FINAL
1993 ANNUAL PROGRESS REPORT
HEALY CLEAN COAL PROJECT

DOE COOPERATIVE AGREEMENT
DE-FC-22-91PC90544

JUNE 1994

ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

Prepared by

STONE & WEBSTER ENGINEERING CORPORATION

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PROJECT DESCRIPTION

The objective of the Healy Clean Coal Project (HCCP) is to demonstrate the integration of an advanced combustor and heat recovery system with both high and low temperature emission control processes at a utility scale power plant. The resulting emission levels of SO_2, NO_x, and particulates are expected to be significantly lower than the federal New Source Performance Standards (NSPS).

The project demonstration test period is currently scheduled to start at the latest by January 1, 1998.

The site is located adjacent to the existing Golden Valley Electric Association, Inc. Healy Unit No. 1 power plant in Healy, Alaska. The project is co-funded by the U.S. Department of Energy (DOE), and the Alaska Industrial Development and Export Authority (AIDEA).

The project is broken down into the following phases over a 90 month period.

Phase I - Project Definition and Design
Phase II - Procurement and Construction
Phase III - Operation

Project Definition, Design, and Procurement activities were completed under Budget Periods 1 and 2. DOE has approved the application to proceed into Budget Period 3. Budget Period 3 started on July 1, 1993. The HCCP participants' current activities are in support of the General Construction bid process.

The primary roles of the HCCP team participants include:

- Alaska Industrial Development and Export Authority (AIDEA) - Ownership, overall project and construction management and financing.
- Golden Valley Electric Association, Inc. (GVEA) - Design input and review, operator and purchaser of the HCCP electrical output.
- Usibelli Coal Mine, Inc. (UCM) - Design input and review, coal supplier and ash disposal.
- TRW, Inc. (TRW) - Slagging coal combustion system technology supplier.
- Joy Technologies, Inc. (Joy) - Spray dryer, fabric filter and ash recycle system technology supplier.
- Stone & Webster Engineering Corporation (SWEC) - Architect/ Engineer.

In addition, Foster Wheeler Energy Corporation (FWEC) has been contracted for design, supply, and erection of the boiler and supply and erection of the TRW combustors. Sumitomo Corporation of America (SCOA) has been contracted for design, supply, and erection of the turbine/generator.

During 1993, engineering and design efforts neared completion on the boiler, combustion, flue gas desulfurization (FGD), turbine/generator, and balance of plant systems.

The design of TRW combustors, the combustor cooling systems, the direct coal feed system and the limestone feed system were essentially complete in July of 1993. The boiler and FGD systems design was completed except for incorporation of final participant comments on FWEC and Joy drawings. The specifications and drawings required to support the General

Construction contract bid process were completed in December of 1993.

The Alaska Department of Environmental Conservation (ADEC) issued the final Prevention of Significant Deterioration (PSD) permit on March 10, 1993. Subsequently the Trustees for Alaska and the Department of Interior (National Park Service) appealed the PSD permit. During November 1993, a Memorandum of Agreement among the DOE, Department of Interior, AIDEA, and GVEA was signed resolving the NPS concerns and appeal.

Efforts continued throughout 1993 to finalize the Environmental Impact Statement (EIS). The final EIS was issued for public comments in late December 1993. Public comments were received January 24, 1994. The Record of Decision (ROD) was issued on March 10, 1994.

BACKGROUND

The Healy Clean Coal Project was selected in 1989 by the Department of Energy as a participant in its Clean Coal Technology Demonstration Program.

The primary objective of the HCCP is to demonstrate a new power plant design integrating an advanced combustor and heat recovery system coupled with both high and low temperature emission control processes. The parties anticipate that, if the demonstration project is successful, the technology will be commercialized in the late 1990s and be capable of (1) achieving significant reductions in the emissions of sulfur dioxide and the oxides of nitrogen from existing facilities, (2) providing for future energy needs in an environmentally acceptable manner.

