HEALY CLEAN COAL PROJECT

TOPICAL REPORT

AIR EMISSION COMPLIANCE TESTING

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Abstract

The Healy Clean Coal Project (HCCP) is a coal-fired power-generating facility that has successfully demonstrated the use of Clean Coal Technology. The 2-year-long Demonstration Test Program provided conclusive data showing that energy needs could be met using coal-fired power plants in an environmentally acceptable manner. The HCCP is the first utility-scale demonstration project of its kind. The air emission compliance testing program showed that EPA New Source Performance Standards, the stringent facility air permit emission limits, and the rigorous DTP emission goals could all be met by the HCCP integrated technologies.

Executive Summary

The Clean Coal Technology Program was initiated in 1986 with the purpose of expanding innovative pollution control options for coal-fired power-generating facilities. The Clean Coal Technology (CCT) Program was subsequently developed to demonstrate these technologies in commercial-scale facilities. The CCT Program is a government and industry initiative that includes generating information on the ability of various clean coal technologies, such as low-polluting coal burners and post-combustion, sulfur-removing devices, to meet air emission goals while operating in an economically efficient manner.

The Healy Clean Coal Project (HCCP), which is owned by the Alaska Industrial Development and Export Authority (AIDEA), is a 50-megawatt (MW), coal-fired power-generating facility located in Healy, Alaska. The U.S. Department of Energy (DOE) selected the HCCP for funding in 1989 under Round III of the CCT Program.

Coal-fired operations commenced at the HCCP on January 14, 1998. The technologies utilized at the HCCP are the TRW Clean Coal Combustion System equipped with a Babcock and Wilcox/Joy/NIRO Activated Recycle Spray Dryer Absorber (SDA) and Pulse-Jet Baghouse. The HCCP completed its Demonstration Test Program (DTP) in December 1999. Part of the DTP was to demonstrate compliance with the U.S. Environmental Protection Agency (EPA) New Source Performance Standards (NSPS) and with the air-emission limits of the HCCP State of Alaska Air Quality Permit to Operate (Air Permit). Furthermore, the DTP also had more rigorous air emission goals for the HCCP (Stone & Webster Engineering Corporation and Steigers Corporation 1998). The DTP air emission compliance demonstration is the subject of this Topical Report.

The DTP demonstrated that the HCCP clean coal technologies have the ability to maintain air emissions at levels below both the NSPS limits and the Air Permit limits and, furthermore, have the ability to meet the more stringent DTP emission goals, as described below. The emissions monitoring systems also met all EPA-required standards for accuracy.

- Particulate matter (PM) emissions were measured at 0.0047 lb/MMBtu during a stack test performed on March 10 and 11, 1999. The PM NSPS emission limit, Air Permit limit, and DTP emission goal, are 0.03, 0.02, and 0.015 lb/MMBtu, respectively.

- Nitrogen oxides (NO_x) emissions were measured during a June 17, 1998, stack test at 0.260 lb/MMBtu. The NSPS limit for NO_x is 0.5 lb/MMBtu, the Air Permit limit is 0.350 lb/ MMBtu, and the DTP emission limit goal is 0.20 to 0.350 lb/MMBtu.

- Sulfur dioxide (SO_2) emissions were measured during a June 17, 1998, stack test at 0.010 lb/MMBtu. The Air Permit limits include the annual average limit of 0.086 lb/MMBtu and the 3-hour average limit of 0.10 lb/MMBtu.

- Carbon monoxide (CO) emissions measured during a June 17, 1998, stack test were 0.6 ppm. The Air Permit limit and DTP emission goal are 202 and 206 ppm, respectively.

Introduction

AIDEA constructed the nominal 50-MW coal-fired power-generating facility at a site near Healy, Alaska. The facility is adjacent to the existing Golden Valley Electric Association, Inc. (GVEA) Healy Unit No. 1 power plant. The HCCP was constructed in response to the DOE Program Opportunity Notice issued in May 1989 for the CCT Program. The goal of the CCT Program is to demonstrate new technologies and meet power needs in an environmentally acceptable manner.

The objectives of constructing the plant were:

- to demonstrate a novel power plant design that features the combined removal of SO_2, NO_x, and PM emissions using a combination of two advanced technologies
- to further demonstrate reduced emission levels well below the requirements of the EPA NSPS for new utility coal-fired units
- to meet future energy needs in an environmentally acceptable manner.

The technologies used in the HCCP are the TRW Clean Coal Combustion System equipped with a Babcock and Wilcox (B&W)/ Joy/NIRO Activated Recycle Spray Dryer Absorber and Pulse-Jet Baghouse (SDA System). The TRW combustor includes a precombustor and a slagging combustor. The precombustor increases the air inlet temperature to optimize slagging performance. In the slagging combustor, the coal is burned at a high temperature so that 80 percent of the ash in the incoming coal may be removed as molten slag, thereby reducing the amount of fly ash. In the two-stage combustion system, the air/fuel stoichiometry is controlled to result in low NO_x emissions.

The advanced slagging combustion system is integrated with the sorbent injection, spray dryer, and baghouse system. The first stage of SO_2 control occurs in the boiler. Limestone is injected into the boiler and subsequently becomes flash calcined material (FCM), which reacts with SO_2. Most of the FCM is then slurried and atomized through the SDA in order to remove additional SO_2. The FCM residue is then removed in the baghouse system (the second stage of SO_2 control). The SO_2 that makes it through the boiler and SDA reacts with the FCM on the baghouse filters as the third stage of SO_2 control. These technologies were developed to meet energy needs from coal-fired power plants in an environmentally acceptable manner. The HCCP is the first utility-scale demonstration of the integrated TRW Clean Coal Combustion and the SDA Systems.

The design coal for the HCCP consists of a blend of Run of Mine (ROM) and waste coal called performance coal. The HCCP combustors were designed to burn several blends of ROM and waste coal including 100 percent ROM coal, 55 percent waste coal and 45 percent ROM coal, and 50 percent waste coal and 50 percent ROM coal. The combustors are also capable of burning 100 percent waste coal. The coals that were used in the HCCP design occur in abundance in the area immediately surrounding the plant. Utilizing these coals to supply local energy needs is a key objective of the HCCP. The specifications for ROM coal, waste coal, and performance coal are summarized in Table 1.

Table 1 HCCP Coal Specifications

Coal Parameter	Values for Each Coal		
	ROM Coal	Waste Coal	Performance Coal
Proximate Analysis			
Moisture, %	26.35	23.87	25.11
Ash, %	8.20	25.00	16.60
Volatile, %	34.56	27.00	30.78
Fixed Carbon, %	30.89	24.13	27.51
Total, %	100.00	100.00	100.00
HHV, Btu/lb	7,815	6,105	6,960
Ultimate Analysis			
Moisture, %	26.35	23.87	25.11
Ash, %	8.20	25.00	16.60
Carbon, %	45.55	35.59	40.57
Hydrogen, %	3.45	2.70	3.07
Sulfur, %	0.17	0.13	0.15
Oxygen, %	15.66	12.23	13.94
Chlorine, %	0.03	0.02	0.03
Total	100.00	100.00	100.00

The Demonstration Test Program (DTP) was initiated when the facility commenced coal-fired operations. The DTP is the start-up program for CCT Program facilities and is an integral part of the DOE CCT Program because it is used to demonstrate that the clean coal technologies can reduce air emissions below EPA-required levels for new coal-fired facilities and that the technologies can be scaled up for use in a commercial design. The DTP is a more comprehensive start-up program than those used for commercial power plants utilizing conventional technologies. The DTP for HCCP included approximately 2 years of testing under various operating scenarios to characterize the performance of the new technologies, verify environmental compliance, and conduct performance guarantee testing. The DTP also included environmental compliance testing, evaluation of facility capacities, determination of operating costs, testing of various coal blends, assessment of limestone feed rates and composition, review of operating and maintenance requirements, and the study of long-term operating scenarios (Stone & Webster Engineering Corporation and Steigers Corporation 1998). During the DTP, GVEA operated the new power generating facility and purchased the net power generation from AIDEA.

This Topical Report addresses the DTP goal of demonstrating that the HCCP can be operated in an environmentally acceptable manner. The success of the HCCP in meeting this goal is primarily measured by the ability to meet the DTP air emission goals. Although water discharges and waste generation are also reviewed to determine the environmental affects of the

HCCP, air emissions have the most critical environmental effect. Therefore, the primary focus of this Topical Rport is the results of air emission compliance testing conducting during the DTP as they related to the requirements of the EPA's New Source Performance Standards, the emission limits in the facility's Air Permit to Operate No. 9431-AA007, and the more rigorous air emission goals of the DTP.

Summary

The purpose of the DTP was to prove that the commercial use of the integrated TRW Combustion System and the SDA System would offer competitive power costs, increased efficiency, and reduced environmental impact compared to alternative coal-based power systems. The DTP included the following tasks that were to be completed prior to commercial operation of the facility.

- Task 1 - Coal Firing Startup and Trials
- Task 2 - Compliance Testing [1]
- Task 3 - TRW Combustor Characterization Testing
- Task 4 - B&W/Joy/NIRO SDA Characterization Testing
- Task 5 - Boiler Characterization Tests
- Task 6 - Coal Blend Tests
- Task 7 - Performance Guarantee Acceptance Testing
- Task 8 - 90-Day Commercial Operation Test (90-Day Test)
- Task 9 - Long-Term Commercial Operation Demonstration

Because this report discusses the goal of reduced environmental impact, the principal focus is on the results of Task 2 - Compliance Testing. However, because environmental impacts, primarily air emissions, were evaluated in most of the above-listed tasks, this report also includes some of the air emissions information obtained from other DTP tasks. Both Task 3 - TRW Combustor Characterization Testing (TRW combustor characterization) and Task 8 - 90-Day Commercial Operation Test (90-Day Test) included evaluations of air emissions. Therefore, certain results of the TRW combustor characterization and the 90-Day Test are also included here. Although Task 9 has not been initiated, Tasks 1 through 8 were completed during the HCCP DTP.

Compliance Testing included compliance monitoring and supplemental monitoring performed during the demonstration period. Compliance monitoring included water, waste, and air monitoring for the purpose of meeting permit limits and regulatory requirements. Supplemental monitoring was additional monitoring that provided useful information for CCT projects, but the information was not specifically required for environmental permit compliance.

The purpose of the TRW combustor characterization was to establish the baseline performance of the combustion system using several coal blends; to determine the combustion system operating envelope by testing configurations and operating conditions; and to develop the most feasible set of conditions for the steady-state operation of the facility. The TRW combustor characterization was performed over two time periods that equated to approximately 6 months of operating time.

[1] Compliance Testing was actually termed Environmental Monitoring Plan in the 1998 DTP. A separate report prepared in 1997 was also called the Environmental Monitoring Plan. To avoid confusion, this report will use the term Compliance Testing when referring to Task 2 of the DTP. Task 2 was also called Compliance Testing in reports prepared by TRW and Harris Group, Inc.

The 90-Day Test was mainly an exercise to determine the commercial viability of the project. The test requirements partially overlapped the goals of the last stage of the TRW combustor characterization and involved operation of the facility at an output of 50 MW per hour at a capacity factor of at least 85 percent, for 90 consecutive days. During the 90 days, the facility was required to use coal representative of what would be used during the long-term operation of the HCCP. The Harris Group, Inc. (Harris Group) was contracted to observe and evaluate the test. Other components of the test included, but were not limited to, evaluations of maintenance and staffing requirements, examination of emissions, observations of equipment and instrumentation conditions, assessment of limestone feed rates and composition, and a review of coal supply characteristics.

Compliance Testing

Compliance testing for the DTP comprised compliance monitoring and supplemental monitoring measures. Compliance monitoring consisted of a compliance review of the surface water discharge permit that covers water discharges from the HCCP into the Nenana River, a review of HCCP waste generation, and a review of compliance with the HCCP Air Permit. Supplemental monitoring consisted of testing for various parameters that are related to environmental issues, such as fly ash monitoring (to forecast recycling opportunities), evaluation of work-place hazards, and limestone analyses. The majority of information from supplemental monitoring is provided in other topical reports.

