the methods and procedures outlined in the following sections. In addition to those procedures, the information immediately below will be used for sampling and calculating emissions:

- Location of the sampling points within the stack per USEPA reference method (RM) 1.
- Verification of the absence of cyclonic flow per USEPA RM1.
- Moisture content of flue gas by gravimetric analysis using USEPA RM 4.
- Measurement of volumetric flow rate using USEPA RM 1, 2, 3A, and 4.

### 5.1 REAL-TIME MONITORING SYSTEM

The real-time monitoring system will be used to sample NO<sub>x</sub>, CO, VOC (THC), and O<sub>2</sub> concentrations. All monitors conform to the design and performance criteria outlined in 40 CFR 60 Appendix A. The sampling interface system (SIS) consists of the following components:

- Stainless steel probe;
- Particulate filter, if needed;
- Stainless steel calibration overflow assembly;
- Heated Teflon sampling line;
- High-volume (20 lpm) Teflon-lined sample pump;
- Calibration gas line;
- Chiller for moisture removal.

The SIS allows for transporting filtered stack gases to the individual instruments while maintaining the temperature well above the dew point of the gases. All instrument output signals are recorded by a data logger and/or on a computer-based data acquisition system at a minimum collection interval of 30 seconds.

Prior to initiating the stack test, the real-time monitoring system is calibrated. **Excluding method 25A**, the calibration process may be summarized as consisting of two basic procedures- a calibration-error test and the sampling system bias check.

The analyzer calibration-error (rack calibration) test is performed to establish the linearity and accuracy of the reference method analyzer(s). A total of three standards for each parameter will be used to perform the rack calibration: zero, a mid-range (40-60 percent), and a high-range standard (100 percent). Based upon the revised RM 7E, the operating range of the analyzer is now defined as being equal to the high-level calibration gas.

The zero standard is introduced to the analyzer, (not to the probe) and any necessary adjustments are made, and the zero potentiometer is then locked in place. The high-range standard is introduced next. Any necessary adjustments are made and the span potentiometer is locked in place. The final recorded values for the zero and high-range responses must be within 2% of the selected span from zero and the high-range value. The analyzer is now calibrated. No further adjustments will be made during the test program.

The mid-range standard is introduced, and if required, the low-range standard is introduced. If the response of the analyzer to either the low or mid standard deviates from the reference value of the respective standard by more than 2 percent of the span, the analyzer is not acceptable. The problem is addressed and corrected, and the rack calibration procedure is re-initiated.

Once the analyzer calibration-error check has been successfully completed, the sampling system bias check (stack calibration) is performed. First, the zero standard is introduced to the entire sampling system at the junction of the probe and the heated sample line.

Then the appropriate upscale standard (either low-, mid- or high-range) is introduced to the entire sampling system. If the response to either the zero or upscale standard deviates by more than 5 percent of the span from the response recorded for the respective analyzer calibration error test, the sampling system is unacceptable. The problem is addressed and corrected, and the sampling system bias check is repeated.

**For reference method 25A**, the calibration error test is completed through the entire sampling system, eliminating the sampling system bias test. The zero standard is introduced to the sampling system and a zero reading is obtained. The zero potentiometer is then locked in place. The high-range standard is introduced next. Any necessary adjustments are made and the span potentiometer is locked in place. The final recorded value for the high-range response must be within 5% of the high-range standard's value. The analyzer is now calibrated. No further adjustments will be made during the test program.

The mid-range standard is introduced and the low-range standard is introduced. If the response of the analyzer to either the low or mid standard deviates from the reference value of the respective standard by more than 5 percent of the respective gas value, the analyzer is not acceptable. The problem is addressed and corrected, and the calibration-error procedure is re-initiated.

At the completion of each run, drift checks will be completed in the same manner as the initial bias checks. The tolerance for acceptable drift is that the zero and upscale responses must not deviate by more than 3 percent of the range (as defined by the high range standard) from the response recorded for the respective analyzer bias test.

Following are the criteria, as outlined in 40 CFR 60, Appendix A that will be applied for evaluating the validity of system responses.

**Analyzer Range or Span:** Defined as equal to the high-range calibration standard. (All except RM 25A.)

**Analyzer Calibration Error:**  $\pm 2\%$  of the instrument span for zero, mid-range, and high-range calibration gases. (All except RM 25A.)

**RM 25A Analyzer Calibration Error:**  $\pm 5\%$  of the calibration gas value for zero, low-range, mid-range, and high-range calibration gas challenges completed through the entire sampling system.

**Sampling System Bias:**  $\pm 5\%$  of the instrument span relative to the recorded response during the analyzer calibration-error test for the zero and an upscale calibration gas. (Not applicable to RM 25A.)

**Zero Drift:**  $\pm 3\%$  of the instrument span relative to the respective system bias response over the period of each run. (All methods)

**Calibration Drift:**  $\pm 3\%$  of the instrument span relative to the respective system bias response over the period of each run. (All methods)

**Drift Correction:** the average of each parameter over each test run will be corrected for drift based upon the responses recorded for bias and the successive calibration drift checks, as per RM 6C. (All methods)

## 5.2 CARBON MONOXIDE

**SUMMARY:** Carbon monoxide emissions will be determined in accordance with U.S. EPA Method 10 and the recently revised RM 7E. A continuous gas sample is extracted from the stack and analyzed for carbon monoxide using non-dispersive infrared (NDIR) absorptiometry.

**CALIBRATION GASES:** Instruments will be calibrated with known concentrations of CO in nitrogen (N<sub>2</sub>) certified to a tolerance of  $\pm 2\%$ . Zero, mid- and high-range calibration gases (0%, 40-60%, and 100% of range) will be used.

**RANGE, SAMPLING RATE, AND DETECTION LIMIT:** The analyzer will be operated at the range as specified in Table 2. For each test, the analyzer will process approximately 1 liter of stack gas per minute. Using the NDIR analyzer on the specified range, the detection limit is 1 ppm.

**SAMPLE TRAIN OPERATION:** A representative exhaust gas sample is extracted from the emission source through a stainless steel probe, heated Teflon sample line and passed through a chilled condenser (glass, Teflon, and/or stainless steel) for moisture removal prior to being introduced to the instrument for immediate analysis.

As the sample enters the analyzer, it is passed through a measurement cell. While the sample is in the cell, an infrared (IR) source located at the focal point of a concave mirror shines a beam through the measurement cell and through a parallel reference cell. A chopper disc rotates to send the IR beams alternately through the sample to the reference and measurement cells.

The radiant beams, after passing through the two cells, are reflected by a second mirror onto two photo detectors with spectral filters. The detectors convert optical energy from the radiant beams into electrical signals.

The signals from the reference cell are compared to the signals of the sample cell. Any absorption of the IR beam in the sample cell by CO in the sample causes a proportional difference in the signals from the sample and the reference cell beams. The difference is converted electronically into an output signal that is linearly proportional to the concentration in the sample.



### 5.3 NITROGEN OXIDES

**SUMMARY:** Nitrogen oxides ( $\text{NO}_x$  as  $\text{NO}_2$ ) emissions will be determined in accordance with U.S. EPA Method 7E. A continuous gas sample is extracted from the source and is analyzed for  $\text{NO}_x$  using a chemiluminescent analyzer.

**CALIBRATION GASES:** Instruments will be calibrated with known concentrations of NO in nitrogen ( $\text{N}_2$ ) certified to a tolerance of  $\pm 2\%$ . Pre-purified  $\text{N}_2$  for zero and two additional concentrations corresponding to approximately 40-60% and 100% of span will be used.

**RANGE, SAMPLING RATE, AND DETECTION LIMIT:** The analyzer will be operated at the range as specified in Table 2. For each test, the analyzer will process approximately 1 liter of stack gas per minute. Using the chemiluminescent analyzer on the specified range, the detection limit is 1 ppm.

**SAMPLE SYSTEM OPERATION:** A representative exhaust gas sample is extracted from the emission source through a stainless steel probe and heated Teflon sample line and passed through a chilled condenser for moisture removal prior to being introduced to the instrument for immediate analysis.

**$\text{NO}_2$  CONVERTER CHECK:** An  $\text{NO}_2$  to NO converter check will be completed prior to testing. The converter check may be completed as outlined in RM 20, section 5.6.1 (bag procedure) or via section 8.2.4 of the recently revised RM 7E ( $\text{NO}_2$  standard procedure). Successful conversion is not less than 2% for the bag procedure or not less than 90% for the  $\text{NO}_2$  standard-based tests. At a minimum, a successful CE check will be completed following each day of testing.

The principle of the analyzer is the following reaction:  $\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2 + \text{hv}$   
The intensity of the chemiluminescent (hv) is proportional to the concentration of NO present.