Alaskan bituminous and subbituminous coals will be the fuels. Coal from the adjacent Usibelli Coal Mine (UCM) will be pulverized and burned at the proposed facility to generate high-pressure steam used by a steam turbine generator to produce electricity. The primary fuel to be fired is a blend of run-of-mine (ROM) and waste coals. ROM coal is a subbituminous coal with a higher heating value (HHV) range of 7500 - 8200 Btu/lb, a low average sulfur content of 0.2 percent, and an average ash content of 8 percent. The waste coal is either a lower grade seam coal or ROM contaminated with overburden material having an HHV range, average sulfur content, and average ash content of approximately 5,000 - 9,000 Btu/lb, 0.15 percent, and 20 percent respectively. The project will demonstrate the ability of slagging combustors to utilize low quality coals effectively.

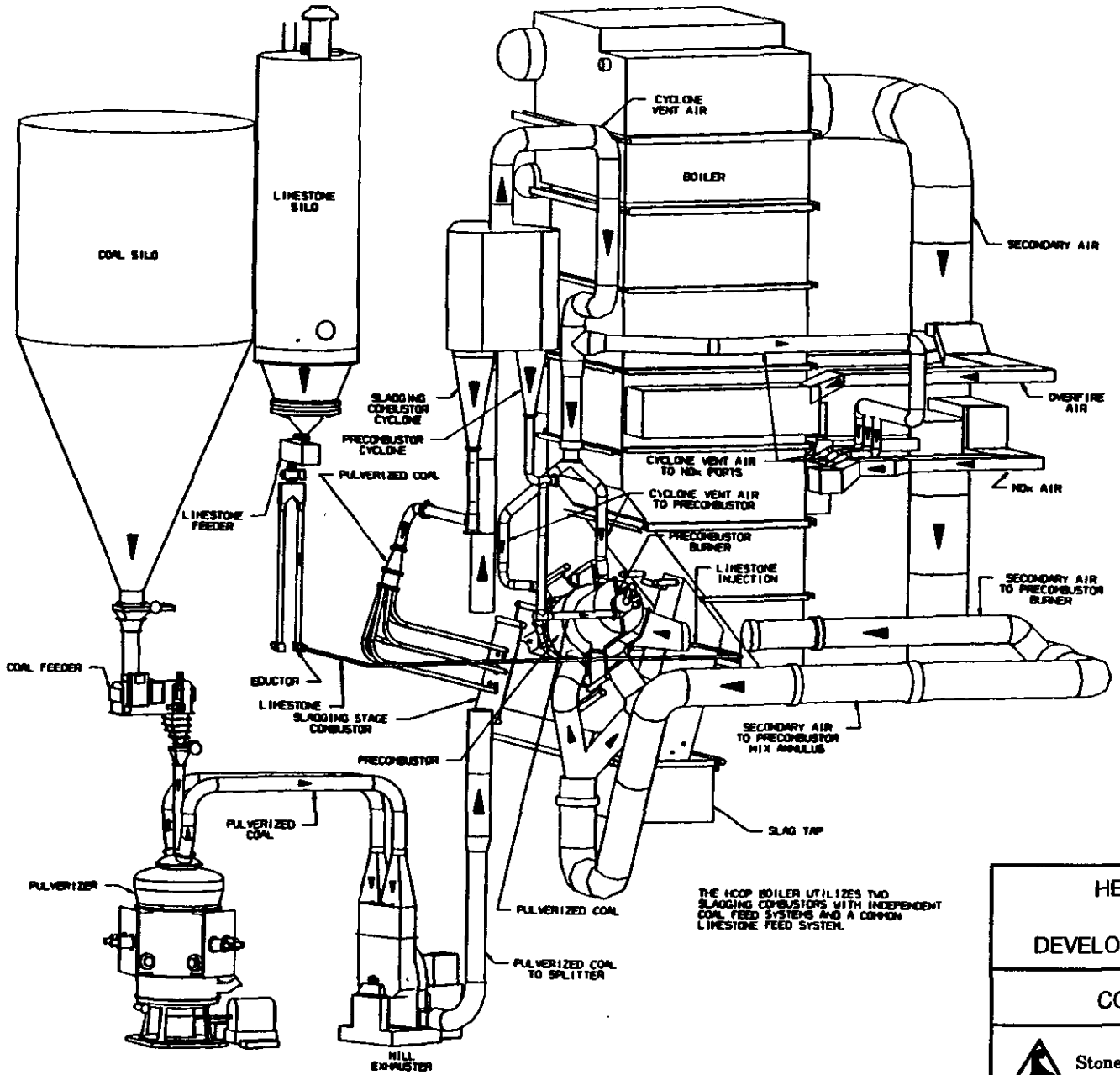
Emissions of SO_2 and NO_x from the plant will be controlled using TRW's slagging coal combustor with limestone injection, in conjunction with a boiler supplied by Foster Wheeler. Further SO_2 and particulate removal will be accomplished using Joy Technologies, Inc.'s (Joy) Activated Recycle Spray Absorber System. Successful demonstration of these technologies is expected to result in NO_x emissions of less than 0.2 lb/MMBtu and SO_2 removal efficiencies greater than 90 percent.

