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KENNEDY SPACE CENTER

THE UNIVERSITY OF ALABAMA

A PRELIMINARY STUDY OF ENVIRONMENTAL PARAMETERS ASSOCIATED WITH THE FEASIBILITY OF A POLYGENERATION PLANT AT KENNEDY SPACE CENTER

Prepared By:	Grover D. Barnes, Ph.D.
Academic Rank:	Associate Professor
University and Department:	Jackson State University Department of General Science
NASA/KSC:	
(Directorate)	Design Engineering
(Branch)	Project Engineering Office
KSC Counterpart:	Gary Gutkowski

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Grover D. Barnes, Ph.D.
Associate Professor of General Science
Jackson State University
Jackson, MS 39217

ABSTRACT

A study is under way to determine the feasibility of a polygeneration plant at Kennedy Space Center. Liquid hydrogen and gaseous nitrogen are the two principal products in consideration.

Environmental parameters (air quality, water quality, biological diversity and hazardous waste disposal) necessary for the feasibility study are being investigated. A National Environmental Policy Act (NEPA) project flow sheet will be formulated for the environmental impact statement. Water quality criteria for Florida waters will be established.

ACKNOWLEDGEMENTS

Special thanks is given to Mr. Gary Gutkowski, my counterpart at KSC, for the fine support given to this participant and to the Polygeneration Team (Walt Feitshans, Frank Howard, Julian King and Larry Manfredi) for their help. I appreciate Mr. Peter Minderman, Director of Design Engineering, asking me to work on the Polygeneration Project.

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INTRODUCTION

A feasibility study is being done on a polygeneration facility (PF) on the Kennedy Space Center (KSC) in Brevard County, Florida. KSC borders the Indian and Banana Rivers, important estuarine ecosystems.

Extensive surveys for the proposed PF were conducted. Three potential sites have been selected.

The design of the PF facility will utilize a combined cycle coal gasification system to produce 12 tons of liquid hydrogen/day. Best available control technology will be utilized to limit environmental pollution.

The source of make-up matter is groundwater from the Florida aquifer or a mixture of groundwater and treated sewage effluent from KSC. If any available technology (Luthy, 1981) is economically feasible, no discharge to surface waters will occur. If wastewater is eliminated, the effluent will be discharged into a turn basin barge canal which empties into the Banana River, a Class III Outstanding Florida Water Stream. Available technology within economic restraints will be utilized to control air pollutant emissions including the removal of sulfur, nitrogen, and particulates.

Dr. Grover D. Barnes

Outline of the 1982 DOE/ASEE Summer Fellowship Program Objectives

I. Examine the proposed site for the polygeneration plant

   A. Order aerial photographs of the proposed area

   B. Visually examine the site for environmental features: aquatic and terrestrial - especially note endangered and protected species of plants and animals

II. Attend the short course on ASPEN

III. Meet key personnel who will be involved in various phases of implementation

IV. Formulate project environmental flow sheet

V. Run computer searches for data on air and water pollution produced by polygeneration plants in the following sources: Aquatic Sciences & Fisheries Abstracts, Aqualine, APTIC, CHEM SEARCH, DOE Energy Environmental Biblio, Pollution Abstracts, Water Resources Abstracts, CHEM Industry Notes, and BIOSIS Reviews