The HCCP and Healy Unit No. 1 operate under the same Air Permit. Because the HCCP is a "new source" of air emissions, NSPS apply to the HCCP facility, and these are included in the Air Permit. NSPS for the HCCP are specified in the regulations in 40 CFR 60 Subpart Da (which includes requirements for all electric utility steam generating units constructed after September 18, 1978, that have a heat input of greater than 250 MMBtu/hr). The NSPS requirements relate to emission limits, source emission testing, continuous emission monitoring systems (CEMS), continuous opacity monitoring systems (COMS), certification of compliance, and auditing of CEMS data. Due to the nature of the HCCP technologies and the results of pilot-scale testing of these technologies, emission limits established in the Air Permit are more stringent than the NSPS requirements. Furthermore, the DTP has goals for air emission limits that are more rigorous than either the NSPS requirements or the permitted emission limits. Table 2 provides a summary of the three emission limits.

TRW Combustor Characterization

The TRW combustor characterization included three series of tests evaluating the TRW Clean Coal Combustion Technology over a period equivalent to approximately 6 months of coal-fired operation (TRW 2000). The first test series was performed to determine baseline performance using various coal blends. The second test series involved a check of the technology characteristics while introducing a broad range of operating conditions and hardware configurations. The third test series was performed using the best operating conditions and hardware configurations determined by the second test series but operating under longer test runs.

Table 2 HCCP Air Emission Limits and Air Emission Goals

Air Quality Permit to Operate No. 9431-AA001 Emission Limits				
Opacity	**PM Emissions [1]**	**NO_x Emissions [2]**	**SO_2 Emissions [3]**	**CO Emissions [4]**
20% opacity, 3-minute average one 6-minute period per hour of 27% opacity	0.020 lb/MMBtu, hourly average 13.2 lb/hr, hourly average 58 ton/yr, full load	0.350 lb/MMBtu, 30-day rolling average 1,010 ton/yr, full load	0.086 lb/MMBtu, annual average 0.10 lb/MMBtu, 3-hour average 65.8 lb/hr, 3-hour average 248 ton/yr, full load	0.20 lb/MMBtu, hourly average 202 ppm at 3.0% O_2 132 lb/hr 577 ton/yr, full load
NSPS Emission Limits (40CFR 60 Subpart Da)				
Opacity	**PM Emissions**	**NO_x Emissions**	**SO_2 Emissions**	**CO Emissions**
20% opacity, 6-minute average	0.03 lb/MMBtu, hourly average 99% reduction	0.50 lb/MMBtu	70% removal when emissions are less than 0.60 lb/MMBtu	Dependent on HCCP ambient CO levels (no requirements listed in Subpart Da)
Demonstration Test Program Goals				
Opacity	**PM Emissions**	**NOx Emissions**	**SO_2 Emissions**	**CO Emissions**
20% opacity, 3-minute average	0.015 lb/MMBtu, hourly average	0.20 to 0.35 lb/MMBtu	70% removal 79.6 lb/hr, maximum	200 ppm (dry basis) at 3.5% O_2 206 ppm at 3.0% O_2

Sources: TRW 2000, Harris Group 1999, Stone & Webster Engineering Corporation and Steigers Corporation 1998
1. Particulate Matter , 2. Oxides of Nitrogen , 3. Sulfur Dioxide , 4. Carbon Monoxide

During all three of these test series, air emissions were evaluated and compared to the limits contained in the NSPS and the Air Permit and the more rigorous air emission goals of the DTP.

90-Day Test

The Power Sales Agreement and the Construction Agreement state that commercial operations shall not occur until testing has been completed and an independent engineer deems the plant capable of generating 50 MW per hour power at a capacity factor of not less than 85 percent for 90 consecutive days. The agreements further state that the coal used during the test period shall be equivalent to long-term Usibelli coal, as defined in the Agreement between AIDEA and Usibelli Coal Mine, Inc. (January 1991). The Independent Engineer is also required to consider the operation of the major project systems in its review. The 90-day test was performed from August 17, 1999, through November 15, 1999, and was observed and evaluated by the Harris Group, who served as the Independent Engineer.

Description

Air emissions were evaluated in several DTP tasks. Compliance Testing included certifying the CEMS, evaluating the performance of the COMS, and performing stack tests. Stack test results were compared to Air Permit limits, NSPS regulatory limits, and program goals. Since the primary function of the TRW combustor characterization was to evaluate the performance of the plant's new technology, it included an evaluation of air emissions under various operating scenarios. The 90-Day Test was essentially a continuation of the TRW combustor characterization but included longer operational runs under a single operating scenario. Air emissions were measured and recorded throughout the 90-day period.

Description of Compliance Testing

The HCCP Air Permit and the NSPS regulations in 40 CFR 60 require:

- initial CEMS certification and ongoing CEMS audits
- performance evaluation of COMS
- air emission source performance testing and emission compliance demonstrations.

The initial CEMS certification is performed by comparing CEMS data to stack test data obtained using EPA Reference Methods (RM). The CEMS data must be within certain accuracy requirements described in the NSPS regulations. The CEMS must also be audited on a regular basis if the system will be used for demonstrating compliance with air emission limits in the future.

The initial COMS performance evaluation includes calibrating the COMS using calibration attenuators. Once the COMS performance evaluation is completed the, COMS data can be used in place of stack tests.

Source performance testing involves stack tests that measure levels of specific pollutants in the facility exhaust gas. The emissions compliance demonstration is the comparison of stack test results to NSPS emission limits. The Compliance Testing was performed by outside contractors, which are listed in Table 3 along with their respective testing and reporting dates.

Table 3 Compliance Testing for Air Emissions

Test Name	Performed by	Test Date(s)	Report Date
Initial CEMS Certification	Am Test [1]	April 14-15, 1998 June 16, 1998	July 10, 1998
1999 Annual CEMS Audit	HMH [2]	August 31, 1999	September 28, 1999
COMS Performance Evaluation	Monitoring Solutions [3]	April 14, 1998	May 1998
Source Performance Test HCCP Stack	Am Test	June 17, 1998	July 10, 1998
Source Performance Test (PM re-test) HCCP Stack	HMH	March 10-11, 1999	May 18, 1999

1. Am Test-Air Quality, L.L.C.
2. Haas, Morgan & Hudson Technical Environmental Consulting, L.L.C.
3. Monitoring Solutions, Inc.

Initial CEMS Certification and Ongoing CEMS Audits

The Air Permit and the NSPS regulations in 40 CFR 60 Subpart Da require the installation and operation of a CEMS for NO_x, SO_2, and O_2 or CO_2. The NSPS regulations and Air Permit also require the CEMS to be certified initially and to be audited on an ongoing basis if the system will be used to show future compliance with emission limits.

According to 40 CFR 60 Appendix F, the initial CEMS certification shall be a relative accuracy test audit (RATA). The ongoing CEMS audits must include additional RATAs performed on a quarterly basis. However, a cylinder gas audit may be used for three of the four quarters.

The RATA includes the comparison of CEMS-measured emissions to RM data. Relative accuracy is the absolute mean difference between the CEMS data and the stack test data plus the 2.5 percent error confidence coefficient of the series of tests divided by the mean of the stack test data or the applicable emission limit. The RATA acceptance criteria differ among pollutants. Formulas and sample calculations are provided in the CEMS testing reports.

AIDEA contracted Am Test-Air Quality, L.L.C. (Am Test) to perform the initial CEMS RATA for NO_x, SO_2, and CO_2. Am Test performed the testing on April 14 and 15 and June 16, 1998. The testing included the use of EPA Reference Methods to measure the stack emissions concurrently with the CEMS. The CEMS data were compared with the RM data in order to

calculate the relative accuracy of the CEMS. The calibration drift characteristics of the CEMS were evaluated during the time period June 11 through June 18, 1998, during which time the difference in zero and span values was recorded every 24 hours for the 7 days of the test period. A description of the Am Test Initial RATA is provided in Section 5.0 of Am Test's July 10, 1998, report (Am Test 1998a). The CEMS Initial Certification report was transmitted to EPA on July 13, 1998.

The 1999 Annual CEMS RATA was performed on August 31, 1999, by Haas, Morgan & Hudson Technical Environmental Consulting, L.L.C. (HMH). A description of the 1999 CEMS RATA is provided in Section 3 of HMH's September 28, 1999, report (HMH 1999b). As in the initial RATA, the three pollutants evaluated were NO_x, SO_2, and CO_2. The 1999 Annual CEMS RATA results were also transmitted to EPA.

Performance Evaluation of COMS

The NSPS regulations (40 CFR 60.13) require an initial performance evaluation of the COMS if the COMS data will be used in place of source performance testing and emission compliance demonstration. The performance evaluation must be conducted and the results submitted to EPA prior to the source performance testing.

Monitoring Solutions, Inc. (Monitoring Solutions) conducted the performance evaluation of the COMS on April 14, 1998. A description of the testing is included in Monitoring Solutions' May 1998 report (Monitoring Solutions 1998).

Source Performance Testing and Emission Compliance Demonstration

According to the NSPS regulations in 40 CFR 60.8, source performance testing and compliance demonstration must be conducted within 60 days after the facility reaches the maximum design output or within 180 days after facility startup. Furthermore, as required by the regulations in 40 CFR 60.47a(f), testing of NO_x and SO_2 emissions must be performed during periods of extended operation, which means at least 22 days out of a 30-day period. As stated above, performance testing is accomplished by means of stack testing, and emission compliance is demonstrated by comparing the stack test results to the NSPS emission limits.

The HCCP began coal-fired operations on January 14, 1998. In order to comply with NSPS requirements, source performance testing and emission compliance demonstration were completed by June 17, 1998, which was within 180 days of startup. However, because the facility was still operating under the DTP, it was still experiencing significant shutdowns (both planned and unexpected) and startups and relatively short operational periods. Therefore, NO_x and SO_2 emissions were measured during an operating period that was less than 22 days long. The operating period under which they were measured (June 10 through June 25, 1998) was a 16-day period. Because the 22-day operating period requirement could not be met, the alternate procedures contained in Section 7 of EPA RM 19 were used for the NO_x and SO_2 compliance demonstration, as provided for in 40 CFR 60.46a(h).

The NSPS regulations allow the substitution of COMS opacity data for stack test data to demonstrate compliance as long as the initial performance evaluation of the COMS has been completed satisfactorily. As indicated above, the performance evaluation of the COMS had been completed in April 1998 and subsequently reported to EPA.

Am Test provided a description of the HCCP source performance test performed on June 17, 1998, in Section 5.0 of its July 10, 1998, report (Am Test 1998b). Emissions of PM during the stack test exceeded the HCCP emission limits and did not meet the program goals. Excess PM emissions were attributed to a bag failure in the baghouse (within the SDA system). Therefore, plans were made to repeat the PM test at a later date. The results of the source emission test were transmitted to EPA on July 13, 1998, along with a discussion of the PM emissions and a statement that there would be another test for PM emissions after the baghouse equipment was repaired.

Subsequent to the modification of the baghouse, another source performance test was performed to measure PM emissions. The PM re-test was performed by HMH on March 10 and 11, 1999. A description of this testing is contained in Sections 4, 5, and 6 of HMH's May 18, 1999, report (HMH 1999a). This report was transmitted to EPA on May 21, 1999.

Copies of letters to EPA that transmitted compliance testing results are provided in Appendix A.

Description of TRW Combustor Characterization

The TRW combustor characterization included three series of tests for evaluating the performance of the new technology. During each of the series, air emissions were measured and evaluated. The three series of tests were:

- Test Series 1 - Initial Performance Characterization
- Test Series 2 - Operating Envelope Characterization
- Test Series 3 - Steady-State Operation Characterization.

The TRW combustor characterization was performed primarily over two time periods from May 1998 through May 1999. During 1998, testing was performed over approximately 4 cumulative months during May, July, October, November, and December. During 1999, testing was performed over approximately 2 cumulative months during March, April, and May. Test Series 1, Initial Performance Characterization, was completed in May 1998. During the remainder of 1998 testing, Test Series 2, Operating Envelope Characterization, was 70 percent completed, and Test Series 3, Steady-State Operation Characterization, was 20 percent completed. In 1999, an additional 10 percent of Test Series 2 was completed (bringing the total to 80 percent complete), and an additional 30 percent of Test Series 3 was completed (bringing the total to 50 percent complete). The 90-Day Test provided additional testing for Test Series 3 (TRW 2000).