The hv is measured by a photomultiplier tube and is directly proportional to NO concentration. Therefore, the measured value for hv is recorded as the concentration for NO.  $\text{NO}_x$  comprises NO and  $\text{NO}_2$ . Any  $\text{NO}_2$  present in the sample gas is converted into NO prior to entering the measurement cavity by a  $\text{NO}_2$  to NO converter.

## 5.4 VOLATILE ORGANIC COMPOUNDS

**SUMMARY:** The volatile organic compounds (VOC) test requirement will be fulfilled by measuring total hydrocarbons as methane (THC as CH<sub>4</sub>) via USEPA Reference Method 25A (RM 25A) and, if necessary, methane using USEPA RM 18. A continuous gas sample is extracted from a sampling point and analyzed for THC (as methane) using a flame ionization detector (FID). Simultaneously, methane is analyzed using USEPA Method 18 via an online gas chromatograph.

Note that based upon experience with these and similar sources, it is anticipated that the RM 18 methane measurements will not be necessary and that compliance will be demonstrated via the RM 25A results. If RM 25A data show compliance with the VOC allowable, then the RM 18 methane measurements may not be performed.

**CALIBRATION:** The calibration gases for the RM 25A FID (Signal Model 3000) and the GC-based CH<sub>4</sub> FID (ThermoEnvironmental 55C) analyzers will be EPA Protocol standards, if available, or certified master standards of methane for instrument span and high purity air for zero. Low-, mid- and high-range calibration gases (20-30%, 50-60%, 80-90%, respectively) will be used.

The instruments are checked for drift following each test with high-purity air for zero and one additional upscale concentration to establish that there is no excessive drift or any malfunction.

For the GC-based methane analyzer, calibrations will be completed such that a minimum of three stable and distinct responses are recorded for each zero and methane gas introduced to the system during calibrations and drift checks. The CH<sub>4</sub> GC data are processed automatically and are recorded as ppm concentrations – chromatograms are not generated as part of data collection.

**SAMPLE VOLUMES AND DETECTION LIMITS:** For each test, the RM25A FID operates at approximately 2 liters per minute. Using an FID analyzer, the analytical method detection limit for THC (as methane) is 1 ppmv. The RM 18 GC-based analyzer uses approximately 2 lpm and also has a detection limit of 1 ppm.

**OPERATING RANGE:** The THC and CH<sub>4</sub> analyzers will be operated at the range as specified in Table 2. If the THC and/or CH<sub>4</sub> concentrations exceed the specified range, an appropriate higher range will be selected.

**SAMPLE SYSTEM OPERATION:** A representative exhaust gas sample is extracted from the emission source through a stainless steel probe, heated Teflon sample line and heated pre-filter prior to being introduced to the instruments for immediate analysis. The RM25A FID provides a continuously updating response to the stack gas. The GC-based methane analyzer obtains a reading roughly every 80 seconds (due to the nature of the GC injection cycles and separation column).

The FIDs uses well-controlled flames to combust the hydrocarbons within the gas stream. Burner oven temperature is fixed at 190 degrees Celsius.

Hydrocarbons are ionized by the flame, and the detector (typically a thin, platinum wire) measures this ionization energy of the carbon-hydrogen bonds that are broken. The methane analyzer uses the same FID analytical technique. A proprietary column specifically engineered to provide distinct separation of methane from other hydrocarbons is used to enable the FID to respond only to the methane in the stack gas.

The FID detector's response is directly related to the number of carbon atoms contained in each organic molecule of the sample. Output from the detector is electronically converted into a concentration based on the compound (methane) used to calibrate the FID.

## 5.5 SULFUR DIOXIDE

**SUMMARY:** Emissions of sulfur dioxide will be determined using USEPA Method 6C and the recently revised RM 7E. A continuous gas sample is extracted and analyzed for SO<sub>2</sub> using an ultraviolet (UV), non-dispersive infrared (NDIR), or fluorescence analyzer.

**CALIBRATION GASES:** Instruments will be calibrated with known concentrations of SO<sub>2</sub> in nitrogen (N<sub>2</sub>) certified to a tolerance of  $\pm 2\%$ . Pre-purified N<sub>2</sub> for zero and two additional concentrations corresponding to approximately 40-60%, and 100% of span will be used.

**RANGE, SAMPLING RATE, AND DETECTION LIMIT:** The analyzer will be operated at the range as specified in Table 2. For each test, the analyzer will process approximately 1 liter of stack gas per minute. The detection limit is 1 ppm.

**SAMPLE SYSTEM OPERATION:** A representative exhaust gas sample is extracted from the emission source through a stainless steel probe and heated Teflon sample line and passed through a chilled condenser for moisture removal prior to being introduced to the instrument for immediate analysis.

The NDUV analyzer operates based on absorption of electromagnetic radiation. Sample gas passes through a chamber that ultraviolet radiation also passes through.

The ultraviolet radiation is split into two paths prior to entering the chamber allowing the intensity of the two paths to be measured. One path of radiation enters the sample chamber while the other does not.

The intensities of both paths of radiation are detected by an optical detector. The transmittances are linearly related to the concentration of sample gas being measured. The detector's output is changed to a digital output indicating concentration.

## 5.6 PARTICULATE

**SUMMARY:** Stack gas will be sampled isokinetically for total suspended particulate (TSP) emissions in accordance with New Jersey Air Test Method 1, Sampling and Analytical Procedures for Determining Emissions of Particles from Manufacturing Processes and from Combustion of Fuels.

Key sample train components will include:

- A sized, tapered-edge, stainless steel "button-hook" sample nozzle;
- A stainless steel sample probe with a heated glass liner, S-type pitot tube, and thermocouple;
- A heated glass filter holder with a tared glass fiber filter supported by a Teflon or glass frit;
- A condenser system consisting of modified Greenburg-Smith glass impingers and connecting pieces;
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers;
- A thermowell at the probe outlet and at the filter outlet to monitor sample gas stream temperature.

**PREPARATIONS:** Sampling glassware and sample containers will be cleaned prior to sampling in the following sequence:

- Soap and water wash and rinse;
- Triplicate rinse with distilled, de-ionized water (nozzle, probe, front-half of filter holder, and sample containers);
- Acetone rinse (nozzle, probe, front-half of filter holder, and sample containers).

The condenser system will consist of four impingers. All impingers, except impinger #2, will be Greenburg-Smith, modified with an unrestricted opening and no impactor plate. Impinger #2 will be standard Greenburg-Smith with the impactor plate. All impingers will be weighed prior to sampling to the nearest 0.1 gram. Each impinger will be charged for sampling as follows:

- Impinger 1 & 2, approximately 100 ml water each;
- Impinger 3, empty;
- Impinger 4, approximately 300 gm silica gel.

**SAMPLING:** Completion of each test run will include the following key procedures:

A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.020 cfm will be achieved prior to run commencement. Each sample point will be sampled for an equal duration.

The sample probe will be heated enough to prevent internal moisture condensation, but the probe exit temperature will not exceed 225°F as measured with the thermowell.

The filter holder will be heated enough to prevent internal moisture condensation, but the filter holder exit temperature will not exceed 225° F as measured with the thermowell.

Ice will be maintained in the impinger cooling bath. The gas temperature at the exit of the last impinger will not exceed 68°F.

All necessary temperature and sample rate adjustments (to maintain isokinetic sampling) will be made as required and recorded at each sample point.

A post-test leak check will be performed on the entire sample train at a vacuum approximating the highest vacuum achieved during the test run. If the leak rate is greater than 0.020 cfm, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the NJDEP-BTS).

**SAMPLE RECOVERY:** Sample recovery may be performed entirely in the field or entirely at Arrow's office. Typically, probe and nozzle recovery is performed in the field. The samples will be recovered as follows:

- Each impinger will be weighed to 0.1 gm;
- The particulate filter and loose particulate will be transferred (with plastic tweezers) to a plastic petri dish;
- The probe, nozzle, and front-half of the filter holder will be rinsed and brushed three times with acetone into a cleaned glass bottle.

**SAMPLE ANALYSIS:** Sample analysis will be performed in accordance with NJ Method 1. Filters will be dried at a temperature not to exceed the maximum filter exit temperature observed during testing and then desiccated at ambient temperature and pressure to a constant ( $\pm 0.0005$  gm) weight.

After measuring the quantity of acetone, the contents of each rinse sample bottle will be transferred to separate dry and tared Teflon baggie-type beaker. After evaporating the acetone at a temperature not to exceed 130°F, each beaker will be desiccated and reweighed to a constant weight.

