119-31a

FINAL

CONTROL TECHNOLOGY ASSESSMENT

FOR

COAL GASIFICATION AND LIQUEFACTION PROCESSES

C.F. Braun & Co.
Alhambra, California

Report for the Site Visit of
September 1981

Contract No. 210-70-0084

April 1982

Submitted to:

Phillip A. Froehlich, Project Officer
National Institute for Occupational
Safety and Health
Division of Physical Sciences and Engineering
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati, Ohio 45226

Submitted by:

Donato R. Telesca, Manager
Engineering Department
Dynamac Corporation
Enviro Control Division
11140 Rockville Pike
Rockville, Maryland 20852

FINAL

CONTROL TECHNOLOGY ASSESSMENT

FOR

COAL GASIFICATION AND LIQUEFACTION PROCESSES

C.F. Braun & Co.
Alhambra, California

Report for the Site Visit of
September 1981

Contract No. 210-70-0084

April 1982

Submitted to:

Phillip A. Froehlich, Project Officer
National Institute for Occupational
Safety and Health
Division of Physical Sciences and Engineering
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati, Ohio 45226

Submitted by:

Donato R. Telesca, Manager
Engineering Department
Dynamac Corporation
Enviro Control Division
11140 Rockville Pike
Rockville, Maryland 20852

FOREWORD

On September 17, 1981, the Control Technology Assessment (CTA) team visited C.F. Braun & Co. in Alhambra, California. The purpose of the visit was to discuss with C.F. Braun, an engineering and construction subsidiary of Santa Fe International Corporation, the control technology they incorporated, or are considering for incorporation into the design of synthetic fuel plants.

The meeting was attended by the following:

C.F. Braun & Co.

Roger Detman, Project Manager

Enviro Control

Donato Telesca, Project Manager
Russell Tanita, Industrial Hygienist
Jan Scopel, Chemical Engineer

TABLE OF CONTENTS

I. SUMMARY

C.F. Braun & Co. (Braun), an engineering and construction firm, has been a major contributor to the synthetic fuel program. Braun was the evaluation contractor for the combined Department of Energy (DOE) and Gas Research Institute (GRI) high-Btu coal gasification program.

Braun performed technical evaluations on the following processes under development in the combined program.

- HYGAS Steam-Oxygen
- HYGAS Steam-Iron
- Synthane
- BI-GAS
- CO_2 Acceptor

An index of the "Coal Gasification Program Reports on Work by C.F. Braun & Co." is attached.

II. INTRODUCTION

C.F. Braun & Co., the Engineering and Construction Subsidiary of Santa Fe International Corporation is located at 1000 So. Fremont Avenue, Alhambra, California. Braun initiated the "Evaluation of the High-Btu Gasification Project" sponsored jointly by DOE and GRI in March 1972. Because of the complex nature of the program, a number of concurrent efforts, ranging from monitoring pilot plants to in-depth studies, were required to evaluate the technical and economic potential of the processes for continued development.

III. DISCUSSION

Braun recognizes the potentially hazardous components which may be produced in the coal conversion process. However, because of the preliminary nature of conceptual designs to establish an economic, feasible conversion process there is little or no design done to incorporate controls for occupational health.

Design engineers usually design the process for the specific coal feed to be used by the plant. After the design is completed, material balances are checked and the in-process products are checked against existing OSHA standards and also proposed NIOSH standards. If there are apparent problems, the process is "fine tuned" so that existing regulations can be met.

Architectural and engineering (A&E) and engineering and construction (E&C) firms such as Braun, normally design plants to meet construction and safety standards. These are mechanical engineering, safety, electrical and fire regulations, and vessel design, pressure vessels, welding, etc. (i.e., safety oriented) standards. A&E and E&C firms have difficulty incorporating the health aspect into the design of coal conversion units due to the lack of standards regulating worker exposure to plant products. As a result, A&E firms can design the plants only to meet the standards established for each of the various chemicals which may be present during the operation of the coal conversion units. However, it is recognized that potentially hazardous components may be produced in the coal conversion process, even though occupational health-related parameters are not considered during the design of the system. This action has been taken because of the absence of definitive occupational health standards comparable to the Environmental Protection Agency (EPA) emission standards which can be used in setting the operational parameters of the process design. Braun prefers, in the absence of such definitive standards, to address these health-related issues at some later stage in the development of the overall gasification system. It is not considered cost effective to investigate health related parameters by providing a more realistic setting for evaluating the occupational hazard imposed by the coal conversion process until after a candidate process has sucessfully passed the inital screening evaluation such as is conducted in the joint program.