During the TRW combustor characterization, a total of approximately 33 tests were performed during 77 operational runs in the 1998 and 1999 testing periods. An operational run is an operational period followed by a shutdown period. The shutdown period is an intentional shutdown to inspect the equipment and perform modifications.

During testing in 1998, slag freezing problems within the precombustor affected the ability to sustain operation for long periods of time. Therefore, some equipment adjustments were made that included moving the secondary air from the precombustor mix annulus to the head end of the slagging stage and moving the precombustor mill air to the boiler NO_x port once the boiler is warmed up. These adjustments reduced the slag freezing problems.

In 1999, a few minor modifications were performed to further reduce slag freezing, and a water lance was added to the furnace hopper to mitigate ash accumulation in this region. Ash accumulation at the furnace hopper slope was found to cause pressure spikes due to rapid steam generation when accumulated fly ash/slag fell abruptly into the water-filled slag or ash tank. Additional information is provided in the TRW report (TRW 2000).

Description of 90-Day Test

The 90-Day Test was conducted from August 17 through November 15, 1999. The Harris Group was contracted by AIDEA to evaluate HCCP performance during the 90-Day Test and also to provide a review of the performance of the HCCP over the 2-year DTP. The specific requirements of the 90-Day Test were that:

- the plant generate 91,800 MW-hours of 50 MW per hour power for 90 days at a capacity factor of no less than 85 percent
- the testing period be 90 days
- the unit run on coal representative of what will be supplied for the life of the plant, as specified in the coal contract.

The test was performed using the operating conditions and hardware configurations developed during the TRW combustor characterization.

The Harris Group had an engineer on site during each day of the 90-Day Test to evaluate the operation of the facility relative to meeting the above-described goals. The Harris Group performed full-system reviews several times per day, including evaluations of operations, maintenance, sampling, equipment condition, and control systems. The Harris Group collected and analyzed hourly distributed control system (DCS) data logs, other hourly logs, strip charts, daily emission reports, dispatch logs, and other data during its review of the 90-Day Test. A description of the 90-Day Test is provided in Section 5.0 of the Harris Group's December 1999 report (Harris Group 1999).

Methodology

Numerous methods were utilized in performing the Compliance Testing, the TRW combustor characterization, and the 90-Day Test. Methods used for Compliance Testing were dictated by the Air Permit and by the NSPS regulations contained in 40 CFR 60. The TRW combustor characterization and the 90-Day Test primarily followed methods specified in the DTP. However, additional methods were used by both TRW and the Harris Group.

Compliance Testing Methods

The NSPS regulations require that compliance demonstrations be performed. The demonstrations must utilize EPA Reference Methods, EPA Performance Specifications, and EPA Quality Assurance Procedures, which are contained in 40 CFR 60 Appendices A, B, and F, respectively. Reference Methods are methods of sampling and analyzing an air pollutant, and they are used when conducting source performance testing (stack tests). The Performance Specifications are used to evaluate the acceptability of CEMS data and are to be performed at, or near, the time of CEMS installation. The Quality Assurance Procedures dictate the RATA procedures used in CEMS evaluations.

A list of the Reference Methods and Performance Specifications that were used for the HCCP is provided in Table 4. HCCP stack testing utilized EPA Reference Methods 1, 2, 3A, 4, 5, 6C, 7E, 10, and 19. Reference Methods 1, 2, and 4 were used to determine the physical characteristics of the exhaust gas. The other Reference Methods were used to determine emissions of CO_2, PM, SO_2, NO_x, and CO. The Performance Specifications used to compare Reference Method emissions data and CEMS were Performance Specifications 1, 2, and 3. The evaluation of the COMS was performed using Performance Specification 1.

TRW Combustor Characterization Methods

The methods used by TRW in its testing of the Clean Coal Combustion System were very comprehensive because the HCCP is the first commercial-scale demonstration of the technology. Test Series 1, the Initial Performance Characterization (TRW 2000), was performed in a manner similar to the coal-firing trials held in early 1998. The first run of testing used the operating scenario from the original design. The Initial Performance Characterization continued with additional tests performed while key operating parameters of the combustor system, such as stoichiometry, coal split between combustor stages, and inlet velocities to the slagging stage, were varied. Air emissions were evaluated during each of the runs.

Test Series 2, the Operating-Envelope Characterization, included the introduction of variations in operating parameters on a plant-wide basis (TRW 2000). The test runs included the operating parameters of the Test Series 1 but also added some larger-scale system configuration variations such as adjusting the location of secondary air injection, changing the combustor mixing characteristics, and adjusting the amounts of limestone injection. During the Operating Envelope Characterization, each variable was introduced in a manner that it could be evaluated independently.

Table 4 EPA Reference Methods and Performance Specifications Used for the HCCP (40 CFR 60 Appendices A and B)

Reference Method / Specification Number	Method/Specification Name
Reference Method 1	Sample and Velocity Traverses
Reference Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate
Reference Method 3A	Determination of CO_2 and O_2 Emissions
Reference Method 4	Determination of Moisture Content of Stack Gases
Reference Method 5	Determination of Particulate Emissions
Reference Method 6C	Determination of SO_2 Emissions
Reference Method 7E	Determination of NO_x Emissions
Reference Method 10	Determination of CO Emissions
Reference Method 19	Determination of SO_2 Removal Efficiency and Particulate SO_2 and NO_x Emission Rates
Performance Specification 1	Specifications and Test Procedures for Opacity CEMS (COMS)
Performance Specification 2	Specifications and Test Procedures for SO_2 and NO_x CEMS
Performance Specification 3	Specifications and Test Procedures for O_2 and CO_2 CEMS

Test Series 3, the Steady-State Characterization, was performed using a single set of operating conditions in a longer test run (TRW 2000). The purpose was to show that the longer run could be used to determine the commercial viability of that set of conditions.

The 90-Day Test, which was very similar to Test Series 3 of the TRW combustor characterization, replaced some of the steady-state characterization testing.

The TRW methodology is described in Section 5.0 - Test Procedures of the TRW Topical Report on combustion system operation (TRW 2000).

During the TRW combustor characterization, air emissions were measured by the CEMS. However, the early portions of the TRW combustor characterization were performed prior to certification of the CEMS.

90-Day Test Methods

The Harris Group observed and evaluated the 90-Day Test and had an engineer on site for at least 10 hours of each day of the test. The methods that were used are described in the report by the Harris Group report on the 90-Day Test (Harris Group 1999). On-site activities included several "walk downs" of the facility each day, where the engineer noted operations, maintenance, sampling procedures, and condition of equipment and instrumentation. The on-site engineer also evaluated control room operations for several hours each day. Considerable data were also collected and analyzed.

During the 90-Day Test, air emissions were measured by the CEMS.

Additional DTP components were also evaluated by the Harris Group. These components included boiler testing, SDA testing, CEMS RATA, turbine testing, coal sampling, and combustor test operations. The evaluation of these other DTP components assisted the Harris Group in it's evaluation of the 90-Day Test and it's assessment of the commercial viability of the HCCP.

Results

Air emission evaluations accomplished during the DTP Compliance Testing, TRW combustor characterization, and 90-Day Test demonstrated compliance with NSPS requirements and Air Permit limits. The more stringent DTP emission goals were also met.

Compliance Testing

The results of the initial CEMS certification, the ongoing CEMS audits, and the performance evaluation of the COMS, are contained in the Am Test, HMH, and Monitoring Solutions reports (Am Test 1998a, HMH 1999b, Monitoring Solutions 1998). The results of the source performance testing and the emission compliance demonstration are contained in the reports prepared by Am Test and HMH summarizing the HCCP stack tests (Am Test 1998b, HMH 1999a). The CEMS data, the COMS data, and the stack test data are also summarized below.

Initial CEMS RATA and 1999 Annual CEMS RATA

The initial CEMS certification was performed on April 14 and 15 and June 16, 1998. The best nine of twelve runs were used to calculate the accuracy of measurements of CO_2, SO_2, and NO_x. The NSPS requirements contained in Subpart Da do not include continuous monitoring of CO emissions or a CO emission limit; however, the HCCP Air Permit limits CO emissions. The relative accuracy and calibration drift data are summarized in Table 5.

Table 5 Initial CEMS Certification Results

Pollutant	**Relative Accuracy % and % Difference**	**NSPS Requirement**	**Maximum Zero Drift and Maximum Calibration Drift % of Span**	**NSPS Requirement**
CO_2	0.8% 0.1%	20% of RM [1] mean or 1% of CO_2 difference	0.06 0.39	0.5% difference
SO_2	65.9% 0.004%	20% of RM mean or 20% of emission standard	0.02 0.36	2.5% of span
NO_x	12.8% 0.034%	20% of RM mean or 10% of emission standard	0.00 1.46	2.5% of span

Source: Am Test 1998a

1. RM is the air emissions data determined by EPA Reference Methods

With respect to the 40 CFR 60 Performance Specifications, the HCCP CEMS meets the acceptable standard. These results are also summarized on page 6 of the Am Test July 10, 1998, report (Am Test 1998a).

The 1999 annual RATA was performed by HMH on August 31, 1999. The results of the RATA are presented below in Table 6. The requirements of the annual RATA were met by the HCCP CEMS.

Table 6 Results of 1999 Annual CEMS RATA

Pollutant	Relative Accuracy %	NSPS Requirement
CO_2	1.3%	20% of RM [1] mean
SO_2	5.6%	10% of emission standard
NOx	0.02%	20% of RM mean

Source: HMH 1999b

1 - RM is the air emissions data determined by EPA Reference Methods

Performance Evaluation of COMS

The performance evaluation of the COMS was performed on April 14, 1998, by Monitoring Solutions. The COMS equipment used to monitor opacity is the CEMOP-281. A total of 20 runs were performed during which the CEMOP measurements were calibrated using calibration attenuators as described by EPA Performance Specification Number 1 (40 CFR 60 Appendix B). The CEMOP-281 met the NSPS regulatory requirements. Additional information regarding the results is in Monitoring Solution's May 1998 report (Monitoring Solutions 1998).

Appendices B, C, and D contain summary data tables from the three reports prepared by Am-Test, HMH, and Monitoring Systems, respectively (Am Test 1998a, HMH 1999b, Monitoring Solutions 1998).

Source Performance Testing and Emission Compliance Demonstration

The HCCP source performance test (stack test) was performed on June 17, 1998, by Am Test. With the exception of PM emissions, all emissions measured during the June 17, 1998, stack test were below NSPS emission limits and Air Permit emission limits. Furthermore, all pollutants except PM also met the emission limit goals of the DTP. On March 10 and March 11, 1999, the PM test was performed again by HMH. PM emissions during the HMH stack test were well below the NSPS emission limit and the Air Permit emission limit. The PM emissions also met the emission limit goals of the DTP (HMH 1999a). Stack test results are summarized in Table 7. Appendices E and F include summary tables from the reports prepared by Am Test and HMH, respectively (Am Test 1998b, HMH 1999a).

Table 7 HCCP Stack Test Summary of Results [1]

Test Date	PM	NO_x	SO_2	CO
June 17, 1998	0.033 lb/MMBtu 24.56 lb/hr	0.260 lb/MMBtu 191.5 lb/hr 175.8 ppm	0.010 lb/MMBtu 7.68 lb/hr 5.1 ppm	0.0005 lb/MMBtu 0.399 lb/hr 0.6 ppm
March 10-11, 1999	0.0047 lb/MMBTU 4.172 lb/hr	Data not collected	Data not collected	Data not collected

Sources: Am Test 1998b , HMH 1999a

1. measurements shown in the table are averages of three test runs

Results of the TRW Combustor Characterization

The TRW combustor characterization demonstrated that the Clean Coal Combustion System could effectively achieve low NO_x, CO, and SO_2 emissions along with high carbon burnout, high combustion efficiency, high slag recovery, and excellent slagging characteristics. All goals could be met while burning both run of mine (ROM) and ROM/waste coal blends. The carbon burnout was 99.7 percent during both 1998 and 1999 test periods. Slag recovery was an average of 80 to 85 percent during 1998 and 81 percent during 1999 testing, with less than 5 percent bottom ash for both time periods. The slagging characteristics were classified as excellent during both 1998 and 1999 testing. The overall results of the TRW combustor characterization are summarized in the TRW Topical Report (TRW 2000), Table 1, which is provided here in Appendix G.