**METHOD DETECTION LIMIT:** The analytical detection limit (DL) for each fraction is 0.0002 grams. Two fractions are obtained for each run (the filter and the probe/nozzle/filter holder acetone rinse), resulting in a net method DL of 0.0004 grams. Note that this DL does not consider the tolerance (0.0005 gm) for achieving the final weight for each fraction. An overall DL for this method may be presented as 0.001 gm.

## 5.7 PM-10 (Condensable Fraction only)

**SUMMARY:** Stack gas will be sampled for PM-10 emissions in accordance USEPA Method 202, Determination of Condensable Particulate Emissions from Stationary Sources

Due to an anticipated stack moisture content of ~20% USEPA Method 201A which requires an in-stack cyclone to collect filterable particulate matter < 10 microns will not be used. Instead, it is proposed to analyze the back half (impinger catch) of the NJATM 1 sample train to get the condensable particulate fraction. The front half results of the NJATM 1 train will be added together with the back half results to report a total PM<sub>10</sub> emission.

Recovered samples for condensable particulate matter will be analyzed gravimetrically for particulate in accordance with Method 5 and Method 202.

Key sample train components will include:

- A stainless steel sample probe with a heated glass liner, S-type pitot tube, and thermocouple;
- A condenser system consisting of Greenburg-Smith glass impingers and connecting pieces;
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample-rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers.

**PREPARATIONS:** The probe liner and condenser system will be cleaned with soap and water. The condenser system will also be rinsed with water, DI water, methylene chloride, and again with DI water.

The condenser will consist of Greenburg-Smith impingers, interconnected with glass U-bends. Reagent charging and stem configurations will be as follows:

- Impinger 1, impactor tip with 100 ml distilled water;
- Impinger 2, impactor tip with 100 ml distilled water;
- Impinger 3, unrestricted tip, 100 ml distilled water;
- Impinger 4, unrestricted tip, silica gel.

All impingers will be weighed to within 0.1 grams prior to sampling.

**SAMPLING:** Completion of each test run will include the following key procedures:

- A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.02 CFM will be achieved prior to run commencement;
- Probe heat will be maintained to prevent internal moisture condensation. Ice will be maintained in the impinger ice bath;

#### Sampling (continued)

- A post-test leak check will be performed on the entire sample train at a vacuum approximating the highest vacuum achieved during the test run. If the leak rate is greater than 0.02 CFM, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the administrator);
- All necessary data for each sample point and test run will be recorded on appropriate data forms.

**SAMPLE RECOVERY:** Sample recovery will be performed in the field in a suitable area, protected from wind.

- The pH of the impinger solution will be checked immediately after each test run. If the pH is found to be less than 4.5, the impinger train will be purged for 1 hour with nitrogen (N<sub>2</sub>), to remove dissolved sulfur dioxide;
- Each impinger will be weighed to 0.1 gm;
- The impinger catch and a distilled water rinse of the impinger train and filter-holder back-half will be collected in clean amber glass bottle (container 3);
- A methylene chloride rinse of the impinger train and filter-holder back-half will be collected in an amber glass jar (container 4).

Blanks will be recovered as follows:

- Volumes of distilled water and methylene chloride similar to those used for stack samples will each be placed in a separate amber glass bottle.

**SAMPLE ANALYSIS:** Container 3 and container 4 contents will be transferred to a separatory funnel and thoroughly mixed. The organic layer will be drained into a clean, tared teflon beaker. The methylene chloride extraction will be repeated twice more with 75 ml portions of methylene chloride. The organic layer from all three extractions will be collected in one teflon beaker. After evaporating the beaker contents, the beaker will be dried and desiccated to a constant weight.

The remaining separatory funnel contents will be collected in a tared teflon beaker and analyzed in the same manner as the methylene chloride extraction.

## 5.8 AMMONIA

SUMMARY: Stack gas will be sampled isokinetically for ammonia emissions in accordance with CTM 027, Procedure for Collection and Analysis of Ammonia in Stationary Sources, modified to reflect low particulate loadings.

CTM-027 was developed and validated on a coal-fired boiler. For that source, an in-stack filter assembly was selected to eliminate particulate from entering the majority of the sampling train and to avoid the use of a heated filter holder.

For this source (FCCU), it is proposed that the CTM-027 sampling train be modified to use a traditional RM 5 configuration. The main reason for this requested modification is that the moisture content of the stack are relatively high (~ 18%), resulting in a potential to saturate the instack filter and create a situation where the appropriate vacuum can not be pulled to maintain isokinetic sampling.

Key sample train components will include:

- A sized, tapered-edge, glass "button-hook" sample nozzle.
- A stainless steel sample probe with a heated glass liner, S-type pitot tube, and thermocouple.
- A heated glass filter holder with a glass fiber filter supported by a Teflon or glass frit.
- A condenser system consisting of Greenburg-Smith glass impingers and connecting pieces.
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers.
- A thermowell at the probe outlet and at the filter outlet to monitor sample gas stream temperature.

PREPARATIONS: Sampling glassware and sample containers will be cleaned prior to sampling in the following sequence:

- Soap and water wash and rinse.
- Triplicate rinse with distilled, de-ionized water (all sampling glassware, and sample containers).
- 0.1 H<sub>2</sub>SO<sub>4</sub> rinse (all sampling glassware, and sample containers).

The condenser system will consist of five impingers. All impingers will be weighed prior to sampling to the nearest 0.1 gram. Each impinger will be charged for sampling as follows:

- Impinger 1, 2, & 3 GS with plate, approximately 100 ml 0.1 N H<sub>2</sub>SO<sub>4</sub> each
- Impinger 4 no impactor, empty
- Impinger 5, approximately 300 gm silica gel.



**SAMPLING:** Completion of each test run will include the following key procedures:

A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.020 cfm will be achieved prior to run commencement. Each sample point will be sampled for an equal duration.

The filter holder hot box will be heated to a minimum of 250° F, as measured with a thermocouple.

Ice will be maintained in the impinger cooling bath. The gas temperature at the exit of the last impinger will not exceed 68°F.

All necessary temperature and sample rate adjustments (to maintain isokinetic sampling) will be made as required and recorded at each sample point.

A post-test leak check will be performed on the entire sample train at a vacuum equal to or greater than the highest vacuum achieved during the test run. If the leak rate is greater than 0.020 cfm, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the NJDEP-BTS).

**SAMPLE RECOVERY:** Sample recovery may be performed entirely in the field or entirely at Arrow's office. Typically, the recovery is performed in the field. The samples will be recovered as follows:

- Each impinger will be weighed to 0.1 gm.
- All necessary glassware will be rinsed with 0.1 N H<sub>2</sub>SO<sub>4</sub> and DI H<sub>2</sub>O.
- The first impinger (and the back-half of the filter holder and connecting glassware) will be recovered as **container 1**.
- The second impinger (and the u-bend) will be recovered as **container 2**.
- The third and fourth impingers (and the u-bend) will be recovered as **container 3**.
- One blank for DI water and one for the 0.1 N H<sub>2</sub>SO<sub>4</sub> will be obtained per day of sampling.
- The probe, nozzle, and front-half of the filter holder will not be recovered. Ammonia will not condense on the surfaces at the proposed operating temperatures ( $\geq 250^{\circ}$  F).

**SAMPLE ANALYSIS:** Sample analysis will be performed in accordance with CTM-027 via HPIC. Each resulting sample fraction will be analyzed separately in order to confirm that breakthrough has not occurred during sampling. Analyses will be completed by Enthalpy Analytical.

## 5.9 SULFUR TRIOXIDE & SULFURIC ACID MIST

**SUMMARY:** Stack gas will be sampled isokinetically for sulfur trioxide and sulfuric acid mist emissions in accordance with US EPA Method 8, "The Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources".

Key sample train components will include:

- A sized, tapered-edge, stainless steel "button-hook" sample nozzle.
- A stainless steel sample probe with a heated glass liner, S-type pitot tube, and thermocouple.
- A glass filter holder with a glass fiber filter supported by a Teflon or glass frit. The filter is located between the 2<sup>nd</sup> and 3<sup>rd</sup> impingers.
- A condenser system consisting of Greenburg-Smith glass impingers and reagents per RM 8.
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers.
- A thermowell at the outlet of the last impinger to monitor sample gas stream temperature.

**PREPARATIONS:** Sampling glassware and sample containers will be cleaned prior to sampling in the following sequence:

- Soap and water wash and rinse.
- Triplicate rinse with distilled, de-ionized water (nozzle, probe, front-half of filter holder, and sample containers).
- Acetone rinse (nozzle, probe, front-half of filter holder, and sample containers).