An exception to this general policy should be recognized by Braun and this involves points in the process where products or byproducts are removed. This aspect of the occupational health issue can be addressed at the design stage where the composition and amount of product or byproduct being released can be determined. Such information should allow an assessment of the hazard of working in the area and the corresponding need of controls, such as local exhaust ventilation.

IV. CONCLUSIONS

A&E firms do not include equipment for occupational health during the conceptual design of the plant for economic evaluation.

A&E firms design the coal conversion units to meet existing or proposed exposure standards; but have no way of determining any resulting synergistic effects of products at coal conversion units.

V. RECOMMENDATIONS

A research program is needed to determine the workplace exposure standards for chemicals produced at coal conversion facilities.

The A&E firms should include known occupational health standards early in the design phase. Retrofitting necessary equipment to protect the workers is costly and, in many cases, not the most effective means of reducing exposure in the workplace.

APPENDIX A

Coal Gasification Program

Reports on Work by C.F. Braun & Co.

Coal Gasification Program
Reports on Work by C F Braun & Co

Index

Revision 2

Roger Detman

C F BRAUN & CO
Alhambra, Cal 91802

EVALUATION CONTRACTOR
FOR
JOINT DOE-GRI COAL
GASIFICATION PROGRAM

Date Published—September 1978

PREPARED FOR THE UNITED STATES
DEPARTMENT OF ENERGY
AND
GAS RESEARCH INSTITUTE

Under Contract No. EX-76-C-01-2240

FORWARD

The efforts being expended to accomplish the objectives of the Combined DOE-GRI High Btu Coal Gasification Program have been directed toward the development of a number of coal gasification techniques that show promise as commercial processes for the production of a substitute natural gas from coal. The complex nature of this program requires a number of concurrent efforts ranging from evaluation of pilot plant operations to in-depth studies and trade-off analyses of alternate unit processes and individual types of equipment. The wide spectrum of engineering expertise required to complete these studies is being provided by C F Braun & Co, and the data thus collected or generated in these efforts are being prepared for distribution. The reports cover a variety of subjects associated with the development of the technology and equipment required in a commercial coal gasification facility.

Each study prepared for publication as an interim or final report is given a series number that permits classification of these reports as part of an expandable index system. This number classifies the report by general subject area (category), division of the general subject area (subcategory), and specific study within each division. The major subject areas/categories are designated as follows:

I Process Studies

II Mechanical Development Studies

III Engineering Studies

IV Economic Studies

V Environmental Studies

The divisions are designated by Alphabetical letters starting with "A" and proceeding sequentially with numbers used to designate the specific study within the division. Using the index as a reference and the index number I:E-8 as an example, the final report thus designated is a process study on methanation with the emphasis on "Carbon Formation in Methanators."

Although the work required to complete all the assigned studies will require several years, individual reports will be prepared, classified as above, and published whenever an identifiable phase of the work has been completed. When justified, periodic updating of the work will also be performed, and these updated versions published in a similar format. The complete report series will provide an extensive resource of data on all aspects of coal gasification techniques, unit operations, processing equipment, construction, materials, economics, environmental impact, etc. Report numbers will not be a continuous consecutive series because of deletions or withdrawals before publication.

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY I - PROCESS STUDIES

SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
A COAL PRETREATMENT	1	COAL PRETREATMENT STUDY	FE-2240-20	INTERIM	MAY 75
	2	COAL PRETREATMENT PROCESSES *			
B COAL FEEDING	1	COAL SLURRY FEEDING *			
	2	COAL SLURRY DRYING *			
C SHIFT CONVERSION	1	PACKED BED REACTOR SHAPE	FE-1235-2	FINAL	SEP 75
	2	SHIFT CONVERSION CATALYSTS COMPARISON	FE-2240-48	FINAL	OCT 77
D ACID GAS REMOVAL	1	COMPARISON OF ACID GAS REMOVAL PROCESSES	FE-2240-49	FINAL	APR 78
	2	SELECTIVE VERSUS NONSELECTIVE ACID GAS REMOVAL (THIS REPORT WAS WITHDRAWN FOR INCORPORATION INTO FE-2240-50, CATEGORY I: F-8)	FE-2240-24	INTERIM	
E METHANATION	1	METHANATION PROCESSES	FE-2240-18	INTERIM	MAR 75
	2	WET METHANATION EVALUATION	FE-2240-14	FINAL	OCT 73
	3	LIQUID PHASE METHANATION, PRESSURE STUDY	FE-2240-17	INTERIM	DEC 74
	4	METHANATION PROCESSES COMPARISON *			
		a FIXED BED METHANATION PROCESSES	FE-2240-96	FINAL	AUG 78
		b LIQUID PHASE METHANATION PROCESS *			
		c PACKED TUBE METHANATION PROCESS *			
		d FLUIDIZED BED METHANATION PROCESS *			
		e TUBE WALL AND PARALLEL PLATE * METHANATION PROCESSES			
	5	METHANATION CATALYSTS COMPARISON	FE-2240-42	FINAL	OCT 77
	6	METHANATION FEED GAS CARBON DIOXIDE LEVEL	FE-2240-45	FINAL	OCT 77
	7	COMBINED SHIFT-METHANATION PROCESSES	FE-2240-97	FINAL	SEP 78
	8	CARBON FORMATION IN METHANATORS	FE-2240-10	FINAL	JUL 76