Air emissions levels, as measured by the CEMS, during the time period June 12 through December 21, 1998, (excluding periods of oil-fired operation) were lower than Air Permit emission limits and NSPS emission limits and also surpassed all DTP program goals. During the time period April 23 through June 30, 1999, the air emissions also met all emission limits and DTP program goals. Table 8 summarizes the 1998 and 1999 typical emissions.

Table 8 Typical Air Emission Levels for TRW Combustor Characterization 1998 and 1999 Time Periods

Date(s)	NO_x Emissions	SO_2 Emissions	CO Emissions
June 12 - December 21,1998	0.245 lb/MMBtu, 30-day average	0.036 lb/MMBtu, 30-minute average 15 ppm at 3% O_2 25 lb/hr	0.038 lb/MMBtu, 30-minute average 30 to 40 ppm at 3% O_2
April 23 - June 30, 1999	0.247 lb/MMBtu, steady-state average 0.261 lb/MMBTU, 30-day average [1]	0.040 lb/MMBtu, 30-minute average	0.077 lb/MMBtu, 30-minute average

Source: TRW 2000

1. Due to the relatively short time period evaluated during 1999, the 30-day average is not an accurate reflection of the steady-state average. Therefore, both the 30-day average and steady-state average are provided.

Results of the 90-Day Test

The results of the 90-Day Test were as follows:

- 102,373 MW-hours of power were generated at a capacity factor of 94.79 percent over 90 days.

- The test was run with coal representative of that which will be supplied for the life of the plant.

The actual average heating value of the coal blend used during the 90-Day Test was 7,194 Btu/lb. The blend consisted of 17 percent ROM coal and 83 percent waste coal. Of the 83 percent waste, 57.1 percent consisted of fines and 42.9 percent was regular waste. This large amount of waste coal created an uncontrolled variability in the Btu content of the mixture used in the test since the Btu content of waste coal can range from 5,000 to 9,000 Btu/lb. Overall, the Btu content of the coal used during the test was representative of the coals that will be supplied over the life of the project (AIDEA 2000).

Emissions were measured by the CEMS during the 90-Day Test. Air Permit emission limits and NSPS limits were met, with the exception of five SO_2 emission exceedances and two PM exceedances. SO_2 emission exceedances occurred on August 19, August 28, September 7, September 11 and November 11, 1999. Two of the exceedances (September 7 and September

11) were due to start-up conditions, two (August 19 and September 28) were due to equipment maintenance, and the remaining one (November 11) was due to an equipment malfunction. All SO_2 emission exceedances were exceedances of the 3-hour permit limit, and the average of the five exceedances (0.074 lb/MMBtu) was less than the yearly emission limit (0.086 lb/MMBtu). The total period of SO_2 exceedances was less than 2 percent of the time. Opacity exceedances occurred on September 7 and September 11, 1999. Both opacity exceedances were due to plant startup. Appendix H contains graphs of NO_x emissions and SO_2 emissions during the 90-Day Test. The NO_x NSPS limits and Air Permit limits were met throughout the test duration. Additional information regarding the results of the 90-Day Test is provided in the Harris Group report (Harris Group 1999).

Conclusions

This report documents the results of selected environmental compliance testing for the HCCP Demonstration Test Program, namely that related to air emission monitoring and the demonstration of compliance with air quality permit limits and program goals. The air emission results described in the report demonstrate that the TRW Clean Coal Combustion System and the SDA System have the ability to maintain air emissions at levels below both the NSPS limits and the Air Permit limits and, furthermore, have the ability to meet the more stringent DTP emission goals.

The Compliance Testing task of the DTP demonstrated that air emissions were in compliance with NSPS requirements and Air Permit limits for all parameters and that the emissions also satisfied the DTP emissions goals. The Compliance Testing task also certified the acceptability of the CEMS and the COMS for use in long-term monitoring of emissions from the HCCP stack. This certification will continue to be verified through comparisons of CEMS and COMS data with periodic stack test results. Stack testing quantified emissions as follows.

- PM emissions were 0.0047 lb/MMBtu. The PM NSPS emission limit, Air Permit limit, and DTP emission goal, are 0.03, 0.02, and 0.015 lb/MMBtu, respectively.

- NO_x emissions were 0.260 lb/MMBtu. The NSPS limit for NO_x is 0.5 lb/MMBtu, the Air Permit limit is 0.350 lb/ MMBtu, and the DTP emission goal is 0.20 to 0.350 lb/MMBtu.

- SO_2 emissions were 0.010 lb/MMBtu. The most stringent Air Permit limit is 0.086 lb/MMBtu.

- The CO emissions were 0.6 ppm. The Air Permit limit and DTP emission goal are 202 and 206 ppm, respectively.

The TRW combustor characterization was a three-stage trial of varying operating conditions that consistently resulted in HCCP operations that met NSPS and Air Permit regulatory limits and could also meet the more rigorous DTP emission goals. The TRW combustor characterization demonstrated that the HCCP could achieve low NO_x, CO, and SO_2 emissions, as well as high carbon burnout, high combustion efficiency, high slag recovery, and excellent slagging characteristics. Considering that the HCCP is the first full-scale demonstration of this technology and that the facility has just completed the start-up program, it is apparent that the HCCP adequately demonstrates technical viability.

The 90-Day Test was essentially a continuation of testing at the “optimal” conditions established under the TRW combustor characterization. Air emissions data collected throughout the 90-Day Test were well within the NSPS and Air Permit limits, with only a few SO_2 and PM exceedance incidents related to plant startup and equipment malfunction or maintenance episodes.

The HCCP integrated technologies successfully maintained air emissions below Air Permit limits, NSPS limits, and DTP emission goals. In general, the air emissions testing components of the Compliance Monitoring, TRW combustor characterization, and 90-Day Test tasks of the DTP have been satisfactorily accomplished.

References

1. Alaska Industrial Development and Export Authority. 2000. Comments on Harris Group Report, Independent Engineer's Review of HCCP 90-Day Test and Determination of Sustained Operations, provided to DOE in draft format. March 2000.

2. Am Test-Air Quality, L.L.C. 1998a. Continuous Emissions Monitor Initial Certification Performance Specification Test. July 10, 1998.

3. Am Test-Air Quality, L.L.C. 1998b. HCCP Stack Initial Performance Test. July 10, 1998.

4. Haas, Morgan, & Hudson 1999a. Particulate Emissions Testing Program. May 18, 1999.

5. Haas, Morgan, & Hudson 1999b. Continuous Emission Monitoring System 1999 Annual Relative Accuracy Test Audit. September 28, 1999.

6. Harris Group, Inc. 1999. Independent Engineer's Review of HCCP 90 Day Test and Determination of Sustained Operations. December 1999.

7. Monitoring Solutions, Inc. 1998. CEMOP-281 Opacity System EPA Certification Tests. May 1998.

8. Stone & Webster Engineering Corporation and Steigers Corporation 1998. HCCP Demonstration Test Program. July 1998.

9. TRW 2000. Healy Clean Coal Project Demonstration Test Program, Topical Report: Combustion System Operation. March 31, 2000.

Acronyms and Abbreviations

AIDEA	Alaska Industrial Development and Export Authority
ADEC	Alaska Department of Environmental Conservation
B&W	Babcock and Wilcox
Btu	British Thermal Unit
CCT	Clean Coal Technology
CEMS	Continuous Emission Monitoring System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COMS	Continuous Opacity Monitoring System
DCS	Distributed Control System
DOE	U.S. Department of Energy
DTP	Demonstration Test Program
EPA	U.S. Environmental Protection Agency
GVEA	Golden Valley Electric Association
HMH	Haas, Morgan & Hudson
HCCP	Healy Clean Coal Project
IE	Independent Engineer
MMBtu	Million Brittish Thermal Units
MW	Megawatt
NO_x	Oxides of Nitrogen
NSPS	New Source Performance Standards
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 um in diameter
ppm	Parts per Million
RATA	Relative Accuracy Test Audit
RM	Reference Method
ROM	Run of Mine
SDA	Spray Dryer Adsorber
SO_2	Sulfur Dioxide

APPENDIX A
EPA Transmittal Letters

ALASKA INDUSTRIAL DEVELOPMENT
AND EXPORT AUTHORITY

ALASKA ENERGY AUTHORITY

480 WEST TUDOR ANCHORAGE, ALASKA 99503 907 / 269-3000 FAX 907 / 269-3044

July 13, 1998

Ms. Anita Frankel, Director
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington, 98101-3188

Subject: Initial Performance Test Results for New Source Performance Standards
Healy Clean Coal Project

Dear Ms. Frankel:

The Alaska Industrial Development and Export Authority (AIDEA) is hereby submitting the New Source Performance Standards (NSPS) initial performance test data and supporting information for the Healy Clean Coal Project (HCCP) coal-fired electric utility steam generating unit and the oil-fired support boiler Auxiliary No. 2 (Aux #2), located at the Golden Valley Electric Association, Inc.'s (GVEA) Healy facility. The HCCP is a demonstration project that is cost-shared by the U.S. Department of Energy (DOE) and AIDEA under the Clean Coal Technology (CCT) Program. The goal of the CCT Program is to demonstrate advanced coal utilization technologies that are more energy efficient and reliable, and achieve substantial reductions in emissions as compared with existing coal technologies. The HCCP is subject to 40 CFR 60 Subpart Da requirements, and support boiler Aux #2 is subject to Subpart Dc requirements.

HCCP Operational Status

The HCCP demonstrates the combined removal of sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter using advanced integrated combustion and flue gas cleanup technologies. The HCCP first began firing coal on January 14, 1998. This marked the beginning of the Demonstration Test Program, a 1-year DOE funded program during which the HCCP technologies will be tested over a wide range of operating conditions to characterize the operating envelope for each major subsystem. Each subsystem will be also be tuned for optimum efficiency and environmental performance. This Demonstration Test Program is a more substantial and prolonged test program than would normally occur at a commercial facility that undergoes startup testing, and this has ramifications for the initial NSPS performance testing.

It would be typical and logical to conduct the initial NSPS performance tests after the integrated HCCP system has been optimized for routine operations (which is scheduled for early 1999). However, the NSPS requirements call for the initial performance tests to be conducted "within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup." Startup is defined in the context of the NSPS regulations as "the setting in operation of an affected facility for any purpose." Therefore, this requirement has necessitated that the initial NSPS performance tests be conducted during HCCP's Demonstration Test Program.

During the Demonstration Test Program the HCCP is brought online and offline regularly, as equipment is tested, examined, cleaned, and optimized. In addition, there are unscheduled outages because of minor equipment problems. The net result is that the HCCP has not operated for the extended periods of time (at least 22 days out of a 30-day period) that are required for the initial NSPS SO_2 and NO_x performance tests under 40 CFR 60.47a(f). The emission maintaining system has been in operation throughout this time.

Therefore, the data submitted herein for the initial NSPS SO_2 and NO_x performance tests for the HCCP are based on 16 days of representative operating data, from June 10 through June 25, 1998. The manual Method 5 particulate matter initial performance test, and manual Method 6c, 7e, and 10 SO_2, NO_x, and CO tests were conducted on June 17, 1998, also within this representative 16-day period. Because the data requirements of 40 CFR 60.47a(f) cannot be met, the alternate procedures described in Section 7 of Method 19 were used to demonstrate compliance with the NSPS emission limits, as provided for in 40 CFR 60.46a(h).