The condenser system will consist of four impingers. All impingers will be of the Greenburg-Smith design. The second and fourth impinger will have the 0.5-inch tube to within 0.5 inches from the bottom. The first and third impingers will have the standard tip with impactor plate. A glass wool plug is placed between the first and second impinger. All impingers will be weighed prior to sampling to the nearest 0.1 gram. Each impinger will be charged for sampling as follows:

- Impinger 1, approximately 100 ml 80% isopropanol;
- Impingers 2 & 3, each with approximately 100 ml of 3% hydrogen peroxide;
- Impinger 4, approximately 300 gm silica gel.

**SAMPLING:** Completion of each test run will include the following key procedures:

A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.020 cfm will be achieved prior to run commencement. Each sample point will be sampled for an equal duration.

The sample probe will be adequately heated to prevent internal moisture condensation.

Ice will be maintained in the impinger cooling bath. The gas temperature at the exit of the last impinger will not exceed 68°F.

The nozzle chosen will allow for isokinetic conditions to be met; however, the nozzle will be sized to maintain sampling rate under 1.0 CFM. The probe temperature will be set to a minimum temperature to prevent condensation from occurring in the probe.

All necessary temperature and sample rate adjustments (to maintain isokinetic sampling) will be made as required and recorded at each sample point.

A post-test leak check will be performed on the entire sample train at a vacuum equal to or greater than the highest vacuum achieved during the test run. If the leak rate is greater than 0.020 cfm, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the NJDEP-BTS).

At the conclusion of the test, the sample train is disconnected at the first impinger and the pump turned on and run at the average sample rate that occurred during the test. The impingers are allowed to purge for 15 minutes.

**SAMPLE RECOVERY:** Sample recovery may be performed entirely in the field or entirely at Arrow's office. Typically, probe and nozzle recovery is performed in the field. The samples will be recovered as follows:

- Each impinger will be weighed to 0.1 gm.
- The first impinger is emptied into a 250 ml graduated cylinder and then it is rinsed with 80 percent isopropanol. The front-half of the filter holder and the probe, nozzle, and connecting glassware are also rinsed with the 80% IPA and added to the cylinder. The volume is brought to 225 ml with IPA and transferred to a 250 ml plastic bottle (**Container 1**). A 25 ml rinse of the cylinder is completed and added to Container 1.
- The filter (situated between impingers 1 and 2), is added to Container 1 and the volume is marked.
- Excepting for the post-test weighing of impingers 2, 3, and 4, no recovery is performed.

**SAMPLE SHIPMENT AND STORAGE:** Samples will be transported from the test site to Arrow Environmental Consulting, LLC, where the RM 8 samples will be packaged for shipment to Enthalpy Analytical.

**SULFURIC ACID MIST SAMPLE ANALYSIS:** The  $\text{SO}_3/\text{H}_2\text{SO}_4$  collected in the isopropanol is oxidized to sulfate and analyzed by the Barium-Thorin titration method. A standardized solution of barium perchlorate is used as the titrant and Thorin indicator is added to the sample aliquot to determine the titration end point. Barium ions react preferentially with the sulfate ions to form an insoluble barium sulfate salt. When all of the sulfate has been reacted, then any additional barium reacts with the Thorin indicator to form a metal salt which causes a color change in the solution signaling the end point.

#### METHOD DETECTION LIMITS:

**SULFURIC ACID MIST:** The analytical detection limit (DL) typically achieved by Enthalpy analytical is 0.01 mg  $\text{SO}_3$ , which, for a 30 cubic foot sample volume, is equivalent to 0.006 pounds per hour of  $\text{H}_2\text{SO}_4$ .

## 5.10 BENZENE

**SUMMARY:** Emissions of benzene will be determined by using USEPA Method 18, "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography."

**PREPARATION OF SAMPLING TRAIN:** Benzene sample collection will be performed using paired sample trains each consisting of a stainless steel or Teflon probe, a condenser system (an empty chilled impinger), two glass tubes in series each containing adsorbent media (charcoal), a Teflon-lined leak-free pump, and a rotameter. One sample train will include the benzene spiked charcoal tube (first tube in the series of two).

The sampling probe is rinsed with distilled water. The midget impinger is washed with distilled water and baked for a minimum of two hours at  $\geq 225^{\circ}\text{F}$ . The sample line from the midget impinger to the glass tube and from the glass tube to the pump is rinsed with distilled water. The pump is purged with clean ambient air for a minimum of 5 minutes prior to initiating sample collection.

**LEAK-CHECK PROCEDURES:** Sample train leak checks are performed at the beginning of each test. A soap film bubble meter will be placed at the outlet of the sampling system. The pump is then turned on. Once a single soap film bubble starts moving through the meter, the end of the sampling probe is plugged. Any leakage will be calculated from the movement of the bubble. A calculated leak rate of less than 4% of the test draw rate shall be considered acceptable.

**SAMPLE VOLUMES AND DETECTION LIMITS:** For each test, the train will extract a sample for one hour at approximately 0.8 liters per minute, obtaining a final sample volume of approximately 48 liters. The analytical method detection limit for benzene is 0.1 ppm.

**SAMPLE TRAIN OPERATION:** A single-point, integrated, one-hour sample will be obtained in each test. The sample train flow rate is calculated onsite with a soap-film bubble tube and stopwatch. Before the test begins, the sampling train is assembled.

At the beginning of each test, the sampling probe is placed at the centroid of the stack. The rotameter is adjusted to correspond with the calibrated rate.

**SAMPLE RECOVERY:** A spiking solution will be added to the spiked train condensate following completion of sampling and its recovery. The condensate of the unspiked train will be recovered with no further action. The glass tubes will be capped on both ends. All samples will be labeled and chains-of-custody completed prior to shipping the samples to Enthalpy Analytical for analysis.

**ANALYTICAL PROCEDURES:** Each sample component is analyzed by GC and reported as a sum total. A recovery efficiency determination will be conducted in both the midget impinger and adsorbent tube as required by Method 18.

## 5.11 MULTIPLE METALS

**SUMMARY:** Stack gas will be sampled isokinetically for metal emissions in accordance USEPA Method 29, Determination of Metals Emissions from Stationary Sources.

Metals in the sample gas will be collected in the sample train on a filter and in acidic impinger reagents. Recovered samples will then be digested and analyzed for lead (Pb) and nickel (Ni) in accordance with Method 29.

Note, since mercury is not a test parameter for this program the 4% KMNO<sub>4</sub>/10% H<sub>2</sub>SO<sub>4</sub> impingers will not be used in the sample train configuration.

Key sample train components will include:

- A sized, tapered-edge, glass "button-hook" sample nozzle;
- A glass sample probe with a heated glass liner, S-type pitot tube, and thermocouple;
- A heated glass filter holder with a low-metal quartz fiber filter supported by a Teflon frit;
- A condenser system consisting of Greenburg-Smith glass impingers and glass connecting pieces;
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers.

**RM29 PREPARATIONS:** Sampling glassware and sample containers will be cleaned prior to sampling in the following sequence:

1. Soap and water wash
2. A four-hour soak in 10% HNO<sub>3</sub> (plastic ware will be rinsed only)
3. Triplicate rinse with distilled de-ionized water

The condenser will consist of Greenburg-Smith impingers, interconnected with glass U-bends. Reagent charging and stem configurations will be as follows:

- Impinger 1: Empty, short-stem
- Impinger 2: Unrestricted tip with 5% HNO<sub>3</sub>/10% H<sub>2</sub>O<sub>2</sub>
- Impinger 3: Restricted impactor tip with 100 mls 5% HNO<sub>3</sub>/10% H<sub>2</sub>O<sub>2</sub>
- Impinger 4: Unrestricted tip, empty
- Impinger 5: Unrestricted tip, silica gel.

All impingers will be weighed prior to sampling to 0.15 grams. 5% HNO<sub>3</sub>/10% H<sub>2</sub>O<sub>2</sub> will be used within one month of preparation.

**SAMPLING:** Completion of each test run will include the following key procedures:

- A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.02 CFM will be achieved prior to run commencement.
- Each sample point will be sampled for an equal duration.
- Filter holder hot box temperature will be maintained at  $250 \pm 25$  °F.
- Probe heat will be maintained to prevent internal moisture condensation
- Ice will be maintained in the impinger ice bath.
- All necessary temperature and sample rate adjustments (to maintain isokinetic sampling) will be made at each sample point.
- A post-test leak check will be performed on the entire sample train at a vacuum approximating the highest vacuum achieved during the test run. If the leak rate is greater than 0.020 CFM, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the administrator).
- All necessary data for each sample point and test run will be recorded on appropriate data forms.

