

PD-ABI-658

12/14/93

**R-II BUILDERS - FLUE GAS CONDITIONING EQUIPMENT
FOR MUNICIPAL WASTE INCINERATION
TECHNOLOGY ASSESSMENT PROJECT**

December 14-18, 1993

Prepared for:

US - ASIA ENVIRONMENTAL PARTNERSHIP



WORLD ENVIRONMENT CENTER

DISCLAIMER

This project was sponsored by the U.S. Agency for International Development through WEC's Cooperative Agreement in support of the US - Asia Environmental Partnership (US-AEP). The opinions expressed herein are the professional opinions of the author and do not represent the official position of the Government of the United States of America or the World Environment Center.

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I. EXECUTIVE SUMMARY

R-II Builders, Inc. was founded on September 8, 1988. Since then, the firm has undertaken several major construction projects, some of which are considered landmark structures. Examples of R-II Builders' past projects include the construction of 1664 residential units, valued at P\$200 million, in 1990 and a development of 100 hectares to resettle the victims of Mount Pinatubo in 1992. Recently, R-II was awarded the Smokey Mountain Development and Reclamation Project (SMDRP).

Currently in Metro-Manila, the environment continues to deteriorate due to, among other factors, ineffective garbage disposal systems. The Smokey Mountain open pit garbage site has been in existence for four decades and has become a human health and safety hazard, as well as, the center of an impoverished community of 3500 shanties.

In an effort to review technologies that would be used to clean up Smokey Mountain, a senior level delegation from R-II Builders, Inc. participated in WEC's Environmental Business Exchange program from December 14-18, 1993. The delegation was interested in environmentally-safe and economical solutions to the problems they faced at Smokey Mountain. R-II Builders has taken on the challenge of cleaning up the dumpsite and turning this prime real estate to more useful purposes. By completing the development plan, they will reduce the volume of the current mountain and effectively deal with the continued in-flow of garbage. Ultimately, R-II will reclaim the land and convert the site into housing and industrial areas.

While in the United States, the delegation had the opportunity to assess technologies for incineration, applicable flue gas conditioning, landfill closure, and general environmental engineering services. They found that the U.S. offers state-of-the-art environmental systems that should fit their needs nicely. Currently, they are pursuing business relationships with a supplier of flue gas conditioning, NaTec Resources, Inc. of Houston, Texas. Also, R-II Builders has invited PBS&J, an environmental engineering and consulting firm with extensive experience in landfill closure and leachate recovery systems, to visit Manila for a "scoping mission" on how they can work together to solve some of the problems at Smokey Mountain.

This exchange was conducted under the auspices of the United States-Asia Environmental Partnership (US-AEP), through a Cooperative Agreement with the WEC. The R-II Builders delegation consisted of: Reghis M. Romero II, Chairman of the Board; Edmond Q. Sese, President; Raul A. Arellano, Jr., Vice President - Equipment; and Atanasio Verside, Vice President - Fabrication.

II. INTRODUCTION

The government of former President, Corazon Aquino, initiated a proposal to transform the Smokey Mountain site into a viable residential, commercial, and industrial community. On October 8, 1992, President Fidel Ramos officially launched the project.

The Smokey Mountain site is a 22 hectare open pit garbage dumpsite in the District of Tondo, Manila, the Philippines. The total volume of the Smokey Mountain is estimated at 2.35 million tons. Of this, the percentage of "fresh" or undecomposed garbage is estimated at about 25 percent or 600,000 cu.M. The Philippine government is of course very anxious to rectify the current human health, safety and general environmental hazards caused by this mountain of garbage.

At the same time, the government is seeking methods of increasing electricity generation to help alleviate the crippling power supply shortage. It was the intent of this exchange to help further identify the most economical and efficient solution to Metro-Manila's garbage disposal and electricity shortage problems. The mission was therefore interested in municipal waste incineration facilities with effective flue gas treatment and power generation capabilities.

Metro-Manila is composed of 4 cities and 13 municipalities with a land area of 636 square kilometers. Its population estimate as of 1993 was 8.5 million. At present, the area generates domestic waste at a rate of about 5,400 metric tons per day (TPD). With the estimated increase in population and garbage generation per capita, there will be 11,700 TPD by the year 2014. Currently, about 85 percent or 4,590 TPD of garbage is collected and effectively disposed of in the landfills and dumpsites.