NSPS Initial Performance Test Results

The data submitted herein includes the following:

Attachment	Regulatory Requirement	Emission Unit	Contents
Tab 1		HCCP	Opacity Certification
	40 CFR 60.13	HCCP	CEM Certification
Tab 2	40 CFR 60.8 and Subpart Da	HCCP	Initial Performance Test for PM and Opacity (Report also includes stack test results for SO_2, NO_x, and CO)
	40 CFR 60 Subpart Da	HCCP	Initial Performance Test for SO_2 and NO_x Method 19, Section 7
Tab 3	40 CFR 60 Subpart Dc	Aux #2	Initial Performance Test for Particulate Matter and Opacity

Based on these data, the HCCP and Aux #2 meet all NSPS emission requirements with one exception. The HCCP did not meet the NSPS particulate matter emission requirement of 0.03 lb/MMBtu, as the performance test results were 0.033 lb/MMBtu. However, the NSPS opacity requirement was met, as the unit operates at less than 4% opacity. The initially identified cause of this higher than normal emission rate for particulate matter is failure of one or more bags in the baghouse. The vendor (Babcock & Wilcox Company) is currently investigating the situation. AIDEA proposes that the cause of the bag failures be identified and corrective actions taken within the next 6 months, at which time particulate emission rates will be re-tested using Method 5 and the results submitted to EPA.

In general the HCCP technology is operating remarkably well, but the startup of the plant has not been without challenges. We continue to endeavor to make all parts of the plant operable to demonstrate that these new, innovative technologies can burn coal as cleanly as possible.

If you have questions or require additional information, please do not hesitate to call me at (907) 269-3025, Mr. Clive Herrington, HCCP Startup Supervisor, at (907) 683-3000, or Ms. Kate Lamal, GVEA Environmental Officer, at (907) 451-5645.

Sincerely,

DVMc Crohan

Dennis V. McCrohan, P.E.
Deputy Director – Project Development and Operations

cc: Clive Herrington, AIDEA (2)
Kate Lamal, GVEA (2)
Bob Cannone, ADEC
William Steigers, Steigers Corporation
AIDEA (2)

ALASKA INDUSTRIAL DEVELOPMENT
AND EXPORT AUTHORITY

ALASKA ENERGY AUTHORITY

480 WEST TUDOR ANCHORAGE, ALASKA 99503 907 / 269-3000 FAX 907 / 269-3044

May 21, 1999

Ms. Anita Frankel
Director
U.S. Environmental Protection Agency
1200 Sixth Avenue (OAQ-107)
Seattle, Washington 98101-3188

Subject: Particulate Performance Test Results
for New Source Performance Standards
Healy Clean Coal Project

Dear Ms. Frankel:

The Alaska Industrial Development and Export Authority (AIDEA) is owner of the Healy Clean Coal Project (HCCP) and is hereby submitting the New Source Performance Standards (NSPS) particulate performance test data and supporting information for the HCCP coal-fired electric utility steam generating unit, located at the Golden Valley Electric Association, Inc.'s (GVEA) Healy facility. As you may recall, AIDEA submitted the initial performance test results on July 13, 1998. The HCCP met all Subpart Da NSPS emissions requirements with the sole exception of the particulate matter emission requirement of 0.03 lb/MMBtu (the performance test results were 0.033 lb/MMBtu). The identified cause of the higher than normal emission rate for particulate matter was failure of one or more bags in the baghouse. The vendor (Babcock & Wilcox Company) investigated the situation and a baffle system was installed in each baghouse during December 1998 to smooth the air flow and prevent the rupture and tearing of bags. The baghouse has been operating well since the baffling system was installed.

The HCCP was re-tested on March 10 and 11, 1999, for particulate matter emissions, and the test report is attached. The mean measured particulate matter emission rate is 0.0047 lbs/MMBtu, which is significantly lower than the applicable NSPS emission limit of 0.03 lbs/MMbtu. Therefore, compliance with the NSPS standards has been achieved. The testing data was obtained in accordance with approved methods and procedures contained in 40 CFR Part 60 and are representative of plant performance. Of the three separate runs comprising the performance test, one run was invalidated because of failure of the testing equipment (the filter support). AIDEA hereby requests EPA approve the use of the arithmetic mean of the other two runs to determine compliance (the results from the two valid runs are very consistent and both well below the applicable NSPS emission limit).

If you have questions or require additional information, please do not hesitate to call me at (907) 269-3025, Mr. Clive Herrington, HCCP Startup Supervisor, at (907) 683-3000, or Ms. Kate Lamal, GVEA Environmental Officer, at (907) 451-5645.

Sincerely,

Dennis V. McCrohan

Dennis V. McCrohan, P.E.
Deputy Director - Project Development and Operations

DVM/sd
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Attachments

cc: Clive V. Herrington, HCCP Startup Supervisor
Kate Lamal, GVEA
Bob Cannone, ADEC
William Steigers, Steigers Corporation

APPENDIX B
Tables from CEMS Initial Certification Test

Am Test Report:
CEMS Initial Certification Performance Specification Test

Individual Data Sheets for CO_2, SO_2, and NO_x
and
"Summary of Performance Specification Test"

AM TEST
AIR QUALITY, LLC

40 CFR 60
RELATIVE ACCURACY TEST
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\98-046WD\RATA\%CO2wet
CLIENT:	AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION:	Healy, Alaska
MONITOR LOCATION:	Unit #2
MONITOR DESCRIPTION:	California Analytical Model ZRH1 Carbon Dioxide (CO_2) Analyzer
DATE OF TEST:	April 14-15, 1998

TEST #	CLOCK TIME	REFERENCE METHOD CO_2 % wet	CEMS READINGS CO_2 % wet	DIFFERENCES Xi	Xi^2
1	2107-2128	12.3	12.2	0.1	0.01
2	2145-2205	12.0	12.1	-0.1	0.01
4	2310-2330	12.3	12.4	-0.1	0.01
6	0254-0315	12.2	12.3	-0.1	0.01
7	0335-0355	12.4	12.4	0.0	0.00
8	0415-0435	12.0	12.0	0.0	0.00
9	0455-0516	12.3	12.2	0.1	0.01
10	0637-0657	12.1	12.2	-0.1	0.01
12	0753-0813	12.6	12.7	-0.1	0.01
ARITHMETIC MEAN:		12.24	12.28	-0.03	
SUM OF THE SQUARED DIFFERENCES:					0.070
SUM OF THE DIFFERENCES SQUARED:				0.090	

CONFIDENCE COEFFICIENT:	0.07 % CO_2, wet
RELATIVE ACCURACY:	0.8 % of reference method mean
MAXIMUM DIFFERENCE DURING RATA:	0.1 % CO_2, wet
40 CFR 60 SPECIFICATION: (Appendix B, Performance Spec. 3, Section 2.3)	< or = 20% of reference method mean or 1% carbon dioxide difference

Runs 3, 11, and 13 were rejected.

AM TEST
AIR QUALITY, LLC

24-HOUR ZERO AND CALIBRATION DRIFT TEST
AM TEST-AIR QUALITY, LLC

FILE NAME: JAA\98-081WD\CALDRIFT\CO2
CLIENT: AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION: Healy, Alaska
MONITOR LOCATION: Unit #2
MONITOR DESCRIPTION: California Analytical Model ZRH1
Carbon Dioxide (CO_2) Analyzer
INSTRUMENT SPAN: 20 % CO_2

ZERO (LOW-LEVEL) DRIFT (% Carbon Dioxide)

DATE	TIME	CALIBRATION VALUE (%)	MONITOR READING (%)	ABSOLUTE DIFFERENCE (%)
6/11/98	1018	0.00	-0.02	0.02
6/12/98	0455	0.00	-0.04	0.04
6/13/98	0455	0.00	-0.06	0.06
6/14/98	0455	0.00	-0.05	0.05
6/15/98	0455	0.00	-0.05	0.05
6/16/98	0455	0.00	-0.02	0.02
6/17/98	0455	0.00	-0.02	0.02
6/18/98	0455	0.00	-0.02	0.02

SPAN (HIGH-LEVEL) DRIFT (% Carbon Dioxide)

DATE	TIME	CALIBRATION VALUE (%)	MONITOR READING (%)	ABSOLUTE DIFFERENCE (%)
6/11/98	1050	17.90	18.04	0.14
6/12/98	0510	17.90	18.15	0.25
6/13/98	0510	17.90	18.10	0.20
6/14/98	0510	17.90	18.29	0.39
6/15/98	0510	17.90	18.18	0.28
6/16/98	0510	17.90	17.93	0.03
6/17/98	0510	17.90	17.75	0.15
6/18/98	0510	17.90	17.58	0.32

CRITERIA: 24-hour drift should not exceed 0.5% CO_2 difference.

AMTEST
AIR QUALITY, LLC

40 CFR 60
RELATIVE ACCURACY TEST
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\98-046WD\RATA\SO2lbMMBtu
CLIENT:	AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION:	Healy, Alaska
MONITOR LOCATION:	Unit #2
MONITOR DESCRIPTION:	TECO Model 43B Sulfur Dioxide (SO_2) Analyzer
DATE OF TESTS:	April 14-15, 1998

TEST #	CLOCK TIME	REFERENCE METHOD SO_2 lb/MMBtu	CEMS READINGS SO_2 lb/MMBtu	DIFFERENCES Xi	Xi^2
1	2107-2128	0.0023	0.0056	-0.0033	0.0000109
2	2145-2205	0.0058	0.0053	0.0005	0.0000003
3	2227-2247	0.0011	0.0036	-0.0025	0.0000063
4	2310-2330	0.0033	0.0032	0.0001	0.0000000
7	0335-0355	0.0132	0.0161	-0.0029	0.0000084
8	0415-0435	0.0089	0.0113	-0.0024	0.0000058
9	0455-0516	0.0081	0.0107	-0.0026	0.0000068
12	0753-0813	0.0090	0.0154	-0.0064	0.0000410
13	0831-0851	0.0058	0.0099	-0.0041	0.0000168
ARITHMETIC MEAN:		0.0064	0.0090	-0.0026	
SUM OF THE SQUARED DIFFERENCES:					0.0000961
SUM OF THE DIFFERENCES SQUARED:				0.00056	

CONFIDENCE COEFFICIENT:	0.0016 lb/MMBtu SO_2
RELATIVE ACCURACY:	65.9 % of reference method mean
RELATIVE ACCURACY:	0.0042 lb/MMBtu SO_2
40 CFR 60 SPECIFICATION: (Appendix B, Performance Spec. 3, Section 4.3)	< or = 20% of reference method mean or < or = 20% of the emission standard of 0.086 lb/MMBtu = 0.0172 lb/MMBtu SO_2

Runs 6, 10, and 11 were rejected.

AMTEST
AIR QUALITY, LLC

24-HOUR ZERO AND CALIBRATION DRIFT TEST
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\98-081WD\CALDRIFT\SO2
CLIENT:	AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION:	Healy, Alaska
MONITOR LOCATION:	Unit #2
MONITOR DESCRIPTION:	TECO Model 43B
	Sulfur Dioxide (SO_2) Analyzer
INSTRUMENT SPAN:	750 ppm Sulfur Dioxide

ZERO (LOW-LEVEL) DRIFT (ppm Sulfur Dioxide)

DATE	TIME	CALIBRATION VALUE ppm	MONITOR READING ppm	ABSOLUTE DIFFERENCE ppm	PERCENT OF SPAN
6/11/98	1018	0.00	0.11	0.11	0.01
6/12/98	0455	0.00	0.16	0.16	0.02
6/13/98	0455	0.00	0.05	0.05	0.01
6/14/98	0455	0.00	0.00	0.00	0.00
6/15/98	0455	0.00	0.00	0.00	0.00
6/16/98	0455	0.00	0.11	0.11	0.01
6/17/98	0455	0.00	0.05	0.05	0.01
6/18/98	0455	0.00	0.16	0.16	0.02

SPAN (HIGH-LEVEL) DRIFT (ppm Sulfur Dioxide)

DATE	TIME	CALIBRATION VALUE ppm	MONITOR READING ppm	ABSOLUTE DIFFERENCE ppm	PERCENT OF SPAN
6/11/98	1050	136.00	137.55	1.55	0.21
6/12/98	0510	136.00	137.79	1.79	0.24
6/13/98	0510	136.00	137.40	1.40	0.19
6/14/98	0510	136.00	138.67	2.67	0.36
6/15/98	0510	136.00	138.02	2.02	0.27
6/16/98	0510	136.00	136.39	0.39	0.05
6/17/98	0510	136.00	134.75	1.25	0.17
6/18/98	0510	136.00	133.45	2.55	0.34

CRITERIA: 2.5% of span.