**SAMPLE RECOVERY:** Sample recovery may be performed entirely in the field or entirely at Arrow offices. Typically, probe and nozzle recovery is performed in the field. Samples will be recovered as follows:

**RM 29 STACK SAMPLES:** Stack samples will be recovered as follows:

- Each impinger will be weighed to 0.1 gm.
- The particulate filter and loose particulate will be transferred to container 1, a plastic petri dish.
- With a non-metallic brush, the probe, nozzle and front-half of the filter holder will be rinsed and brushed three times with a total of 100 ml of 0.1N HNO<sub>3</sub> into container 2 (high density polyethylene, HDPE).
- The contents of the knock-out impinger (if used) and the impingers charged with HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> will be transferred to container 3 (HDPE).
- Then, the knock-out impinger (if used), HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> impingers, filter holder back-half, frit and connecting glassware will all be rinsed three times with a total of 100 ml 0.1N HNO<sub>3</sub> into container 3.
- The contents of the impinger between the HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> and KMNO<sub>4</sub> impingers will be transferred to container 4 (HDPE). Then it will be rinsed three times with a total of 100 ml of 0.1N HNO<sub>3</sub> into container 4 (HDPE).

**BLANKS:** Blanks will be collected as follows:

- An unused filter will be placed in a plastic petri dish (container 1).
- An HDPE jar containing 100 ml 0.1N HNO<sub>3</sub> will be recovered as a front-half blank (container 2).
- An HDPE jar containing 200 ml 5% HNO<sub>3</sub>/10% H<sub>2</sub>SO<sub>4</sub> and 100 ml 0.1 N HNO<sub>3</sub> will be recovered as a back-half blank (container 3).
- An HDPE jar containing 100 ml 0.1N HNO<sub>3</sub> will be recovered as a blank for the impinger in between the HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> and KMNO<sub>4</sub> impingers (container 4).

**SAMPLE ANALYSIS:** Sample preparation and analysis will be performed in accordance with EPA Method 29. The following table summarizes the resulting analytical fractions.

|                     |       |   |   |
|---------------------|-------|---|---|
| Analytical fraction | 1     | 2 | 3 |
| Container No.(s)    | 1 & 2 | 3 | 4 |

## 5.12 HYDROGEN CYANIDE

The following test method will be used contingent on Hess's receipt of a Letter of Understanding (LOU) from Mr. Ed Choromanski, the DEP's Chief of Enforcement. Mr. Choromanski is currently drafting a LOU that will enable Hess to proceed with a stack testing program that will help develop appropriate limits based on current scientific knowledge without triggering unnecessary enforcement actions. Notably, if the new testing shows results above the existing Title V HCN limits, it will not be considered a violation and no penalties will be assigned. Based on the testing performed, new limits would be developed (if necessary).

**SUMMARY:** Stack gas will be sampled isokinetically for cyanide compound emissions in accordance with modified Conditional Test Method 033 (CTM-033), Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources.

The modifications are incorporated to maintain the reagent in a basic (pH) state to ensure adequate capture of the hydrogen cyanide. The relatively high levels of carbon dioxide expected in the source (approximately 19%) cause the reagent specified in CTM-033 to lose its basic pH and become acidic. The stronger reagent (6 Normal versus 0.1 N NaOH) and the increased volume of reagent are designed to overcome the high levels of CO<sub>2</sub>. Modifications to isokinetic sampling procedures will also be incorporated to compensate for the volume of CO<sub>2</sub> absorbed by the impingers.

Key sample train components will include:

- A sized, tapered-edge, stainless steel "button-hook" sample nozzle;
- A stainless steel sample probe with a heated glass liner, S-type pitot tube, and thermocouple;
- A heated glass filter holder with a tared glass fiber filter supported by a Teflon or glass frit;
- A condenser system consisting of large Greenburg-Smith design glass impingers and connecting pieces;
- A sample control/metering system consisting of a vacuum pump, dry gas meter, sample flow controls, sample rate manometer, stack gas velocity manometer, temperature indicator, and heat controllers;

**PREPARATIONS:** Sampling glassware and sample containers will be cleaned prior to sampling in the following sequence:

- Soap and water wash and rinse;
- Triplicate rinse with distilled, de-ionized water (nozzle, probe, front-half of filter holder, and sample containers);
- Acetone rinse (nozzle, probe, front-half of filter holder, and sample containers).

The condenser system will consist of four impingers. Impingers 1, 2, and 3 will be of high volume, approximating 2 liters. Impinger 4 will be a traditionally sized impinger of nominally 0.8 liters. Impingers 1 and 2 will be standard Greenburg-Smith with the impactor plate. Impingers 3 and 4 will be Greenburg-Smith, modified with an unrestricted opening and no impactor plate. All impingers will be weighed prior to sampling to the nearest 0.1 gram. Each impinger will be charged for sampling as follows:

- Impinger 1, 2, & 3, approximately 500 ml 6 N sodium hydroxide (NaOH) each;
- Impinger 4, approximately 300 gm silica gel.

**SAMPLING:** Completion of each test run will include the following key procedures:

A pre-test leak check of the entire sample train at a vacuum greater than that anticipated for the test run. A leak rate of no greater than 0.020 cfm will be achieved prior to run commencement. Each sample point will be sampled for an equal duration.

The filter holder hot box will be heated to a minimum of  $248^{\circ}\text{F} \pm 25^{\circ}\text{F}$ , as measured with a thermocouple.

Ice will be maintained in the impinger cooling bath. The gas temperature at the exit of the last impinger will not exceed  $68^{\circ}\text{F}$ .

All necessary temperature and sample rate adjustments (to maintain isokinetic sampling) will be made as required and recorded at each sample point.

Isokinetic sampling: In order to maintain proper isokinetics, the K-factor will need to be adjusted for the difference in flowrate required at the nozzle versus the actual volume measured at the orifice due to the  $\text{CO}_2$  removed in the impingers.

To accomplish this, the nozzle selection calculation is performed as if no  $\text{CO}_2$  was removed in the impingers and use of a nozzle based on this calculation.

The K-factor is then adjusted by artificially reducing the area of the nozzle being used by the same percentage that the total sample flow is reduced due to the  $\text{CO}_2$  removal, determining the corresponding nozzle diameter, and then using this diameter in the K-factor calculation. The  $\Delta\text{H}$  at each sampling point during the test is then determined using the  $\Delta p$  reading and this modified K-factor.

It is proposed that the acceptable range for isokinetics be defined as 80-120% for this modified method.

$\text{CO}_2$  measurement at the exhaust of the sampling train will be completed by using a bag to collect a sample. A rate of approximately 0.5 lpm will be maintained throughout the test. The bag will be analyzed using the calibrated RM3A instrumentation used for measuring the in-stack  $\text{CO}_2$  (and  $\text{O}_2$ ) concentrations during the sampling runs.

A post-test leak check will be performed on the entire sample train at a vacuum approximating the highest vacuum achieved during the test run. If the leak rate is greater than 0.020 cfm, the run will either be voided/repeated or kept and corrected for the leak-rate (at the discretion of the NJDEP-BTS).

**SAMPLE RECOVERY:** Sample recovery may be performed entirely in the field or entirely at Arrow's office. Typically, probe and nozzle recovery is performed in the field. The samples will be recovered as follows:

- Only the impinger contents are recovered. Probe and filter are not recovered (containers 1 and 2) since particulate determination is completed separately via NJATM1.
- The pH of each impinger solution will be checked (in the impingers) immediately after each test run to verify that the pH is not less than 12.0.;
- Each impinger will be weighed to 0.1 gm;
- The volume of the first 2 impingers will be measured with a 500-mL graduated cylinder to within  $\pm 10$  mL. The contents will be placed in **containers 3A and 3B**, 1 liter amber glass bottles. Then the impingers will be rinsed with 30 mL of 0.1 N NaOH. The NaOH will be poured into impingers 1 and 2, agitated and drained into **container 3**. This will be done three times. The



connecting U-bend will also be rinsed and added to **container 3**. *The back-half of the filter housing is not rinsed.* See note regarding oxidizing agents below.

- The volume of impinger 3 will be measured with a 500-mL graduated cylinder to within  $\pm 10$  mL. The contents will be placed in **container 4**, a 1 liter amber glass bottle. Then the impinger will be rinsed with 30 mL of 0.1 N NaOH. The NaOH will be poured into impinger 3, agitated and drained into **container 4**. This will be done three times. the U-bend will also be rinsed and added to **container 3**. See note regarding oxidizing agents below.
- A sample blank will be prepared by placing an unused filter in a glass container and adding a volume of 0.1N NaHCO<sub>3</sub> identical to the total volume of containers 1, 2, and 3.