Under the sponsorship of the US-AEP through its Cooperative Agreement with WEC, the R-II Builders, Inc. delegates met with U.S. firms to observe, review, and evaluate technologies in flue gas treatment, incineration and related power generation. This report discusses the experts' findings, conclusions and recommendations resulting from this mission.

III. DISCUSSIONS AND FINDINGS

A. Introduction

The mission met with experts in flue gas conditioning systems engineering, waste-to-energy facility design, and environmental and infrastructure consulting services. The itinerary included: Ogden Martin in Virginia; PBS&J of Maryland; Wisconsin Power & Electric at Port Washington; and NaTec Resources, Inc. of Texas.

B. Ogden Martin Systems

The first stop on their itinerary was a visit to Ogden Martin Systems of Fairfax, Inc. located in Lorton, Virginia. Adjoining the I-95 Fairfax County Landfill, Ogden Martin has built and operates a municipal solid waste incinerator that burns 3000 tons per day of fresh garbage and produces 80 megawatts of electricity. At this site the delegation met with Mr. Rodney A. True, Chief Engineer of the plant. Mr. True explained the company's systems through the use of leaflets, flow charts, and a video. The team then toured the plant and had the opportunity to observe various components of the fuel receiving and loading areas, the incinerator itself, the extensive flue gas treatment system, and power generation facilities. (A fact sheet for this plant is provided in Appendix A, Annex A.)

The team found it interesting that, because of Ogden Martin's fully automated systems, the entire facility can be run by only seven people per shift. On the other hand, the delegation found it disconcerting that the residual ash (including captured fly ash) from the incineration process is simply transported to the landfill and minimally monitored for toxic elements.

C. I-95 Sanitary Landfill and I-95 Gas-to-Electricity Project

After the Ogden Martin plant tour, the team met with Mr. Jon Dyer, Vice President of Federal Programs and Mr. Joseph David, Jr., of Post, Buckley, Schuh and Jernigen, Inc. (PBS&J), an engineering/planning services company. Messrs. Dyer and David presented PBS&J's typical scope of work for a solid waste management and construction service contract. Services explained in the presentation included: solid waste management planning; sanitary landfill design; leachate management; yard waste composting; and various construction services. In turn, R-II Builders, Inc. presented an outline of the Smokey Mountain Development and Reclamation Project.

PBS&J is involved in the landfill closure operation of the I-95 Sanitary Landfill and escorted the team on a tour of the on-going construction at this site. Mr. Kent Aspelin, Engineer Technician for the Division of Solid Waste Disposal and Resource Recovery of the Fairfax County Department of Public Works, explained the closure operation. The team was able to view the synthetic liner and sandfill.

Also of interest to the team was the "Landfill Gas-to-Electricity" project. This is a 6.0 megawatt facility operated by Michigan Cogeneration System that is fueled solely by the naturally occurring landfill gas produced during composting of the garbage. Unfortunately, the team was not able to directly observe the power generating facility. However, learning that electricity can economically and practically be generated from the naturally occurring methane gas produced by a landfill was an intriguing idea. (Fact sheets for the I-95 landfill and the I-95 Gas-to-Electricity Project are provided in Appendix A, Annexes B and C, respectively.)

D. Wisconsin Electric Power Company

Mr. Tim Cox of NaTec Resources, Inc. escorted the team during their visit to the Wisconsin Electric Power Company's municipal waste incinerator at Port Washington, Wisconsin. Mr. Cox demonstrated the facility's newly installed Unit 1 and 4 flue gas desulfurization (FGD) systems (which were designed and constructed by NaTec) utilizing "Processed Dry Sodium Injection" technology. By injecting a special slurry of sodium bicarbonate, also known as Nahcolite, this system: reduces sulfur dioxide (SO₂) emissions by up to 90 percent; can achieve a 40 percent reduction of nitrogen oxides (NO_x); and produces a commercially valuable byproduct of caustic soda. The delegation was impressed with the compactness of these units, which they feel are suitable for the Philippine's projected applications.

E. NaTec Resources

The delegation met Mr. Paul Chaffee at the corporate offices of NaTec Resources, Inc. in Houston, Texas. Mr. Chaffee, a Senior Vice President at NaTec, provided a briefing on the company's past projects and installations.