AMTEST
AIR QUALITY, LLC

40 CFR 60
RELATIVE ACCURACY TEST
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\98-046WD\RATA\NOxlbMMBtu
CLIENT:	AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION:	Healy, Alaska
MONITOR LOCATION:	Unit #2
MONITOR DESCRIPTION:	TECO Model 42D Nitrogen Oxides (NO_x) Analyzer
DATE OF TESTS:	April 14-15, 1998

TEST #	CLOCK TIME	REFERENCE METHOD NO_x lb/MMBtu	CEMS READINGS NO_x lb/MMBtu	DIFFERENCES Xi	Xi^2
1	0902-0922	0.270	0.239	0.031	0.00096
2	0939-0959	0.262	0.232	0.030	0.00090
3	1014-1034	0.265	0.229	0.036	0.00130
4	1059-1119	0.264	0.237	0.027	0.00073
5	1134-1154	0.265	0.230	0.035	0.00123
6	1207-1227	0.261	0.231	0.030	0.00090
8	1316-1336	0.258	0.229	0.029	0.00084
10	1423-1443	0.258	0.225	0.033	0.00109
12	1526-1546	0.263	0.231	0.032	0.00102
ARITHMETIC MEAN:		0.2629	0.2314	0.0314	
SUM OF THE SQUARED DIFFERENCES:					0.00897
SUM OF THE DIFFERENCES SQUARED:				0.08009	

CONFIDENCE COEFFICIENT:	0.0022 lb/MMBtu NO_x
RELATIVE ACCURACY:	12.8 % of reference method mean
RELATIVE ACCURACY:	0.0337 lb/MMBtu NO_x
40 CFR 60 SPECIFICATION: (Appendix B, Performance Spec. 3, Section 4.3)	< or = 20% of reference method mean or < or = 10% of the emission standard of 0.350 lb/MMBtu = 0.035 lb/MMBtu NO_x

Runs 7, 9, and 11 were rejected.

AMTEST
AIR QUALITY, LLC

24-HOUR ZERO AND CALIBRATION DRIFT TEST
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\98-081WD\CALDRIFT\NOx
CLIENT:	AIDEA @ Healy Clean Coal Project (HCCP)
LOCATION:	Healy, Alaska
MONITOR LOCATION:	Unit #2
MONITOR DESCRIPTION:	TECO Model 42D Nitrogen Oxides (NO_x) Analyzer
INSTRUMENT SPAN:	750 ppm Nitrogen Oxides

ZERO (LOW-LEVEL) DRIFT (ppm Nitrogen Oxides)

DATE	TIME	CALIBRATION VALUE ppm	MONITOR READING ppm	ABSOLUTE DIFFERENCE ppm	PERCENT OF SPAN
6/11/98	1018	0.00	0.00	0.00	0.00
6/12/98	0455	0.00	0.00	0.00	0.00
6/13/98	0455	0.00	0.00	0.00	0.00
6/14/98	0455	0.00	0.00	0.00	0.00
6/15/98	0455	0.00	0.00	0.00	0.00
6/16/98	0455	0.00	0.00	0.00	0.00
6/17/98	0455	0.00	0.00	0.00	0.00
6/18/98	0455	0.00	0.00	0.00	0.00

SPAN (HIGH-LEVEL) DRIFT (ppm Nitrogen Oxides)

DATE	TIME	CALIBRATION VALUE ppm	MONITOR READING ppm	ABSOLUTE DIFFERENCE ppm	PERCENT OF SPAN
6/11/98	1050	366.00	369.35	3.35	0.45
6/12/98	0510	366.00	371.55	5.55	0.74
6/13/98	0510	366.00	371.43	5.43	0.72
6/14/98	0510	366.00	376.95	10.95	1.46
6/15/98	0510	366.00	373.96	7.96	1.06
6/16/98	0510	366.00	368.21	2.21	0.29
6/17/98	0510	366.00	365.99	0.01	0.00
6/18/98	0510	366.00	360.38	5.62	0.75

CRITERIA: 2.5% of span.

Summary of Performance Specification Test (PST) Results

AIDEA @ Healy Clean Coal Project (HCCP)
Golden Valley Electric Association
Healy, Alaska
HCCP Stack
April 14-15 and June 11-18, 1998

	HCCP CEMS	*40 CFR 60 Specification*
Carbon Dioxide (CO_2) (% wet)		
Relative Accuracy (%)	0.8	*20%*
Relative Accuracy (% difference)	0.1	*1%*
Maximum Zero Drift (% difference)	0.06	*0.5% difference*
Maximum Calibration Drift (% difference)	0.39	*0.5% difference*
Sulfur Dioxide (SO_2) (lb/MMBtu)		
Relative Accuracy (%)	65.9	*20%*
Relative Accuracy (lb/MMBtu difference)	0.004	*20% of standard*
Maximum Zero Drift (% of span)	0.02	*2.5% of span*
Maximum Calibration Drift (% of span)	0.36	*2.5% of span*
Nitrogen Oxides (NO_x) (lb/MMBtu)		
Relative Accuracy (%)	12.8	*20%*
Relative Accuracy (lb/MMBtu difference)	0.034	*10% of standard*
Maximum Zero Drift (% of span)	0.00	*2.5% of span*
Maximum Calibration Drift (% of span)	1.46	*2.5% of span*

APPENDIX C
Tables from CEMS 1999 Annual RATA

HRH Report:
HCCP CEMS 1999 Annual RATA

Individual Data Sheets for NO_x, SO_2, and CO_2
and
Summary of Results

Summary Results Table

NO_x

Run #	Time	RM NO_x ppm (wet)	RM CO_2 % (wet)	RM Emission Rate lbs/MMBTU	HCCP CEM Emission Rate lbs/MMBTU	Diff.
1*	1205-1227	154.1	12.3	~~0.289~~	~~0.271~~	~~-0.018~~
2	1256-1318	155.4	12.2	0.273	0.263	-0.010
3	1347-1409	152.5	12.1	0.272	0.262	-0.010
4	1434-1456	146.4	12.1	0.259	0.263	0.004
5	1526-1548	147.88	12.1	0.263	0.267	0.004
6*	1610-1632	149.5	12.1	~~0.285~~	~~0.268~~	~~-0.017~~
7	1658-1720	152.3	12.1	0.270	0.274	0.004
8*	1741-1803	149.2	12.2	~~0.283~~	~~0.266~~	~~-0.017~~
9	1830-1852	151.3	12.1	0.269	0.271	0.002
10	1911-1933	153.6	12.1	0.273	0.276	0.003
11	2000-2022	153.2	12.3	0.268	0.271	0.002
12	2042-2104	153.8	12.3	0.269	0.274	0.005

Mean of RM Tests	**0.268 lbs/MMBTU**
Mean Difference	**-0.0004 lbs/MMBTU**
Std. Deviation of the Difference	**0.006 lbs/MMBTU**
2.5 % Error Confidence Coefficient	**0.005 lbs/MMBTU**
Relative Accuracy	**0.02 % RA**

* In accordance with PS2 the tester may choose to perform more than nine sample runs. If this option is chosen, the tester may, at his discretion reject a maximum of three sets of the test results so long as the total number of test results used to determine the RA is greater than or equal to nine, but all of the data must be reported (40 CFR 60, Appendix B, PS2 Paragraph 7.3). Only the best nine runs were used to calculate the RA. The strikethrough data shown in the above table were not used in the RA calculation.

Summary Results Table

Run #	Time	RM SO_2 ppm (wet)	RM CO_2 % (wet)	SO_2 RM Emission Rate lbs/MMBTU	SO_2 HCCP CEM Emission Rate lbs/MMBTU	Diff.
1*	1205-1227	7.6	12.3	~~0.018~~	~~0.027~~	~~0.009~~
2	1256-1318	7.6	12.2	0.019	0.024	0.005
3	1347-1409	7.4	12.1	0.018	0.024	0.006
4*	1434-1456	7.5	12.1	~~0.018~~	~~0.025~~	~~0.007~~
5	1526-1548	8.2	12.1	0.020	0.024	0.004
6	1610-1632	6.7	12.1	0.017	0.023	0.005
7	1658-1720	6.4	12.1	0.016	0.021	0.004
8	1741-1803	7.6	12.2	0.018	0.023	0.005
9	1830-1852	7.4	12.1	0.018	0.022	0.004
10	1911-1933	6.4	12.1	0.016	0.022	0.006
11*	2000-2022	7.5	12.3	~~0.018~~	~~0.025~~	~~0.007~~
12	2042-2104	7.7	12.3	0.019	0.024	0.005

Mean of RM Tests	**0.018 lbs/MMBTU**
Applicable SO_2 Permit Limit	**0.100 lbs/MMBTU**
Mean Difference	**0.005 lbs/MMBTU**
Std. Deviation	**0.0008 lbs/MMBTU**
2.5 % Error Confidence Coefficient	**0.0006 lbs/MMBTU**
Relative Accuracy	**5.6 % RA**

* In accordance with PS2 the tester may choose to perform more than nine sample runs. If this option is chosen, the tester may, at his discretion reject a maximum of three sets of the test results so long as the total number of test results used to determine the RA is greater than or equal to nine, but all of the data must be reported (40 CFR 60, Appendix B, PS2 Paragraph 7.3). Only the best nine runs were used to calculate the RA. The strikethrough data shown in the above table were not used in the RA calculation.

As allowed by PS2 the RA was calculated using the applicable SO_2 limit instead of the average of the RM.

Summary Results Table

		CO_2		
Run #	Time	RM CO_2 % (wet)	HCCP CEM CO_2 % (wet)	Diff.
1	1205-1227	12.3	12.3	0.0
2	1256-1318	12.2	12.2	0.0
3*	1347-1409	~~12.1~~	~~12.3~~	~~0.2~~
4*	1434-1456	~~12.1~~	~~12.3~~	~~0.2~~
5	1526-1548	12.1	12.2	0.1
6	1610-1632	12.1	12.2	0.1
7	1658-1720	12.1	12.2	0.1
8	1741-1803	12.2	12.4	0.2
9*	1830-1852	~~12.1~~	~~12.4~~	~~0.3~~
10	1911-1933	12.1	12.2	0.2
11	2000-2022	12.3	12.4	0.1
12	2042-2104	12.3	12.3	0.0

Mean of RM Tests	**12.2 % CO_2**
Mean Difference	**0.1 % CO_2**
Std. Deviation of the Difference	**0.08 % CO_2**
2.5 % Error Confidence Coefficient	**0.06 % CO_2**
Relative Accuracy	**1.3 % RA**

* In accordance with PS2 the tester may choose to perform more than nine sample runs. If this option is chosen, the tester may, at his discretion reject a maximum of three sets of the test results so long as the total number of test results used to determine the RA is greater than or equal to nine, but all of the data must be reported (40 CFR 60, Appendix B, PS2 Paragraph 7.3). Only the best nine runs were used to calculate the RA. The strikethrough data shown in the above table were not used in the RA calculation.