**Oxidizing Agents:** For this source, oxidizing agents are not anticipated as being present. However, if oxidizing agents are known or suspected to be present, test and treat the sample as follows. After all washings have been collected in the respective sample container a drop of sample will be tested with potassium iodide-starch test paper (KI-starch paper). If a blue color appears then ascorbic acid, a few crystals at a time, until a drop of sample produces no color will be added to the sample container. Then an additional 0.6 grams of ascorbic acid will be added for each liter of sample volume. Samples will be preserved with 2mL 10 N NaHCO<sub>3</sub> per liter of sample (pH >12) at the time of collection.

**BLANKS:** Reagent, field train, laboratory method blanks and a field spike will be analyzed as part of the sampling program.

**Reagent Blanks:** 100 ml of 0.1 N NaOH and 100 ml of 6N NaOH will be collected separately in 250 ml amber bottles. Each will be analyzed separately.

**Field Train Blank:** A train will be assembled, charged, and transported to the field. Following completion of the sampling program for hydrogen cyanide, the field train blank will be recovered as specified.

**Laboratory Method Blank:** laboratory method blanks will be utilized to verify that contamination does not occur within the laboratory

**Field Spike:** 2 ml of the Field Spike Standard will be added to an impinger (not part of a sampling train) containing 100 ml of 6 N NaOH. The impinger will be recovered into a 250 ml amber glass jar.

**SAMPLE ANALYSIS:** Sample preparation and analysis will be performed in accordance with CTM-033. The impinger 1 and 2 catches (container 3) will be analyzed as a combined sample. Impinger 3 (container 4) will be analyzed separately to evaluate breakthrough. No breakthrough is verified if the impinger 3 (container 4) concentration is less than 5% of that of impingers 1 and 2 (container 3).

Analyses will be completed via ion chromatography.

**METHOD DETECTION LIMIT:** The analytical detection limit (DL) as specified in CTM-033 is 12  $\mu\text{g} / \text{m}^3$ . The analytical detection limit as supplied by Maxxon Analytical is 0.1  $\mu\text{g}/\text{ml}$ .

Based on an approximate sample volume of 30 scf and total recovered impinger catches estimated conservatively at 2,250 ml per run, this is equivalent to a detectable mass of 225  $\mu\text{g}$  per run.

### 5.13 HYDROGEN SULFIDE & CARBONYL SULFIDE

**SUMMARY:** Emissions of hydrogen sulfide ( $H_2S$ ) and carbonyl sulfide (COS) will be determined using USEPA Method 15, Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources. The gas sample will be continuously transported from the source to a citrate scrubber by a heated Teflon sample line. The sample will then be transported via an unheated Teflon line to the GC for direct analysis.

All samples and standards will be analyzed using a Hewlett-Packard 5890 Series II gas chromatograph (GC) equipped with a flame photometric detector (FPD). Samples and calibration standards will be injected into the GC using a VICI six port valve with a gas loop. All analytes will be referenced to certified permeation devices.

**SEPARATION:** All samples will be separated using a Restek Rtx-1 60 m x 0.53 mm capillary column. Hydrogen will be used as the carrier gas. Approximate retention time for  $H_2S$  and COS are 2.3 minutes and 2.4 minutes respectively.

**CHROMATOGRAPHIC CONDITIONS:** Copies of acquisition data including curves and quality assurance chromatograms will be provided.

**REPRODUCIBILITY:** Responses to all standards used will be within allotted tolerance of their respective tag value.

**RECOVERY EFFICIENCY:** At the end of the sampling period a line-loss recovery study will be performed. A cylinder containing hydrogen sulfide at a certified concentration will be introduced at the head of the sample line. The gas will travel through the heated sample line, through the citrate scrubber, and on to the GC for analysis.

The concentration response will be used to calculate and report the recovery efficiency. The recovery efficiency must fall between 80 to 120% for the data to be considered valid. All reported concentrations will be adjusted using the recovery efficiency.

## 5.14 OXYGEN & CARBON DIOXIDE

**SUMMARY:** Oxygen (O<sub>2</sub>) and Carbon dioxide (CO<sub>2</sub>) concentrations will be determined in accordance with EPA Method 3A and RM 7E. A continuous gas sample is extracted from a sampling point and analyzed for O<sub>2</sub> using a paramagnetic oxygen analyzer and for CO<sub>2</sub> using an NDIR analyzer.

**CALIBRATION GASES:** Instruments will be calibrated with known certified master standard concentrations of O<sub>2</sub> and CO<sub>2</sub> in nitrogen (N<sub>2</sub>) certified to a tolerance of  $\pm 2\%$ . Pre-purified N<sub>2</sub> for zero and two additional concentrations corresponding to 40-60% and 100% of span will be used.

**RANGE, SAMPLING RATE, AND DETECTION LIMIT:** The analyzers will each be operated over a calibrated range of approximately 0 – 22% by volume on a dry basis. For each test, the analyzers will process approximately 1 liter of stack gas per minute. The analytical method detection limit for O<sub>2</sub> is 0.1% and CO<sub>2</sub> is 0.1%.

**SAMPLE SYSTEM OPERATION:** A representative exhaust gas sample is extracted from the emission source through a stainless steel probe and heated Teflon sample line, passed through a chilled condenser for moisture removal, and then introduced to the oxygen and carbon dioxide analyzers for immediate analysis.

## 6.0 QUALITY ASSURANCE

This test protocol was developed in accordance with the principles and recommendations outlined in the U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems.

### 6.1 CHAIN-OF-CUSTODY

Each sample requires its own chain-of-custody (COC)/request-for- analysis form. The COC is completed to ensure the integrity of the samples collected. Before relinquishing the sample, the project manager must complete a COC listing his/her name, the name of the person receiving the results, the project number, the sample description (media), the sample date/time, and who performed the sampling.

The COC must also identify the source of the sample, describe the container holding the sample and the preservative (if any). Additional comments or notes can be placed in the Notes section.

Note that no samples for offsite analysis are anticipated during this test program.

### 6.2 CALIBRATION DATA

All pre-test calibration data for sampling equipment will be made available onsite, at the time of testing, to any regulatory representatives. At a minimum, copies of all calibration gas certificates, meter box five-point calibration(s), pitot tube calibrations and/or inspections, and nozzle diameter calibrations will be available onsite and included in the final report.

**PITOT TUBES:** Before each use, a visual inspection of the pitot tube is made to verify that the face openings are in alignment per the specifications shown in Figure 2-2 and 2-3 of U.S. EPA Method 2. A coefficient of 0.84 is assigned to the pitot if the inspection determines that it complies with the specifications.

**DRY GAS METERS:** The dry gas meter for field use is calibrated at five (5) different points initially, and annually thereafter. For isokinetic test programs, the dry gas meter will be checked (post-calibrated) at 3 points. If the meter's coefficient (Y) obtained before and after the isokintec test program agree within five percent of the five-point calibration, the calculations for the test series will be performed using the five-point coefficient (Y). If they differ by more than five percent, the calculations for the test series will be performed using the coefficient (Y) that gives the lower value of sample volume.

**THERMOCOUPLES:** Thermocouple accuracy is checked after each field use in accordance with USEPA Alternative Method 2 (Alt-011). The thermocouple reading is compared to an ASTM mercury-in-glass thermometer at a single temperature.

**SPAN GAS CERTIFICATIONS:** Span gas certifications are provided by the supplier and copies will be included in the final test report. All gases for this project will be either Certified Master ( $\pm 2\%$ ) or EPA Protocol ( $\pm 1\%$ ) standards.

## 7.0 FINAL REPORT

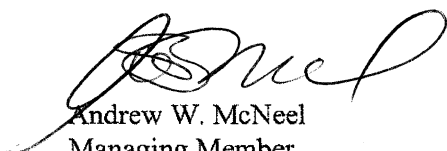
Emissions of TSP, PM<sub>10</sub>, VOC, CO, NO<sub>x</sub> (as NO<sub>2</sub>), SO<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>S, COS, SO<sub>3</sub>/H<sub>2</sub>SO<sub>4</sub>, -CN, benzene, Ni, and Pb will be reported in units consistent with the allowables presented in Hess's permit for these sources. All parameters' emissions will be reported as pounds/hour

The final test report for this project will include the following items:

- An emissions summary, including comparison to permitted allowables.
- Personnel and Certifications (report will be certified in order to comply with NJAC 7:27 - 22.19(c), as required by the NJDEP).
- Sampling location illustration(s).
- Velocity and flow rate data summaries.
- Diluent traverses data.
- Cyclonic flow data summary.
- Gas composition data summary.
- Process information.
- Approved test protocol.
- Equipment calibration data, including a summary of all onsite CEMS calibrations, bias checks, and drift checks.
- Original field data sheets.
- Calculations.
- Laboratory analysis reports.