The heart of the system being demonstrated is a combustion system. Each combustor consists of two cylindrical sections followed by a short duct that connects the combustor to the boiler. A precombustor burns about 35 percent of the coal to preheat the main combustor secondary air. The preheated air enters the main combustor section tangentially to impart a swirling motion to the coal and air. The balance of the coal is injected axially through multiple injection ports at the front end of this cylindrical section.

Molten slag collects on the walls of the main combustor and flows toward an opening in the bottom of the combustor where it falls into a water-filled slag tank. The slagging combustor declines slightly from horizontal to aid in the flow of the molten slag. Some slag solidifies on the water-cooled surface and serves to insulate and protect the main combustor metal walls from erosion and excessive temperatures.

A view of the furnace showing the combustor furnace interface and the combustor fuel, air and limestone feed system is shown in Figure 1.

The main combustion section operates at an air deficiency sufficient to reduce the amount of oxygen available to produce NO_x. Combustion products mix with additional air in the furnace to complete the final combustion reactions. The combustors are coupled with a furnace that, in addition to its heat recovery function, produces



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COMBUSTOR FUEL AND AIR

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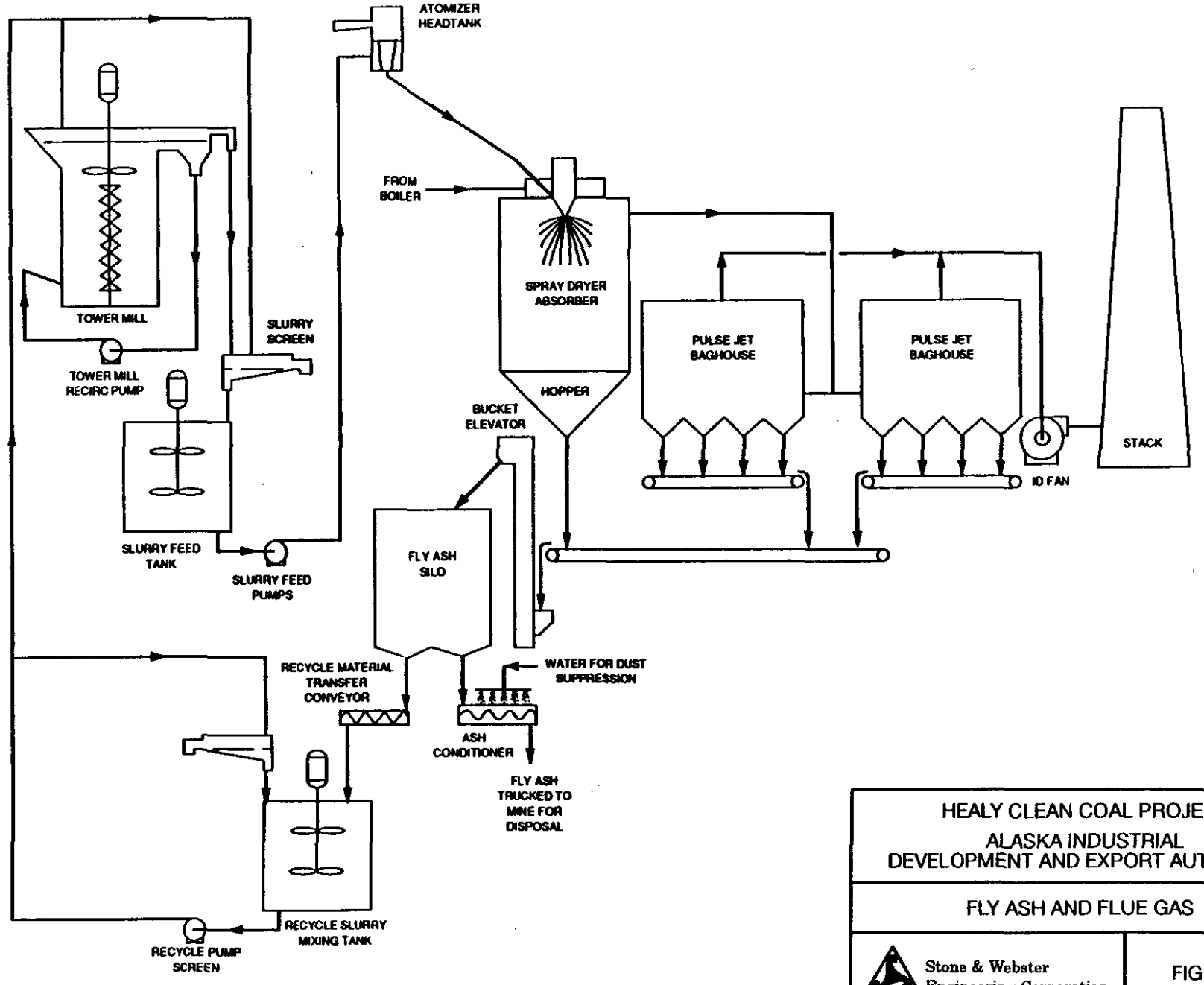
FIGURE 1