Table 2-1 Summary of Results

CEMS	Performance Specifications for Relative Accuracy (RA)	CEMS Relative Accuracy (RA)
NO_X	No greater than 20 % of the average of the RM	0.02 %
SO_2	No greater than 10 % of the applicable emission limit	5.6 %
CO_2	No greater than 20 % of the average of the RM	1.3 %

APPENDIX D
Tables from COMS Initial Certification Tests

Monitoring Solutions Report:
CEMOP-281 Opacity System – EPA Certification Tests

Opacity System Accuracy Determination

OPACITY CERTIFICATION
Accuracy Determination

TRANSCIEVER SERIAL # 32336
REFLECTOR SERIAL # 31497 TYPE II
REMOTE SERIAL # 32343
PROJECT: AIDEA - HCCP HEALY, AK

	Test	Date	Start Time	End Time	Reference Method Samples NUETRAL DENSITY FILTER RM	OPACITY Output FROM FINAL RECORDING DEVICE	FILTER MONITOR Difference (Xi)	Difference ^ 2 (Xi ^ 2)
	1	14-Apr	1219	1220	57.700	58.700	-1.000	1.000
	2	14-Apr	1228	1229	57.700	58.700	-1.000	1.000
	3	14-Apr	1240	1241	57.700	58.700	-1.000	1.000
	4	14-Apr	1247	1248	57.700	58.700	-1.000	1.000
	5	14-Apr	1254	1255	57.700	58.700	-1.000	1.000
*	6						0.000	0.000
*	7						0.000	0.000
*	8						0.000	0.000
*	9						0.000	0.000
*	10						0.000	0.000
*	11						0.000	0.000
*	12						0.000	0.000

* Not included in calculations.

n = 5
t(0.975) = 2.776

Mean Ref. Method Value	65.03	RM
Sum of Differences	2.65	Xi
Mean Difference	0.53	X ave
Sum of Differences Squared	1.42	Xi^2
Standard Deviation	0.07	sd
2.5% Error Conf.Coef	0.09	CC
Calibration Error	0.62	percent

OPACITY CERTIFICATION
Accuracy Determination

TRANSCIEVER SERIAL # 32336
REFLECTOR SERIAL # 31497 TYPE II
REMOTE SERIAL # 32343
PROJECT: AIDEA - HCCP HEALY, AK

	Test	Date	Start Time	End Time	Reference Method Samples NUETRAL DENSITY FILTER RM	OPACITY Output FROM FINAL RECORDING DEVICE	FILTER MONITOR Difference (Xi)	Difference ^ 2 (Xi ^ 2)
	1	14-Apr	1216	1217	46.200	47.460	-1.260	1.588
	2	14-Apr	1216	1227	46.200	47.460	-1.260	1.588
	3	14-Apr	1238	1239	46.200	46.950	-0.750	0.563
	4	14-Apr	1245	1246	46.200	46.950	-0.750	0.563
	5	14-Apr	1252	1253	46.200	46.950	-0.750	0.563
*	6						0.000	0.000
*	7						0.000	0.000
*	8						0.000	0.000
*	9						0.000	0.000
*	10						0.000	0.000
*	11						0.000	0.000
*	12						0.000	0.000

* Not included in calculations.

n = 5
t(0.975) = 2.776

Mean Ref. Method Value	31.54	RM
Sum of Differences	4.40	Xi
Mean Difference	0.88	X ave
Sum of Differences Squared	3.88	Xi^2
Standard Deviation	0.05	sd
2.5% Error Conf.Coef	0.07	CC
Calibration Error	0.95	percent

OPACITY CERTIFICATION
Accuracy Delermination

TRANSCIEVER SERIAL # 32336
REFLECTOR SERIAL # 31497 TYPE II
REMOTE SERIAL # 32343
PROJECT: AIDEA - HCCP HEALY, AK

	Test	Date	Start Time	End Time	Reference Method Samples: NUETRAL DENSITY FILTER RM	OPACITY Output: FROM FINAL RECORDING DEVICE	FILTER MONITOR Difference (Xi)	Difference ^ 2 (Xi ^ 2)
	1	14-Apr	1213	1214	21.100	21.250	-0.150	0.022
	2	14-Apr	1217	1218	21.100	21.990	-0.890	0.792
	3	14-Apr	1221	1222	21.100	21.250	-0.150	0.022
	4	14-Apr	1225	1226	21.100	21.000	0.100	0.010
	5	14-Apr	1229	1230	21.100	21.000	0.100	0.010
*	6						0.000	0.000
*	7						0.000	0.000
*	8						0.000	0.000
*	9						0.000	0.000
*	10						0.000	0.000
*	11						0.000	0.000
*	12						0.000	0.000

* Not included in calculations.

n = 5
t(0.975) = 2.776

Mean Ref. Method Value	13.47	RM
Sum of Differences	-2.75	Xi
Mean Difference	-0.55	X ave
Sum of Differences Squared	1.56	Xi^2
Standard Deviation	0.11	sd
2.5% Error Conf.Coef	0.14	CC
Calibration Error	0.69	percent

APPENDIX E
Tables from HCCP Stack Initial Performance Test

Am Test Report:
HCCP Stack Initial Performance Test

Summary of Results – Methods 1, 2, 3A, 4, 5, and Opacity
Summary of Results – Methods 3A, 6C, 7E, and 10

AMTEST
AIR QUALITY, LLC

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4, 5 AND OPACITY
AM TEST-AIR QUALITY, LLC

File Name: JAA\98-081WD\HCCP\M5\SUM
Client: AIDEA @ Healy Clean Coal Project
Location: Healy, Alaska

	HCCP Stack				*ADEC Emissions Limits*
	RUN #1	RUN #2	RUN #3	AVERAGE	
Lab #:	3076	3077	3078		
Date:	6/17/98	6/17/98	6/17/98		
Start Time:	1045	1425	1730		
Stop Time:	1305	1640	1948		
Sample Length (minutes):	120.0	120.0	120.0		
Method 19 Carbon Fuel Factor (dscf/MMBtu): (dry basis, bituminous coal)	9780	9780	9780		
Volume Sampled (ft^3):	94.510	93.554	95.301	94.455	
Volume Sampled (dscf):	89.764	87.813	88.752	88.776	
Volume Sampled (dscm):	2.542	2.487	2.513	2.514	
Stack Gas Moisture (%):	19.07	18.98	19.17	19.07	
Barometric Pressure ("Hg):	28.90	28.90	28.90	28.90	
Static Pressure ("H_2O)	-1.2	-1.2	-1.2	-1.2	
Stack Pressure ("Hg):	28.81	28.81	28.81	28.81	
Stack Temperature (°F):	187.0	187.1	186.3	186.8	
Stack Temperature (°R):	647.0	647.1	646.3	646.8	
Carbon Dioxide (%):	15.3	15.2	14.9	15.1	
Oxygen (%):	4.4	4.1	4.3	4.3	
Molecular Weight (dry, g/g-mole):	30.62	30.60	30.56	30.59	
Molecular Weight (wet, g/g-mole):	28.22	28.21	28.15	28.19	
F_o factor:	1.08	1.11	1.11	1.10	
Average Velocity Head ("H_2O):	1.545	1.505	1.536	1.529	
Pitot Tube C_p:	0.84	0.84	0.84		
Stack Gas Velocity (ft/sec):	79.6	78.6	79.4	79.2	
Stack Diameter (inches):	96.0	96.0	96.0		
Stack Area (ft^2):	50.3	50.3	50.3		
Stack Gas Airflow (dscf/min.):	152736	150929	152368	152011	
Stack Gas Airflow (acf/min):	240161	237082	239599	238947	
Nozzle Diameter (inches):	0.211	0.211	0.211		
Isokinetics (%):	101	100	101		
Front-half Particulate Matter Emission Conc. (gr/dscf):	0.020	0.018	0.018	0.019	
Front-half Particulate Matter Emission Conc. (mg/dscm):	46.6	40.6	42.2	43.1	
Front-half Particulate Matter Emission Rate (lb/hr):	26.7	22.9	24.1	24.6	*13.2*
Front-half Particulate Matter Emission Rate (lb/MMBtu):	0.036	0.031	0.032	0.033	*0.020*
Average Opacity (%):	4.2	4.5	5.0	4.6	*20/27* *

*not to exceed 20% opacity per 3-minute average, and not to exceed one (1) 6-minute period per hour of 27% opacity

AM TEST
AIR QUALITY, LLC

SUMMARY OF RESULTS - METHODS 3A, 6C, 7E, AND 10
AM TEST-AIR QUALITY, LLC

File Name: JAA\98-081WD\HCCP\GASSUM
Client: AIDEA
Location: Healy, Alaska

	HCCP Stack				*ADEC Emissions Limits*
	RUN 1	RUN 2	RUN 3		
Date:	6/17/98	6/17/98	6/17/98		
Start Time:	1226	1356	1520		
Stop Time:	1325	1456	1619		
Sample Length (minutes):	60	60	60		
Method 19 Carbon Fuel Factor (dscf/MMBtu): (dry basis, bituminous coal)	9780	9780	9780		
Oxygen (percent):	4.5	4.3	4.4	4.4	
Measured Airflow (dscf/min):	152736	150929	152368	152011	
METHOD 6C - SULFUR DIOXIDE (SO_2)					
Sulfur Dioxide Emission Conc. (ppm):	8.7	4.0	2.5	5.1	
Sulfur Dioxide Emission Rate (lb/hr):	13.2	6.01	3.79	7.68	
Sulfur Dioxide Emission Rate (lb/MMBtu):	0.018	0.008	0.005	0.010	*0.086*
METHOD 7E - NITROGEN OXIDES (NO_x)					
Nitrogen Oxides Emission Conc. (ppm):	179.1	175.1	173.3	175.8	
Nitrogen Oxides Emission Rate (lb/hr):	196.0	189.3	189.2	191.5	
Nitrogen Oxides Emission Rate (lb/MMBtu):	0.267	0.257	0.256	0.260	*0.350*
METHOD 10 - CARBON MONOXIDE (CO)					
Carbon Monoxide Emission Conc. (ppm):	0.9	0.3	0.5	0.6	
Carbon Monoxide Emission Rate (lb/hr):	0.600	0.198	0.332	0.399	*132*
Carbon Monoxide Emission Rate (lb/MMBtu):	0.0008	0.0003	0.0005	0.0005	*0.20*

APPENDIX F
Table from HCCP Subsequent Stack Performance Test

HRH Report:
Particulate Emission Testing Program

Summary of Particulate Test Results

1. INTRODUCTION

The Healy Clean Coal Project (HCCP) is a new electrical generating facility located in Healy, Alaska. The HCCP plant is collocated with the Golden Valley Electric Association (GVEA) Healy Power Plant. The HCCP was developed by the Alaska Industrial and Export Authority (AIDEA). Haas, Morgan & Hudson Technical Environmental Consulting, LLC (HMH) was contracted by AIDEA to conduct an emission testing program.

The objective of the testing was to determine the concentration of particulate matter in the HCCP exhaust gases. The testing was performed March 10th and 11th, 1999. The testing was conducted in accordance with USEPA Reference Methods 1, 2, 3a, 4, 5 and 19 as prescribed in 40 *CFR* 60, Appendix A and the specific performance testing requirements of 40 *CFR* 60.48a (Subpart Da).

The HMH field team consisted of Bob Morgan, the project manager and Bill Hudson, project technician. Don Neff coordinated the testing for HCCP.

2. SUMMARY OF RESULTS

2.1 Summary of Particulate Test Results

The particulate source-testing program consisted of three sample runs. The sample results are summarized in Table 2-1.