One certified (NJAC 7:27 - 22.19(c)) comprehensive report copy will be submitted to the NJDEP-BTS within 60 days after the completion of the test program. One summary report copy, which will include the emissions summary with allowable emissions and the certifications per NJAC 7:27 - 22.19(c), will be submitted to the Regional Enforcement office concurrently.

Submitted by:



Andrew W. McNeel  
Managing Member,  
Arrow Environmental Consulting, LLC.

## ATTACHMENT 1

### AIR PERMIT INFORMATION

BOP090001

New Jersey Department of Environmental Protection  
Facility Specific Requirements

| Ref.# | Applicable Requirement   | Monitoring Requirement  | Recordkeeping Requirement  | Submittal/Action Requirement   |
|-------|--|---|--|--|
| 7     | <p>SO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>, as converted and expressed as H<sub>2</sub>SO<sub>4</sub> &lt;= 12.86 lb/hr. This emission rate is after physical modifications are installed.</p> <p>In the 600 days of operation after physical modifications are installed and stack test protocol approved, four stack tests must be completed in the following four feed conditions:</p> <ol style="list-style-type: none"> <li>1) High feed rate and high Carbon Residue of the feed</li> <li>2) Maximum feed rate with corresponding high Carbon Residue of the feed</li> <li>3) High feed rate and high sulfur level of the feed</li> <li>4) Maximum feed rate with corresponding high sulfur level.</li> </ol> <p>Permittee shall endeavor to acquire feedstock with specified characteristics for stack testing study and schedule stack tests within 600 days limit accordingly.<br/>(Carbon Residue as defined in OSI Reference #4). [N.J.A.C. 7:27-22.16(c)]</p> | <p>SO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>, as converted and expressed as H<sub>2</sub>SO<sub>4</sub>: Monitored by stack emission testing at the approved frequency, based on a 1 hour block average and a minimum of three 1-hour tests for each stack test study and a maximum of six 1-hour tests for each stack test study; a minimum total of twenty 1-hour tests for the four stack test studies.</p> <p>Initial Performance Stack test must be completed within 180 days from the date of this permit approval (three 1-hour stack tests).</p> <p>Four feed study related stack tests must be completed within 600 days after physical modifications are installed and stack test protocol approved.</p> <p>Performance stack test is required every 5 years [prior to permit renewal] (three 1-hour stack tests) [N.J.A.C. 7:27-22.16(o)]</p> | <p>SO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>, as converted and expressed as H<sub>2</sub>SO<sub>4</sub>: Recordkeeping by stack test results upon occurrence of event.<br/>[N.J.A.C. 7:27-22.16(o)]</p> | <p>Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule with Bureau of Pre-Construction Permits and BTS: Within 645 days after startup of the unit after physical modifications to the unit are installed and stack test protocol is approved.</p> <p>Initial Performance Stack Test must be completed within 180 days from the date of this approved permit for significant modification due to feed rate increase.<br/>[N.J.A.C. 7:27-22.16(o)]</p> |

BOP090001

**New Jersey Department of Environmental Protection  
Facility Specific Requirements**

| Ref.# | Applicable Requirement   | Monitoring Requirement  | Recordkeeping Requirement   | Submittal/Action Requirement  |
|-------|--|---|---|---|
| 8     | <p>PM-10 (Total) <math>\leq</math> 36 lb/hr This emission rate is after proposed physical changes installation and startup.</p> <p>In the 600 days of operation after all physical changes are installed and stack test protocol approved, four stack tests will be conducted at the following four feed conditions:</p> <ol style="list-style-type: none"> <li>1) High feed rate and high Carbon Residue of the feed.</li> <li>2) Maximum feed rate with corresponding high Carbon Residue of the feed</li> <li>3) High feed rate at high sulfur level</li> <li>4) Maximum feed rate with corresponding high sulfur level.</li> </ol> <p>Permittee shall endeavor to acquire feedstock with specified characteristics for stack testing study and schedule stack tests within 600 days limit accordingly.<br/>(Carbon Residue as defined in OS1 Reference #4). [N.J.A.C. 7:27-22.16(e)]</p> | <p>PM-10 (Total): Monitored by stack emission testing at the approved frequency, based on a 1 hour block average and a minimum of three 1-hour tests for each stack test study and a maximum of six 1-hour tests for each stack test study; a minimum total of twenty 1-hour tests for the four stack test studies.</p> <p>Four feed study related stack tests must be completed within 600 days after physical modifications are installed and stack test protocol approved. Initial Performance Stack Test must be completed within 180 days from the date of this permit approval (three 1-hour stack tests) and stack test protocol approval.</p> <p>Performance stack test is required annually (three 1-hour stack tests). [N.J.A.C. 7:27-22.16(o)]</p> | <p>PM-10 (Total): Recordkeeping by stack test results upon occurrence of event. [N.J.A.C. 7:27-22.16(o)]</p>                        | <p>Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule with Bureau of Pre-Construction Permits and BTS: Within 645 days after startup of the unit after physical modifications are installed and stack test protocol is approved.</p> <p>Initial Performance Stack test must be completed within 180 days from the date of the approved permit for significant modification due to feed rate increase.</p> <p>Annual Performance Stack Test Schedule:</p> <ol style="list-style-type: none"> <li>1. Protocol Submitted: 15 May</li> <li>2. Testing Completed: 15 August</li> <li>3. Test Reports Submitted: 15 October</li> </ol> <p>[N.J.A.C. 7:27-22.16(o)]</p> |
| 9     | <p>NOx (Total) <math>\leq</math> 150 lb/hr or NOx <math>\leq</math> 150 ppmvd at 0% oxygen, whichever is more stringent; and</p> <p>NOx(Total) <math>\leq</math> 125 lb/hr on 7-day average or 130 ppmvd on 7-day average at 0% oxygen, whichever is more stringent.<br/>[N.J.A.C. 7:27-22.16(a)]</p>  | <p>NOx (Total): Monitored by continuous emission monitoring system continuously, based on a 1 hour block average. The continuous emission monitoring system (CEMS) will be equipped with integrating and data logging devices to generate hourly mass emission rates using data of the flue gas flow rates. [N.J.A.C. 7:27-22.16(o)]</p> <p>NOx (Total): Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(e)]</p>   | <p>NOx (Total): Recordkeeping by data acquisition system (DAS) / electronic data storage continuously. [N.J.A.C. 7:27-22.16(o)]</p> | <p>Submit an Excess Emissions and Monitoring Systems Performance Report (EEMPR): Every April 30, July 30, October 30, and January 30 for the preceding quarter year (the quarter years begin on January 1, April 1, July 1, and October 1) electronically through the NJDEP online EEMPR web portal or manually. [N.J.A.C. 7:27-22.16(o)]</p> <p>Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS Summary for details. [N.J.A.C. 7:27-22.16(o)]</p>   |
| 10    | <p>NOx (Total) <math>\leq</math> 150 lb/hr or NOx <math>\leq</math> 150 ppmvd at 0% oxygen, whichever is more stringent.<br/>[N.J.A.C. 7:27-22.16(a)]</p>  | <p>NOx (Total): Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(e)]</p>  | <p>NOx (Total): Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]</p>        | <p>Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS Summary for details. [N.J.A.C. 7:27-22.16(o)]</p>   |
| 11    | <p>CO <math>\leq</math> 160 lb/hr or CO <math>\leq</math> 300 ppmvd at 0% oxygen, whichever is lower. [N.J.A.C. 7:27-22.16(e)]</p>   | <p>CO: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(e)]</p>   | <p>CO: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]</p>                 | <p>Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)]</p>   |