low NO_x levels, functions as a limestone calciner, and accomplishes first-stage SO_2 removal.

The process also uses a single spray dryer absorber vessel for second-stage sulfur removal and a reactivation system that recovers unused reagent from the particulate collected by the baghouse. Figure 2 is a flow diagram of the fly ash and flue gas system.

The slagging combustor with specially designed boiler and the spray dryer/recycle system should be capable of reducing NO_x by 70 percent and SO_2 by at least 90 percent.



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FLY ASH AND FLUE GAS

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FIGURE 2

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ENVIRONMENTAL ACTIVITIES

During 1993 the environmental program for the Healy Clean Coal Project (HCCP) focused on completion of the National Environmental Policy Act (NEPA) process acquisition and amendment of the Air Quality Control PSD/Permit to Operate, completion of the Visibility Monitoring Program, completion and submittal of other permit applications and acquisition of project permits to allow commencement of construction, and preparation of environmental monitoring documents to comply with the cooperative agreement with DOE.

National Environmental Policy Act

The close of 1992 brought DOE's publication and distribution of the Draft Environmental Impact Statement (DEIS) for the HCCP and the public hearings held in Alaska. The DEIS public comment period was extended by 3 weeks from January 5 to January 20, 1993 to accommodate several public requests and a request from the National Park Service (NPS) for an extension. AIDEA prepared technical comments on the DEIS and submitted them to DOE prior to the close of the public comment period. At the close of the public comment period, DOE evaluated all comments received and identified additional information and analyses which would need to be included in the Final Environmental Impact Statement (FEIS) to address public comments. AIDEA participated in meetings and conferences with DOE to provide supporting information to assist DOE in responding to public comments on the DEIS.

To provide the baseline information for DOE's preparation of the FEIS, AIDEA prepared several options analyses to evaluate existing and proposed air emissions from the Healy site under various mitigation scenarios. These options analyses focused on the potential to reduce total air emissions of regulated air pollutants from the Healy site, and included the air emissions from the existing Healy Unit No. 1 power plant. From these options analyses, DOE prepared a mitigation measures section for the FEIS which described potential options to reduce overall air emissions from the Healy site, and which discussed the technical, environmental, and economic feasibility of implementing the mitigation measures. To support the FEIS, AIDEA also conducted and submitted to DOE additional air quality and visibility modeling which reflected the various mitigation scenarios actively under consideration.