Table 2-1 Summary of Particulate Test Results

Parameter	Units	Run #1	Run #2	Run #3	Average
Stack Gas Particulate Concentration	gr/dscf	Request Invalidation	0.0022	0.0031	0.0027
Stack Gas Particulate Concentration	lb/dscf	Request Invalidation	0.00000032	0.00000044	0.00000038
PM Emission Rate	lb/hr	Request Invalidation	3.467	4.877	4.172
PM Emission Rate	lb/MMBtu as per M19 @ 20.9% O_2	Request Invalidation	0.0040	0.0053	0.0047
HCCP Avg. Generating Load	megawatts (gross)	57.98	58.08	58.13	58.06

APPENDIX G
Table from Topical Report: Combustion System Operation

TRW Report:
Healy Clean Coal Project, Demonstration Test Program
Topical Report: Combustion System Operation

HCCP Performance Goals and Results

TABLE 1 – HCCP PERFORMANCE GOALS AND RESULTS

PARAMETER	New Source Performance Standards (NSPS) [1]	HCCP AIR QUALITY PERMIT	CONTRACT GOALS	DEMONSTRATED IN 1998 (June - December, 1998)	
				RANGE	TYPICAL
NOX	0.5 lb/MMBtu (prior to 7/97) 0.15 lb/MMBtu (modified after 7/97) 1.6 lb/MWhr (new plant after 7/97)	0.350 lb/MMBtu (30 day rolling average)	< 0.35 lb/MMBtu	0.208-0.278 lb/MMBtu 30-day rolling ave. [9], [10]	0.245 lb/MMBtu 30-day rolling ave. [9], [11]
CO	Dependent on ambient CO levels in local region (Title V of 1990 CAAA)	0.20 lb/MMBtu, (hourly average) (202 ppm CO @ 3.0% O2)	< 200 ppm (dry basis) at 3.5% O2 (dry basis) [2] (<206 ppm CO @ 3.0% O2)	<130 ppm at 3.0% O2 [6], [8]	30-40 ppm at 3.0% O2 0.036 lb/MMBtu [5], [8]
SO2	90 % removal and less than 1.2 lb/MMBtu 70% removal when emissions are less than 0.60 lb/MMBtu	0.086 lb/MMBtu, (annual average) 0.10 lb/MMBtu, (3-hour average) 65.8 lb/hr max, (3-hour average)	70 % Removal (minimum) 79.6 lb/hr SO2 (maximum)	< 0.09 lb/MMBtu (<35 ppm @ 3% O2) [6], [8]	0.038 lb/MMBtu (15 ppm @ 3% O2) (25 lb/hr) [5], [8]
OPACITY	20% Opacity (6 min. average)	20% Opacity, (3 min average) 27% Opacity (one 6 min period per hour)	20% Opacity, 3 min average	<10 % Opacity [6]	5.6% Opacity (Jun - Dec 1998) [5],[15] 2.3% Opacity (1999) [15]
PARTICULATE MATTER	0.03 lb/MMBtu	0.02 lb/MMBtu, (hourly average)	0.015 lb/MMBtu		0.0047 lb/MMBtu (1999) [14], [15]
CARBON BURNOUT	NA	NA	> 99% at 100% MCR for Perf., ROM, and 55/45 Blend [3] >98% at 100% MCR for Waste Coal	NA	99.7% [4]
SLAG RECOVERY	NA	NA	> 70% at 100% MCR for all coals [3]	78-87% [7]	83% [7]
NET POWER PRODUCTION	NA	NA	50 MWe for all coals	NA	50-55 MWe [12],[13]

NOTES

[1] From 40CFR60.40a - 40CFR60.49a; New NOx Standards based on 62 FR 36948

[2] From minimum to 100% MCR (Maximum Continuous Firing Rate)

[3] 100% MCR for Performance Coal is 315 MMBtu/Hr, ROM Coal is 306 MMBtu/Hr, Waste Coal is 322 MMBtu/Hr, 55/45 Waste/ROM Coal is 316 MMBtu/Hr

[4] Measured for one test based upon slag and flyash carbon contents

[5] Average of available 30 min. (average) test data, June 12,1998 to December 21, 1998 (total of 3100 hours of run time)

[6] 95% of CO, SO2, and opacity data are observed to be less than these reported value (using available 30 min average test data)

[7] Slag weight corrected for 6% moisture content.

[8] Data corrected to 3% O2

[9] 30-day rolling average determined from available 30 min (average) test data, June 12, 1998 to December 21, 1998, total of 3100 hours (5480 data points).
30-day rolling average only includes days in which power was generated.

[10] Represents minimum and maximum of 30-day rolling average data described in Note [9]

[11] Represents the average of 30-day rolling average data described in Note [9]

[12] Nominal power set point from April through September, 1998 was 60-62 MWe (gross), 53-55 MWe (net);

[13] Nominal power set point in November and December, 1998 was 57 MWe (gross), 50 MWe (net)

[14] Based on independent particulate matter testing performed on March 10-11, 1999 by Haas, Morgan & Hudson

[15] Opacity and particulate matter emissions during 1998 were higher than expected due to a problem with premature baghouse filter bag failure, which was corrected in 1999

APPENDIX H

Graphs from the Harris Group Report: Independent Engineer's Review of HCCP 90 Day Test and Determination of Sustained Operations

NO_x and SO_2 Emissions During the 90-Day Test

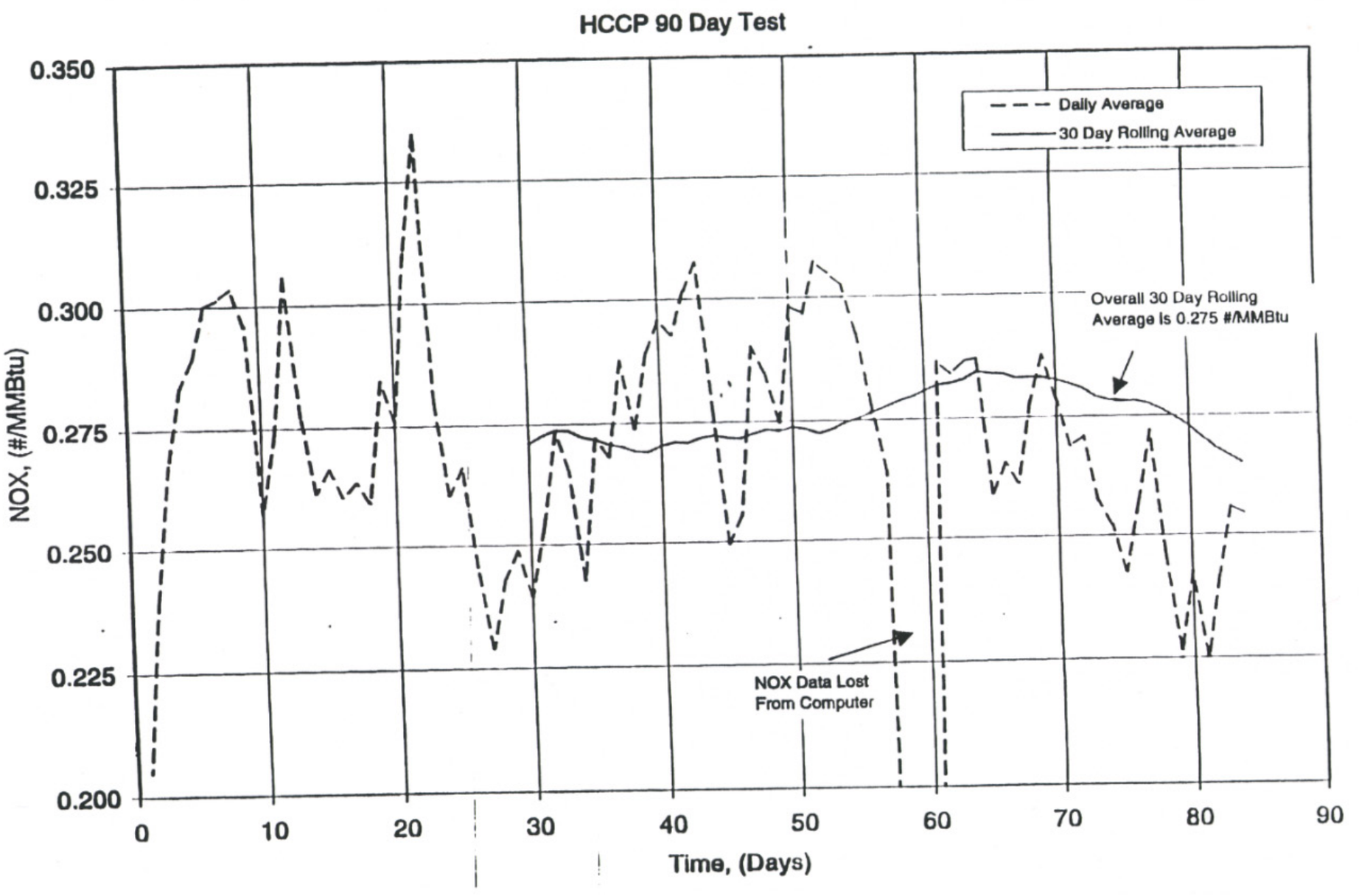
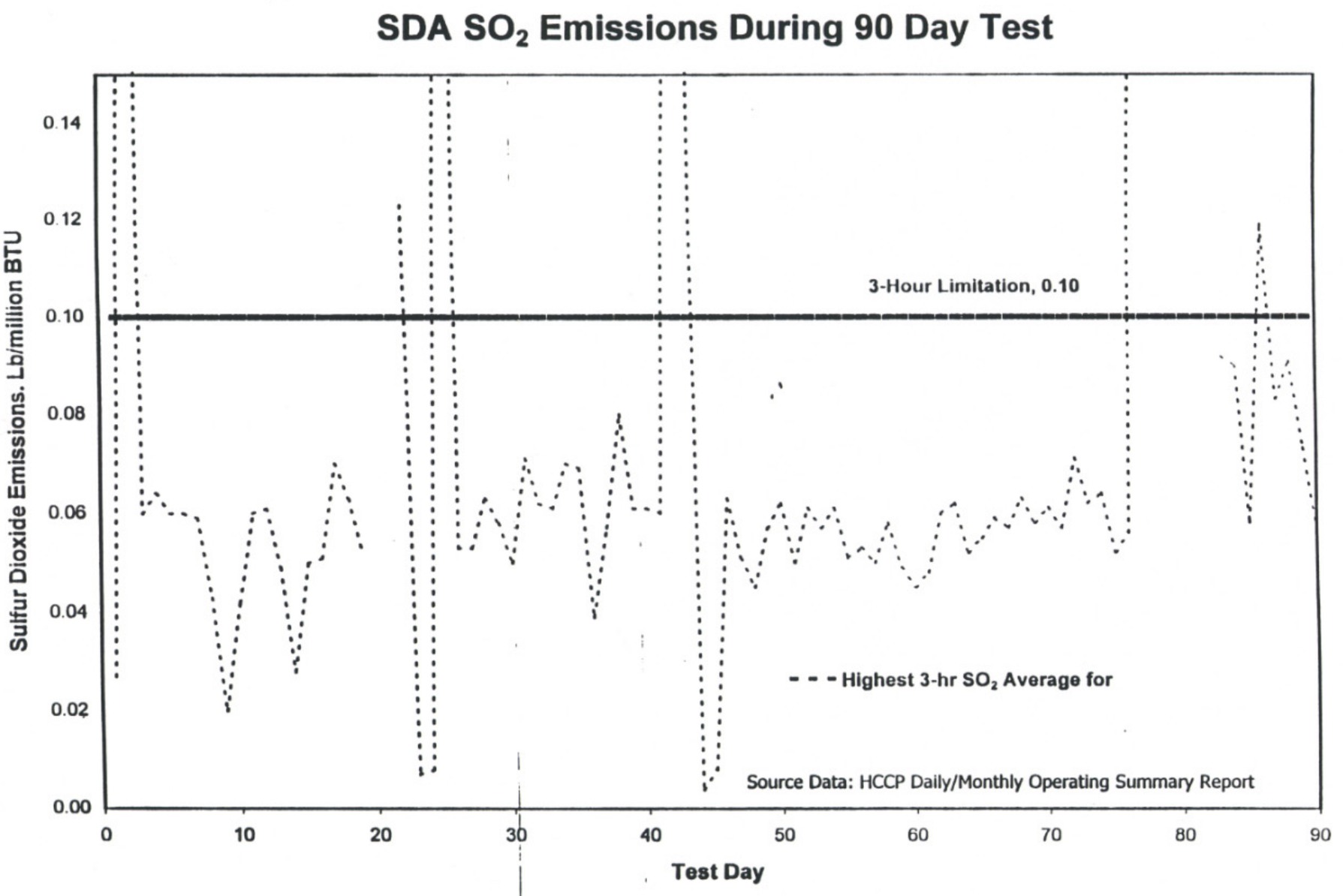

HCCP 90 Day Test
Daily Average
30 Day Rolling Average
Overall 30 Day Rolling Average Is 0.275 #/MMBtu
NOX Data Lost From Computer
NOX, (#/MMBtu)
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0
10
20
30
40
50
60
70
80
90
Time, (Days)

Figure 7



SDA-SR SO2.xls, Figure 7

Harris Group, Inc.