**New Jersey Department of Environmental Protection  
Facility Specific Requirements**

| Ref.# | Applicable Requirement   | Monitoring Requirement  | Recordkeeping Requirement   | Submittal/Action Requirement   |
|-------|--|---|---|--|
| 12    | CO <= 160 lb/hr or CO <= 300 ppmvd at 0% oxygen, whichever is lower. [N.J.A.C. 7:27-22.16(e)]  | CO: Monitored by continuous emission monitoring system continuously, based on a 1 hour block average. The continuous emission monitoring system (CEMS) will be equipped with integrating and data logging devices to generate hourly mass emission rates using data of the flue gas flow rates. [N.J.A.C. 7:27-22.16(e)]  | CO: Recordkeeping by data acquisition system (DAS) / electronic data storage continuously. [N.J.A.C. 7:27-22.16(e)]         | Submit an Excess Emissions and Monitoring Systems Performance Report (EEMPR): Every April 30, July 30, October 30, and January 30 for the preceding quarter year (the quarter years begin on January 1, April 1, July 1, and October 1) electronically through the NJDEP online EEMPR web portal or manually. [N.J.A.C. 7:27-22.16(o)] |
| 13    | SO2 <= 80 lb/hr or SO2 <= 141 ppmvd at 0% oxygen, whichever is lower. [N.J.A.C. 7:27-22.16(e)] | SO2: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(e)]   | SO2: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]               | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)]   |
| 14    | SO2 <= 80 lb/hr or SO2 <= 141 ppmvd at 0% oxygen, whichever is lower. [N.J.A.C. 7:27-22.16(e)] | SO2: Monitored by continuous emission monitoring system continuously, based on a 1 hour block average. The continuous emission monitoring system (CEMS) will be equipped with integrating and data logging devices to generate hourly mass emission rates using data of the flue gas flow rates. [N.J.A.C. 7:27-22.16(e)] | SO2: Recordkeeping by data acquisition system (DAS) / electronic data storage continuously. [N.J.A.C. 7:27-22.16(e)]        | Submit an Excess Emissions and Monitoring Systems Performance Report (EEMPR): Every April 30, July 30, October 30, and January 30 for the preceding quarter year (the quarter years begin on January 1, April 1, July 1, and October 1) electronically through the NJDEP online EEMPR web portal or manually. [N.J.A.C. 7:27-22.16(o)] |
| 15    | VOC (Total) <= 61.1 lb/hr. VOC <= 234 ppmvd at 0% oxygen. [N.J.A.C. 7:27-22.16(e)]             | VOC (Total): Monitored by stack emission testing once initially and prior to permit renewal, based on any 60 minute period and three 1-hour tests. [N.J.A.C. 7:27-22.16(e)]   | VOC (Total): Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]       | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)]   |
| 16    | Benzene <= 0.56 lb/hr. [N.J.A.C. 7:27-22.16(e)]  | Benzene: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(o)]   | Benzene: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]           | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)]   |
| 17    | Cyanide compounds <= 7.8 lb/hr. [N.J.A.C. 7:27-22.16(e)]                                       | Cyanide compounds: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests. [N.J.A.C. 7:27-22.16(o)]   | Cyanide compounds: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(o)] | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS Summary for details. [N.J.A.C. 7:27-22.16(o)]   |

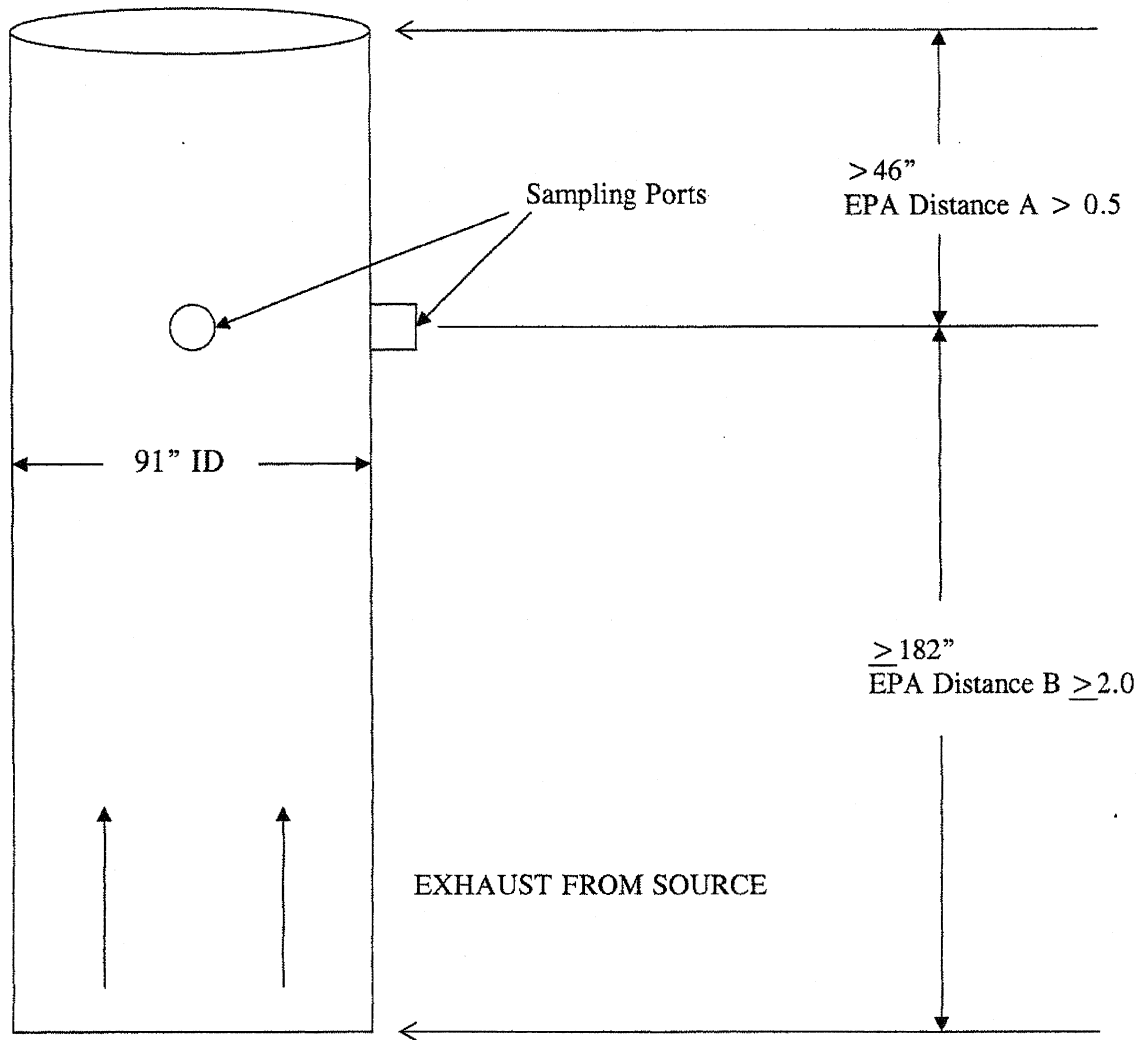
BOP090001

New Jersey Department of Environmental Protection  
Facility Specific Requirements

| Ref.# | Applicable Requirement   | Monitoring Requirement   | Recordkeeping Requirement  | Submittal/Action Requirement   |
|-------|--|--|--|--|
| 18    | Nickel compounds: < or = TBD lb/hr.<br><br>Based on Initial Performance stack testing results for nickel compounds using worst feed quality (High Nickel) and high feed rates, the TBD will be replaced by a number only if the stack test results show any emission rate above de-minimus. The number shall be decided jointly by the Department and the permittee.<br><br>Note: This is a non-PSD requirement.<br>[N.J.A.C. 7:27-22.16(e)] | Nickel compounds: Monitored by stack emission testing once initially, based on a 1 hour block average and three 1-hour tests.<br><br>Initial performance stack test must be completed within 360 days from the date of this permit approval.<br><br>Based on initial performance stack test results, the requirement for future (every 5 years prior to permit renewal) stack testing will be reviewed and decided. [N.J.A.C. 7:27-22.16(o)] | Nickel compounds: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(o)]                     | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)] |
| 19    | Ammonia <= 13.86 lb/hr. [N.J.A.C. 7:27-22.16(e)]   | Ammonia: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests.<br>[N.J.A.C. 7:27-22.16(o)]   | Ammonia: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(e)]                              | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)] |
| 20    | H2S <= 2 lb/hr. [N.J.A.C. 7:27-22.16(e)]   | H2S: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests.<br>[N.J.A.C. 7:27-22.16(o)]   | H2S: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(o)]                                  | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)] |
| 21    | Carbon oxysulfide (Carbonyl sulfide) <= 0.2 lb/hr. [N.J.A.C. 7:27-22.16(e)]  | Carbon oxysulfide (Carbonyl sulfide): Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests.<br>[N.J.A.C. 7:27-22.16(o)]  | Carbon oxysulfide (Carbonyl sulfide): Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(o)] | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)] |
| 22    | Lead compounds <= 0.043 lb/hr. [N.J.A.C. 7:27-22.16(e)]  | Lead compounds: Monitored by stack emission testing once initially and prior to permit renewal, based on a 1 hour block average and three 1-hour tests.<br>[N.J.A.C. 7:27-22.16(o)]  | Lead compounds: Recordkeeping by stack test results once initially and prior to permit renewal. [N.J.A.C. 7:27-22.16(o)]                       | Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule : See stack testing requirements in OS summary for details. [N.J.A.C. 7:27-22.16(o)] |

## ATTACHMENT 2

### PORT LOCATIONS



Schematic of the sampling ports for the FCCU/WGS at Hess Corporation's Port Reading, New Jersey.