* Subject area is still under Research and Development, and insufficient data is available for comprehensive analysis.

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY I - PROCESS STUDIES Continued

SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
F EFFLUENT TREATMENT	1	PROCESS COMPARISON EFFLUENT TREATMENT AMMONIA SEPARATION	FE-2240-19	FINAL	JUN 75
	2	PROCESS COMPARISON SULFUR PLANT	FE-2240-28	INTERIM	NOTE 1
	3	CLAUS SULFUR PLANTS COMPARISON - HIGH SULFUR COAL (PROPRIETARY)			NOTE 2
	4	EFFLUENT TREATMENT - COMBINED ACID GAS AND FLUE GAS SULFUR REMOVAL	FE-2240-11	FINAL	NOTE 3
	5	SULFUR REMOVAL FROM FLUE GAS	FE-2240-51	FINAL	SEP 78
	6	SULFURIC ACID VERSUS ELEMENTAL SULFUR AS BY-PRODUCTS	FE-2240-54	FINAL	JAN 78
	7	PROCESS ALTERNATIVES FOR SULFUR MNGMT	FE-2240-41	OVERVIEW	JAN 78
	8	SULFUR RECOVERY IN A COAL GASIFICATION PLANT	FE-2240-50	FINAL	AUG 78
	9	REMOVAL OF PHENOLS FROM PROCESS CONDENSATE	FE-2240-39	INTERIM	OCT 77
	10	EFFLUENT TREATMENT - AQUEOUS WASTE	FE-2240-9	INTERIM	OCT 77

NOTES: 1 Withdrawn due to lack of sufficient vendor responses to inquiry specification.
2 Deleted due to proprietary limitations on release of design information.
3 Withdrawn due to changes in environmental performance standards.

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY II - MECHANICAL DEVELOPMENT STUDIES

	SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
A	GENERAL	1	MECHANICAL DEVELOPMENT RECOMMENDATIONS	FE-2240-44	INTERIM	JUN 77
		2	MECHANICAL DEVELOPMENT INVESTIGATIONS	FE-2240-47*	INTERIM	OCT 77
B	GRINDING	1	PRELIMINARY COAL GRINDING TESTS FOR THE DESIGN OF COAL GRINDING SYSTEMS IN COAL GASIFICATION PLANTS	FE-1235-4	INTERIM	DEC 75
C	GASIFIER	1	REFRACTORIES	FE-2240-21	FINAL	NOV 76
		2	GASIFIER SHELL DESIGN AND CONSTRUCTION	FE-2240-22	FINAL	DEC 76
		3	BASIC REQUIREMENTS FOR THE DESIGN AND CONSTRUCTION OF GASIFIER VESSELS	FE-2240-46	FINAL	APR 78
D	DUST CONTROL	1	DUST SEPARATOR	FE-2240-29	INTERIM	FEB 77
		2	ELECTROSTATIC PRECIPITATOR	FE-2240-33	INTERIM	FEB 77
		3	GRANULAR BED FILTER	FE-2240-34	INTERIM	FEB 77
		4	CYCLONES	FE-2240-30	INTERIM	JAN 77
E	MACHINERY	1	POWER RECOVERY EXPANDERS	FE-2240-23	INTERIM	DEC 76
		2	SLURRY CENTRIFUGAL PUMPS	FE-2240-25	INTERIM	JAN 77
F	CONTROL	1	ROTARY FEEDERS, (VENDOR RESPONSE)	FE-2240-15	PRELIM	AUG 74
		2	DRY SOLIDS FEEDERS	FE-2240-26	INTERIM	JAN 77
		3	SEAL VALVES AND ROTARY VALVES	FE-2240-27	INTERIM	JAN 77
		4	INTERNAL SOLIDS CONTROL VALVES	FE-2240-36	INTERIM	FEB 77
		5	DRY SOLIDS FLOW METER	FE-2240-94	FINAL	APR 78
		6	GASIFIER TEMPERATURE MEASUREMENT	FE-2240-95	FINAL	APR 78
G	COAL HANDLING	1	COAL SIZE REDUCTION	FE-2240-35	INTERIM	FEB 77
		2	COAL SIZE REDUCTION AND SIMULTANEOUS DRYING	FE-2240-37	INTERIM	FEB 77
		3	COAL DRYING	FE-2240-38	INTERIM	FEB 77
		4	VERTICAL LIFT DRYER PILOT PLANT DESIGN	FE-2240-32	FINAL	APR 78
		5	SLURRY INJECTION NOZZLE FOR A VERTICAL LIFT DRYER	FE-2240-92	FINAL	MAY 78