The NPS had long maintained an opinion that, in the absence of implementation of mitigation measures to reduce existing air emission levels, increased air emissions resulting from the combined operation of the HCCP and Unit No. 1 could result in unacceptable visibility-related impacts in Denali National Park and Preserve (DNPP). To address these concerns, AIDEA and Golden Valley Electric Association, Inc. (GVEA) participated in DOE-facilitated negotiations with the U.S. Department of the Interior (DOI) (which is the parent Department of the NPS). These negotiations were successfully concluded and a Memorandum of Agreement was signed on November 9, 1993. The Memorandum of Agreement addressed NPS concerns primarily through reductions in site air emissions via hardware retrofits and administrative controls on Unit No. 1. Following signing of the Memorandum of Agreement, the NPS withdrew its opposition to the HCCP and publicly offered its support for construction, demonstration, and operation of the HCCP. With opposition to the HCCP by cooperating federal agencies now resolved, DOE completed preparation of the FEIS and released the document to the public on December 15,

1993. The final Record of Decision was signed by DOE on March 10, 1994.

Air Quality Control PSD/Permit to Operate

Following issuance of the Public Comment Draft Air Quality Control PSD/Permit to Operate in December 1992, the Alaska Department of Environmental Conservation (ADEC) conducted public hearings during mid-January 1993. AIDEA prepared extensive technical comments on the Draft PSD/Permit to Operate and submitted them to ADEC prior to the close of the public comment period. In response to NPS, EPA, and Trustees for Alaska comments on the Draft PSD/Permit to Operate, AIDEA also prepared and submitted to ADEC responses to those comments. AIDEA also prepared a document which summarized the crux and status of issues raised by the NPS, EPA, and Trustees for Alaska. ADEC issued the Final PSD/Permit to Operate for the HCCP on March 10, 1993.

Within 30 days of issuance of the Final PSD/Permit to Operate by ADEC, requests for adjudicatory hearing were filed with ADEC by DOI (on behalf of the NPS) and Trustees for Alaska. EPA also provided a comment letter notifying ADEC of deficiencies in short-term emission limitations contained in the Final PSD/Permit to Operate. ADEC conducted several telephone conferences with the appellants and AIDEA/GVEA legal counsel. The DOI withdrew its request for adjudicatory hearing following signing of the Memorandum of Agreement, leaving the Trustees for Alaska as the sole appellant of the March 10, 1993 Final PSD/Permit to Operate. Following submittal by AIDEA/GVEA of a request for amendment of the Final PSD/Permit to Operate to incorporate the terms and conditions of the Memorandum of Agreement, ADEC decided to modify and reissue an amended Final PSD/Permit to Operate which addressed the concerns of all appellants. In early January 1994 AIDEA will submit suggested revisions to the Final PSD/Permit to Operate to ensure accurate incorporation of the terms and conditions of the Memorandum of Agreement into the amended permit. The Final Amended PSD/Permit to Operate was received on May 10, 1994. AIDEA continued to work with the Trustees for Alaska to address their concerns regarding the amended PSD/Permit to Operate. A resolution agreement with the Trustees was signed in June 1994.

Visibility Monitoring Program

The HCCP Visibility Monitoring Program, begun in January 1992 and originally anticipated to run for approximately 6 months, was extended to include 16 months and concluded on May 3, 1993. The Visibility Monitoring Program was initiated by the AIDEA at the request of the NPS and upon the recommendation of ADEC. The objective of the Visibility Monitoring Program was to establish a pre-construction baseline of existing visibility conditions which could be used to assess the impacts of the HCCP on DNPP.

The Final Report, prepared by Air Resource Specialists, Inc. (ARS), culminates the work of quantifying and describing the results of the 16-month photographic monitoring program. Nine cameras were utilized at two monitoring sites: the DNPP Visitor Access Center and Garner Hill overlooking the existing Unit No. 1 power plant. During the monitoring program, 6,568 35mm slides and 472 rolls of 8mm film were taken during the daylight hours over a period covering 474 days.