VI. Initiate a draft of the Intent to Prepare a Draft Environmental Impact Statement to include:

   A. Agency

   B. Action

   C. Summary

      1. What the proposed action consists of

      2. Alternatives under consideration

      3. List of significant environmental issues to be analyzed in depth

      4. Description of the scoping process

      5. List of any environmental review and consultation requirements

      6. Expected release date of draft EIS

      7. Discussion of any letter of agreement regarding lead and cooperating agencies

BODY OF REPORT

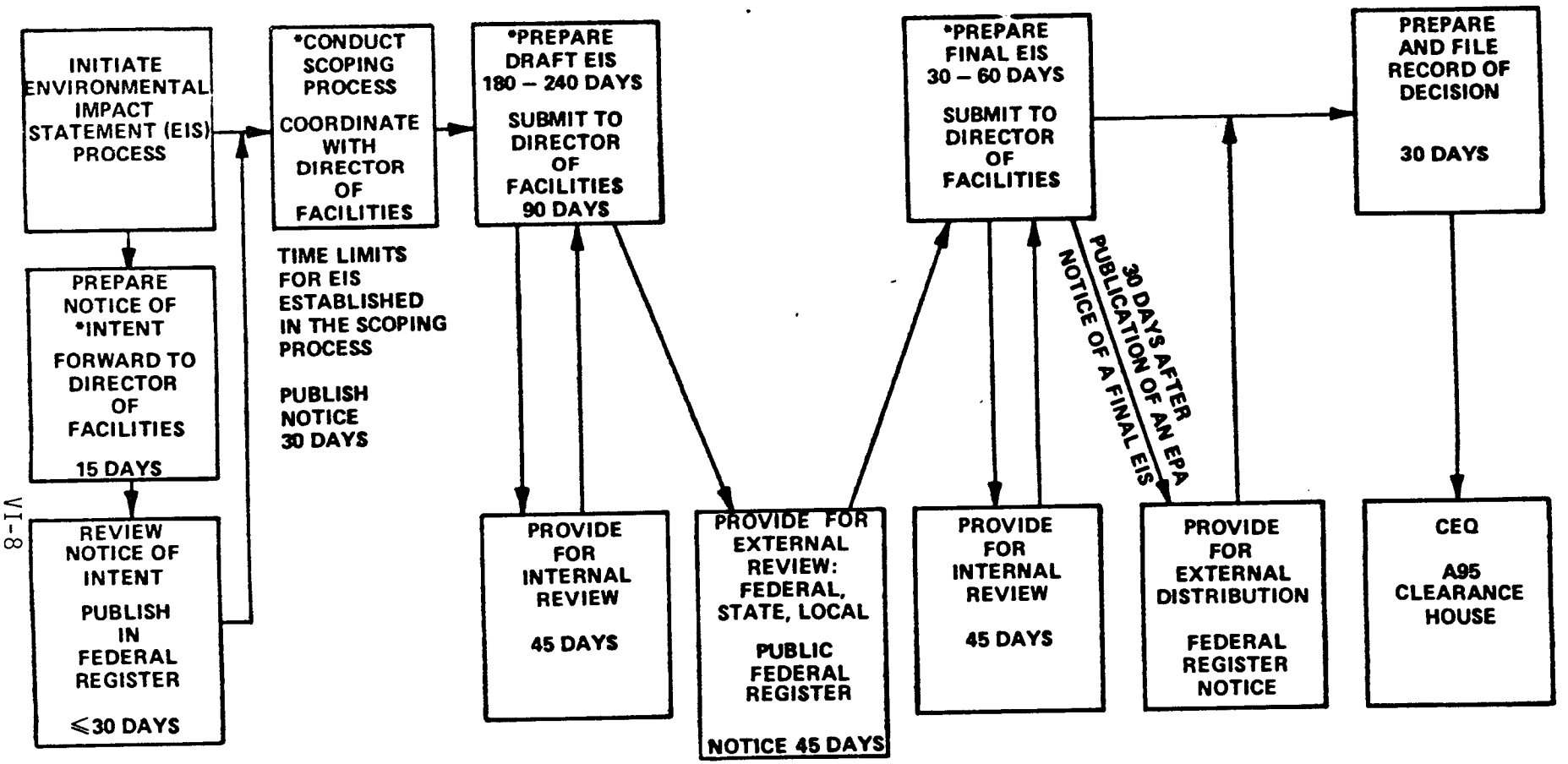
Essentially all of the objectives of the 1982 DOE/ASEE Summer Fellowship Program were done. Aerial photographs were ordered and received.

On two different occasions (22 June and 28 July, 1982), the proposed polygeneration site was observed for endangered and threatened species of plants and animals. Only one threatened species on the Florida State list, the Florida Scrub Jay, was observed. Two jays were seen on the first trip and one on the second trip.

The ASPEN course was conducted from 8 June 1982 to 11 June 1982. This participant attended this course and completed the required assignments.

Various meetings were held to meet individuals involved in various phases of implementation of the polygeneration plan. The following individuals were contacted: Dr. Jim Kanipe, Peggy Hallisey, David Breininger, Dr. Clair Bemiss, David Dunsmoor, Bill Brannan, Dr. Al Koller, Bill Knott, Paul Toft, Pablo Auffant and Terry L. Krzywicki.

The polygeneration environmental flow sheet is shown in Figure 1. Computer searches for air and water pollution produced by polygeneration plants were run in the following sources: Water Resources abstracts, DOE Energy, NASA files and Chem Industry Notes. The other sources were not utilized due to cost factors. The criteria of Florida surface water quality is shown in Table I. These criteria are necessary for evaluation of environmental licensing.



* AT EACH MAJOR STEP, MATERIAL WILL BE SUBMITTED TO THE A–95 CLEARING HOUSE. TIME FRAME FOR COMPLETION OF EIS – (540 – 630 DAYS).