*CONSOLIDATED REPORT CONTAINING UNDERLINED REPORTS

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY III - ENGINEERING STUDIES

SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
A SAFETY ASSURANCE	1	SAFETY ASSURANCE STUDY OF HIGH BTU COAL GASIFICATION PILOT PLANTS	FE-2240-8	INTERIM	AUG 76
B MATERIALS	1	MATERIALS OF CONSTRUCTION FOR HIGH BTU COAL GASIFICATION PLANTS	FE-2240-43	INTERIM	JAN 78
	2	MATERIALS DEVELOPMENT STUDIES FOR HIGH BTU GASIFICATION	FE-2240-93	INTERIM	APR 78

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY IV - ECONOMIC STUDIES

SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
A GUIDELINES	1	COAL GASIFICATION COMMERCIAL CONCEPTS GAS COST GUIDELINES	FE-1235-1	INTERIM	JAN 76
	2	COAL GASIFICATION COMMERCIAL CONCEPTS GAS COST GUIDELINES, REVISION 1	FE-2240-100	FINAL	AUG 78
B ESTIMATES	1	FACTORED ESTIMATES FOR WESTERN COAL COMMERCIAL CONCEPTS	FE-2240-5	INTERIM	OCT 76
	2	FACTORED ESTIMATES FOR EASTERN COAL COMMERCIAL CONCEPTS	FE-2240-31	INTERIM	SEP 78
	3	CONSIDERATIONS IN SIZING COAL GASIFICATION PLANTS	FE-2240-40	FINAL	SEP 78
	4	FACTORED ESTIMATES FOR LIGNITE COMMERCIAL CONCEPTS	FE-2240-98	INTERIM	AUG 78
	5	A COMPARISON OF STEAM-IRON AND KOPPERS-TOTZEK PROCESSES FOR COMMERICAL HYDROGEN FROM CHAR	FE-2240-56N	-	NOTE 1
	6	INTERIM COMPARISON OF HYGAS CONCEPTS FOR HIGH BTU GASIFICATION OF EASTERN COAL	FE-2240-57N	-	NOTE 1

NOTE 1 NOT PUBLISHED, ON FILE AT DOE.

DOE-GRI
Washington, DC

COAL GASIFICATION PROGRAM
REPORTS ON WORK BY C F BRAUN & CO
INDEX

Project 4568-NW
March 1978
September 1978

CATEGORY V - ENVIRONMENTAL STUDIES

SUBJECT AREA		REPORT TITLE	REPORT NUMBER	REPORT TYPE	DATE PUBLISHED
A EVALUATIONS	1	CARBONYL FORMATION IN COAL GASIFICATION PLANTS	FE-2240-16	INTERIM	DEC 74
B SURVEYS	1	PROBLEMS ASSOCIATED WITH CONTROLLING SULFUR EMISSIONS FROM HIGH BTU COAL GASIFICATION PLANTS	FE-2240-13	INTERIM	AUG 78
		GENERAL			
PROJECT SUMMARY		FINAL PROJECT REPORT	FE-2240-101	FINAL	NOV 78
REPORT INDEX		COAL GASIFICATION PROGRAM REPORTS ON WORK BY C F BRAUN & CO	FE-2240-12	REV 0	OCT 76
			FE-2240-12	REV 1	MAR 77
			FE-2240-99	REV 2	SEP 78