During the monitoring period, a baseline data base of the existing visual conditions was compiled. All collected film was reviewed by ARS to document the meteorological conditions and to identify visual anomalies. Of 322 anomalies observed both inside and outside the Class I area on 215 days during the monitoring

period, 159 were identified as naturally-occurring, 91 were due to undetermined causes, 29 were due to Unit No. 1, and 43 were due to other sources. ARS determined that the causes of undetermined anomalies were most likely due to naturally-occurring weather events and not likely caused by Unit No. 1. Of the 130 anomalies observed inside the Class I area, 87 were identified as naturally-occurring, 37 were due to undetermined causes, 3 were due to Unit No. 1, and 3 were due to other sources. The 3 anomalies inside the Class I area which were attributed to Unit No. 1 were steam/ice plumes which were transported from the power plant to the nearest boundary of the Class I area during unusual extreme cold conditions on January 20, 21, and 24, 1993. Importantly, these incidences of steam/ice plumes were not viewed in the two cameras facing north from the DNPP Visitor Access Center.

The primary focus of the Visibility Monitoring Program was to document whether visible nitrogen dioxide (NO_2) plumes or other visible hazes were present within the Class I area viewed by the cameras. No discolored NO_2 plumes or regional haze events were observed at any time during the monitoring period either as a result of Unit No. 1 operations or other sources; the only visible emissions from Unit No. 1 during the 16-month period were white steam/ice plumes. Secondly, periods of prolonged valley stagnation (of many hours to days), which could contribute to the build-up of pollutants in the atmosphere and the formation of visible effects such as regional haze, were not observed during the entire monitoring period. ARS determined that this was primarily due to the windy conditions which were almost always present in the Nenana River Valley. The results of the Visibility Monitoring Program support the conclusion that the existing Healy Unit No. 1 does not have perceptible visibility effects on DNPP.

Status of Other Project Permits

Applications for all remaining project permits were completed and submitted to appropriate resource agencies during 1993. Several permits have been received, and remaining permits are expected to be received during 1994, as outlined in Table 1. The following permits have been received by the Project to date:

Environmental Protection Agency (EPA) Storm Water Runoff for Construction

Federal Aviation Administration (FAA) Notice of Proposed Construction for construction camp

Notice of Proposed Construction for HCCP stack

Alaska Department of Natural Resources (ADNR) Temporary Water Rights for construction camp potable water supply

Alaska Department of Environmental Conservation (ADEC) Final PSD/Permit to Operate (issued March 10, 1993)

Certificate of Reasonable Assurance (for COE Section 404 Permit)

In addition, the final Section 404 permit for the intake and discharge facilities, wetlands, and for the construction camp discharge was issued by the U.S. Army Corps of Engineers (COE) and signed by AIDEA. The final National Pollutant Discharge Elimination System (NPDES) permit for discharge of plant operation and once-through cooling wastewater is expected to be issued by EPA in July 1994. All project permits will have been received by summer 1994.

Table 1. Listing of Project Permits and Receipt Dates for the HCCP.

Agency	Permit Type	Purpose	Date Received	Comments or Additional Requirements
EPA	NPDES	Once-through cooling, operational wastewater, and storm water runoff		Application submitted 10/9/91 Draft NPDES submitted 10/6/93 Final NPDES expected 7/31/94
EPA	NPDES	Storm water runoff for HCCP construction	8/13/93	A Storm Water Pollution Prevention Plan (SWPP Plan) is being prepared and implemented prior to construction of HCCP.
EPA	SPCC	Operational SPCC and FSRP	N/A	Draft completed by SWEC. GVEA needs to complete and submit the Facility Spill Response Plan (FSRP or C-Plan) to ADEC prior to operation of HCCP.
COE	Section 404	Plant intake and discharge, wetlands, and construction camp discharge	4/18/94	Final permit signed and issued by COE on 4/18/94.
FAA	Notice of Proposed Construction	Construction camp	6/3/93	Expires 12/31/94
FAA	Notice of Proposed Construction	HCCP stack	7/9/92	Expires 12/31/94
ADNR	Temporary Water Rights	Construction camp potable water supply	7/1/92	Expires 3/31/96
ADNR	Permanent Water Rights	Plant operation water for boiler feed, potable, and miscellaneous construction water	3/31/94	Once water use is established, ADNR must be notified to obtain a permanent water rights "Certificate of Appropriation".
ADNR	Permanent Water Rights	Plant once-through cooling	3/31/94	Once water use is established, ADNR must be notified to obtain a permanent water rights "Certification of Appropriation".