Figure 1 - A Time Flow Chart for the Environmental Impact Statement (EIS) in a Feasibility Study of a Cogeneration Plant at Kennedy Space Center

TABLE I

THE CRITERIA OF FLORIDA SURFACE WATER QUALITY IN CLASSIFIED WATERS:

CLASS I-A Potable Water Supplies - Surface Waters
CLASS I-B Potable and Agricultural Water Supplies and Storage - Groundwaters
CLASS II Shellfish Propagation or Harvesting - Surface Waters
CLASS III Recreation, Propagation and Management of Fish and Wildlife - Surface Waters
CLASS IV Agricultural Water Supplies - Surface Waters
CLASS V-A Navigation, Utility and Industrial Use - Surface Waters
CLASS V-B Freshwater Storage, Utility and Industrial Use - Groundwaters

All Values mg/l Unless Indicated	Surface	Class I-A	Class I-B	Class II	Class III	Class IV	Class V-A
As	0.05		0.05				
BOD	Class Criteria						
Chlorides	≤ 10% Background						
Cr	1.0 Total		0.05				
Cu	0.5	0.03		15.0	15.0		
Detergents	0.5						
Fluorides	10.0	1.50	1.50	1.50	5.0		
Pb	0.05	0.03	0.05		0.03		
Oils & Greases	5.0						

TABLE I CONTINUED

All Values mg/l Unless Indicated	Surface	Class I-A	Class I-B	Class II	Class III	Class IV	Class V-A
pH	≅ 1.0 unit above or below natural within range: 6.0 - 8.5			≅ 1.0 unit above or below range: 6.5 - 8.5	Same as II	Same as II	5.0 - 9.5 except swamp H_2O (down to 4.5)
Phenols	0.001						
Radioactive (A) radium 226 & 228 (picouries/l)	5.0		5.0				
(B) Gross alpha particles (picouries/l)	15.0		15.0				
Specific Conductance	Not over 100% Increase in Natural Level						
No Adverse Toxic Substances			X			X	X
No Discharge Resulting in Nuisance Species			X				
Turbidity (Jackson Units)	50.0						

TABLE I CONTINUED

All Values mg/l Unless Indicated	Surface	Class I-A	Class I-B	Class II	Class III	Class IV	Class V-A
Zn	1.0	0.03			0.03		
D.O.		5.0		5.0	5.0	Average 4.0/24 hr Never $<$ 3.0	$\geq$ 2.0
Alkalinity mg/l $CaCO_3$		20.0			20.0	600	
NH_3		0.02			0.02		
Bacteriological Quality/100 ml		1.00		70	200		
Ba		1.00	1.00				
Be		1.10			0.011-1.10	0.10-0.5	
Biological Integrity (Background)		75%		75%	75%		
Cd		0.008-0.012	0.001	0.005	0.005		
Chlorides		250					
Chlorine (Total Residual)		0.01		0.01	0.01		
CN		0.005		0.005	0.005	0.005	0.005

TABLE I CONTINUED

All Values mg/l Unless Indicated	Surface	Class I-A	Class I-B	Class II	Class III	Class IV	Class V-A
Dissolved Solids		500					
Fe		0.3		0.3	0.3	1.0	
Hg		0.002	0.002	0.001	0.001	0.002	0.002
Ni		0.1		0.1	0.1	0.1	
NO_3 (Total N)		10.0	10.0	0.025			
Selenium		0.01	0.01	0.05	0.025		
Ag		0.00007	0.00005		0.00005		
Al				1.5	1.5		
Antimony				0.2	0.2		
Bromine				0.1	0.1		
Bromates				100	100		
Mn					0.1		
P (elemental)				0.0001	0.0001		
Polychlorinated Biphenyls				0.000001	0.000001		
Pb					0.03		
Phthalate esters					0.003		
Boron						0.75	

NASA

NOTICE (7 August 1982)

Intent to Prepare a Draft Environmental Impact Statement

AGENCY: National Aeronautics and Space Administrative

ACTION: NOTICE OF INTENT TO PREPARE A DRAFT EIS

SUMMARY:

1. PROPOSED ACTION: A Polygeneration Facility (PF) at Kennedy Space Center (KSC) for producing 12 tons of liquid hydrogen/days and ancillary gaseous nitrogen.

2. ALTERNATIVES UNDER CONSIDERATION:

A. No Action.

With the launch of each shuttle, forty-four trucks are necessary to transport hydrogen from New Orleans, LA, to KSC. Significant increases are expected in transportation costs. The anticipated goal of twenty-four launches will mean that approximately one thousand and fifty-six trucks will be on the road annually with highly explosive materials. This increase in transportation movement increases the statistical chance of accident and public impairment.

With the advent of a petroleum embargo, the possibility exists that no fuel will be available for the hydrogen transportation system. This would preclude shuttle launches and impair national security.

Hydrogen is not the sole product designed by KSC. Nitrogen and electrical generation are additional ancillary products which could be utilized. On-site or near-site generation of hydrogen and other desirable by-products would greatly enhance the feasibility.

B. ACTION

The PF is proposed to be located on/near KSC in Brevard County, FL. The site borders the Indian and Banana Rivers.