Agency	Permit Type	Purpose	Date Received	Comments or Additional Requirements
ADEC	Wastewater Disposal Permit	Construction Camp		Draft permit received. Final permit will by issued upon AIDEA's submittal of final engineering design for wastewater system, well specs., and water quality tests from HCCP Construction Contractor. ADEC requires a 30-day review period.
ADEC	General Wastewater Disposal Permit	Excavation water from the construction area		Application completed and submitted to ADEC by AIDEA on 5/25/94.
ADEC	401 Water Quality Certification	Certification for COE Section 404 Permit	1/14/94	ADEC declined to review or comment on the draft COE Section 404 Permit. This non-action constituted a waiver of ADEC's opportunity to certify the proposed activity, thus it was certified by default.
ADEC	PSD/Permit to Operate	Air quality control permit for construction and operation	5/12/94	ADEC issued the new final Permit to Operate and addendum to the Technical Analysis Report on 5/12/94. The final Permit to Operate requires preparation and submittal of a Draft Air Quality Monitoring Plan by 7/12/94 and the Final Visibility Monitoring Plan by 9/12/94. Because the Final Permit was issued under a new permit number, the BACT does not expire until 11/12/95.
ARRC	Land Use Leases	Construction camp, laydown/storage area		AIDEA to sign contracts when construction schedule is established.
DOE	EMP	Environmental Monitoring Plan document required as part of the Cooperative Agreement		AIDEA submitted Draft EMP to DOE for review on 12/1/93. Final EMP submitted to DOE on 6/17/94.

DOE Environmental Monitoring Documents

The Draft Environmental Monitoring Plan (Draft EMP) required by the Cooperative Agreement with DOE was prepared by AIDEA during 1993 and submitted to DOE on December 1, 1993. The Final EMP was sent to DOE on 6/17/94.

AIDEA also provided support during late 1993 to DOE for their preparation of the Mitigation Action Plan for the HCCP. This support is expected to continue during early 1994.

ENGINEERING ACTIVITIES

Operation of the Design Verification Test (DVT) Direct Coal Feed System (DCFS) with the precombustor at full load was successfully completed in January at TRW's Capistrano Test Site. The operation closely matched that predicted by the small scale laboratory coal flow tests. All pressure drops were consistent with analytical values. Approximately 160 tons of Healy coal were burned with nearly 43 hours of coal firing time accumulated. Trouble free operation, with no accumulation of coal was demonstrated. During all of the tests stable operation over a wide range of operating conditions was confirmed with no loss of coal flame at anytime.

TRW completed shutdown and securing of the DCFS test hardware at the Capistrano Test Site in February. The DVT report was initiated in February. The final DVT report was submitted by TRW in April 1993. The impacts from the DVT results on the Healy design have been analyzed and the results have been incorporated into the final combustor and coal feed designs. There is not significant dimensional changes to the precombustor due to the DVT data. However, the inlet ducts to the cyclones in the coal feed system required some design changes based on experience gained from the DVT's.

FWEC continued final engineering and design of the boiler and related auxiliary equipment. The final report of the cold flow model study on the furnace/combustor arrangement was submitted.

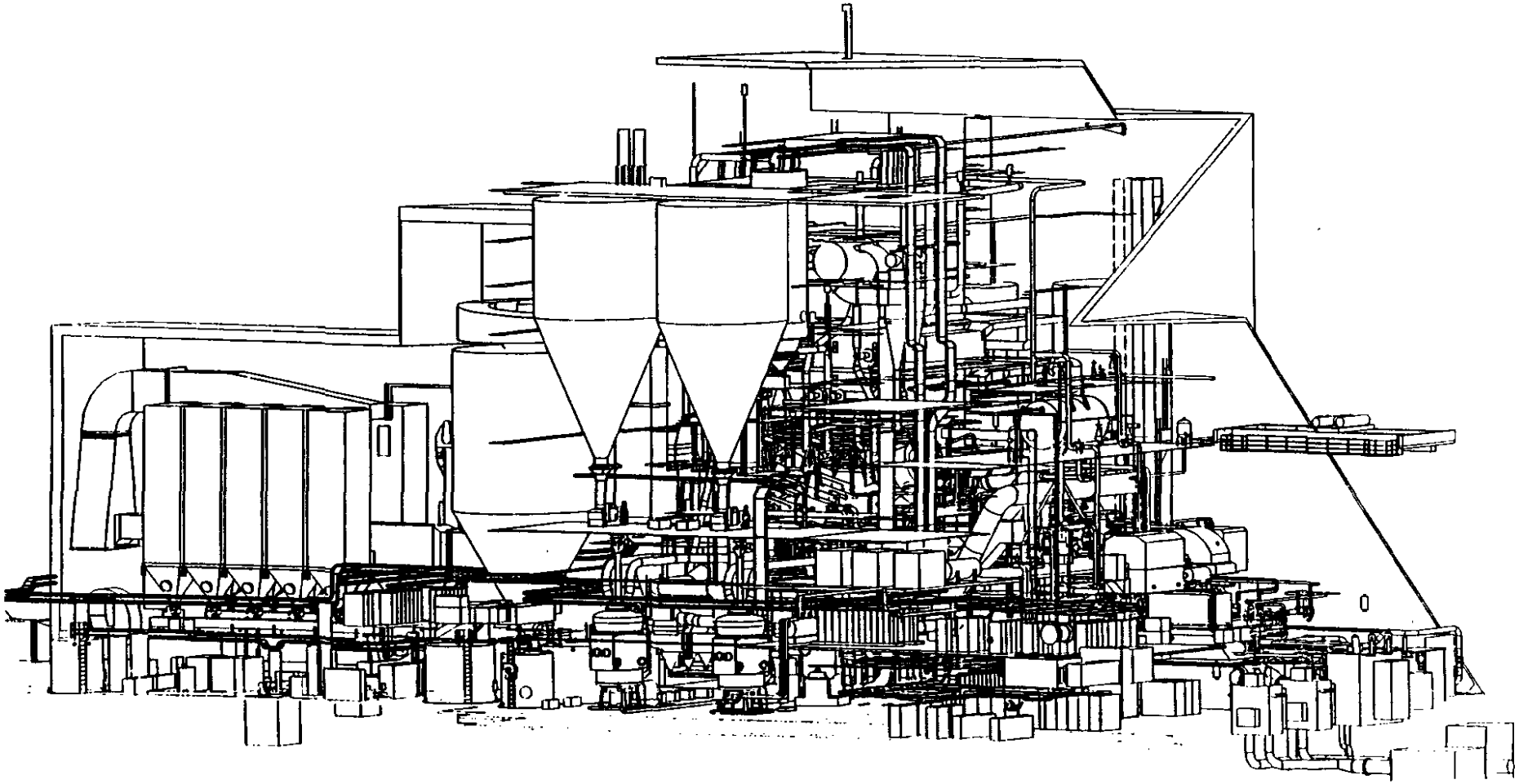
Joy continued final engineering and design on the spray dryer absorber and ash recycle system.

SCOA continued final engineering and design on the turbine and generator.

All balance of plant mechanical, water treatment, electrical, and controls equipment procurement contracts not awarded in 1992 were awarded in 1993. By the end of 1993 engineering for all balance of plant equipment was substantially complete.

SWEC continued work on the plant physical design. An isometric cutaway view of the main powerhouse looking toward the southwest is included as Figure 3.

The General Construction specification and documents were readied for "Bid Issue" in December. This contract will be issued for bids and equipment released for fabrication pending completion of the EIS and PSD processes.



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PLANT EQUIPMENT ISOMETRIC

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FIGURE 3

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