Extensive surveys for the proposed PF were conducted. Three potential sites have been selected.

The design of the PF willutilize a combined cycle coal gasification system to produce 12 tons of liquid hydrogen/day. Best available control technology will be used to limit environmental pollution.

The source of the make-up matter is groundwater from the Florida aquifer or a mixture of groundwater and treated sewage effluent from KSC. If any available technology is economically feasible, no discharge into surface waters will occur. If wastewater is eliminated into surface waters, the effluent will be discharged into a turn basin canal which empties into the Banana River, a Class III (outstanding Florida waters) stream. Available technology within economic restraints will be utilized to control air pollutant emissions including the removal of sulfur, nitrogen and particulates.

3. List of Significant Environmental Issues to be Analyzed in Depth in the Draft EIS.

a. Air quality;

b. Water quality;

c. Waste generation, treatment, transportation disposal and storage;

d. Noise;

e. Toxic substances

f. Biotic resources;

g. Endangered species;

h. Historical, archaelogical and recreational factors;

i. Wetlands and flood plains;

j. Economic, population and employment factors, provided they are interrelated with natural or physical environmental factors.

4. DESCRIPTION OF THE SCOPING PROCESS

The proposed schedule for the Polygeneration Facility is as follows:

ACTIVITY	DATE
State/Federal Scoping Meetings	Dec., 1982
Submission of Draft Environmental Impact Statement (EIS)	Sept., 1983
Final EIS	June, 1984
Commence Construction	May, 1985
Operation	Aug., 1987

5. LIST OF ANY ENVIRONMENTAL REVIEW AND CONSULTATION REQUIREMENTS

a. Air monitoring to include ambient air criteria for one year (specific pollutants: sulfur dioxide, ozone, nitrogen dioxide, carbon monoxide, particulates and hydrocarbons). This includes quality assurance monitoring to assess critical environmental parameters for one year near the proposed sites.

b. Phytoplankton and zooplankton sampling for two years to determine ecosystem species diversity and stability of aquatic ecosystems. Bioassays should be conducted to assess possible toxicity of blowdowns at major discharge points in the PF.

c. Hazardous waste disposal and siting must be investigated.

d. Benthic macroinvertebrate sampling surveys should be conducted. Previous data exists which could be utilized in this area.

e. Terrestial surveys should be correlated with previous studies.

f. Legal assessment and consultation must parallel all environmental work. If legal assitance at local, county, regional and state levels in the environmental areas necessary for the PF is not available or accessible from NASA, then outside legal assistance must be obtained to facilitate legality.

Steps (a), (b) and (d) should be statistically valid.

6. EXPECTED RELEASE DATE OF DRAFT EIS

6 September 1983

7. DISCUSSION OF ANY LETTER OF AGREEMENT REGARDING LEAD AND COOPERATING AGENCIES.

NASA is the initiating agency and there are no cooperating agencies.

8. LOCATION: Kennedy Space Center, Brevard Co., FL 32899

DATE: 7 August 1982

For further information:

Mr. Gary Gutkowski
Polygeneration Project Engineer
DF-PEO
Kennedy Space Center, FL 32899

RESPONSIBLE HEADQUARTERS OFFICIAL:

NASA Headquarters
Attn: NX-2/Gen. Billie J. McGarvey
Washington, D.C. 20546

SIGNATURE:_____

Robert F. Allnutt (Acting)
Associate Administrator for External
Affairs

CONCLUSIONS AND RECOMMENDATIONS

The polygeneration plan appears to be an excellent method for generating liquid hydrogen if environmental control is implemented. Figure 1 should be followed for the development of an environmental impact statement.

Recommendations for the environmental aspects of the EIS include:

a. Air monitoring to include ambient air criteria for one year (specific pollutants: sulfur dioxide, ozone, nitrogen dioxide, carbon monoxide, particulates and hydrocarbons). Quality assurance monitoring to assess critical environmental parameters for one year near the proposed sites.

b. Phytoplankton and zooplankton sampling for two years to determine ecosystem species diversity and stability of aquatic ecosystems. Bioassays should be conducted to assess possible toxicity of blowdowns at major discharge points in the PF.

c. Hazardous waste disposal and siting must be investigated.

d. Benthic macroinvertebrate sampling surveys should be conducted. Previous data exists which could be utilized in this area.

e. Terrestrial surveys should be correlated with previous studies.

f. Legal assessment and consultation must parallel all environmental work. If legal assistance at local, county, regional and state levels in the environmental areas necessary for the PF is not available or accessible from NASA then outside legal assistance must be obtained to facilitate legality.

Steps (a), (b), and (d) should be statistically valid.

REFERENCES

1. Luthy, R. G., "Treatment of Coal Coking and Coal Gasification Wastewaters", Journal of the Water Pollution Control Federation, 53, 3, 325-339.