Dr. Bennett, Process Consultant for NaTec, provided a slide presentation on FGD (SO₂ reduction) systems by NaTec's patented Nahcolite (processed sodium bicarbonate) injection methods. Dr. Bennett also briefed the delegates on the raw sodium bicarbonate mine in Colorado that NaTec Resources, Inc. converts into Nahcolite. This mine has an area of 8200 acres containing more than 85 million tons of naturally occurring sodium bicarbonate.

Mr. Chaffee then provided an additional briefing on the economics of this technology and assured the delegation of a continuous supply of Nahcolite. Mr. Chaffee assured them that the size of R-II Builders' proposed installation is viable and promised to provide a qualification package with cost estimates for the proposed SMDRP incinerator by mid-February.

In turn, Mr. Romero, R-II Builder's Chairman, presented the SMDRP to the NaTec officials. He described the project, particularly the need for an environmentally-friendly municipal waste incinerator.

IV. CONCLUSIONS AND RECOMMENDATIONS

As a result of visiting the Ogden Martin facilities, the I-95 Sanitary Landfill, the NaTec Resources - Port Washington Installation and Corporate Offices, and discussions with PBS&J officials, the executive officers of R-II Builders, Inc. have arrived at the following conclusions.

Recommendation 1: The Ogden Martin technology demonstrated at the I-95 Resource Recovery Incinerator warrants consideration for a joint venture.

The delegation sees the Ogden Martin I-95 Resource Recovery Incinerator as a state-of-the-art facility. However, they are concerned with properly disposing of the residual ash and other waste products. To be viable in R-II Builders installation, the delegation feels that an alternative to landfill burial would have to be found for the disposal of these waste products. If these concerns could be addressed, the mission would be willing to participate in a joint venture with Ogden Martin, or other similar waste-to-energy facility designers, to design and operate a similar municipal waste incinerator for the SMDRP.

Recommendation 2: The I-95 Sanitary Landfill closure procedures could be adopted for the closure of the Smokey Mountain site.

The I-95 Sanitary Landfill and that of the Smokey Mountain Project are akin in size and complexity. The mission experts are considering adopting the same procedures for closing the existing Smokey Mountain dumpsite. They will consider employing the services of consultants who have undertaken similar projects in the U.S. and abroad.

Recommendation 3: The I-95 gas to energy power plant also presents a possible technology for adoption in the Smokey Mountain Project.

The design and operation of the Gas-to-Energy plant at the I-95 Landfill, although small in its power generating capacity, presents an interesting opportunity to enlist the existing garbage at the Smokey Mountain to generate very badly needed electricity with relatively little investment. The delegation hopes to have further discussions about employing this technology in a cost effective manner.

Recommendation 4: NaTec Resources' technology for SO₂ flue gas treatment will be considered.

The NaTec installation for SO₂ treatment is a "space-saver" compared to other systems that the mission has considered. Provided that the system is deemed "cost efficient," it will be considered as a component of the larger flue gas conditioning/treatment systems for the proposed Smokey Mountain incinerator.

Recommendation 5: PBS&J may be able to provide valuable environmental engineering services to the Smokey Mountain Project.

The mission experts recognize the vast expertise offered by PBS&J in the field of environmental engineering. It is thought that PBS&J may be needed in the overall evaluation, design, and implementation of the SMDRP. Further contact to determine the R-II Builders needs and the relevance of PBS&J's services should commence immediately.

APPENDIX A
LIST OF DOCUMENTS RECEIVED

LIST OF DOCUMENTS RECEIVED

1. **From:** WORLD ENVIRONMENT CENTER
 - a. A package of information about US - Asia Environmental Partnership including the agreement for services, scope of work, trip guidelines and trip report.
 - b. The itinerary and schedules.
 - c. US - AEP annual report.

2. **From:** OGDEN MARTIN SYSTEMS OF FAIRFAX, INC.
 - a. Fact sheets about I-95 Resource Recovery Facility.
 - b. Technical brochure on a typical Ogden Martin System Waste-to-Energy Facility.

3. **From:** FAIRFAX COUNTY DEPARTMENT OF PUBLIC WORKS
 - a. Fact sheets I-95 Landfill and I-95 Landfill Gas-to-Electricity Project.
 - b. Literature on disposal fees/regulations and household hazardous waste disposal program.

4. **From:** POST, BUCKLEY, SCHUH & JERNIGAN, INC.
 - a. Book on PBS & J statement of qualifications.
 - b. Environmental services bulletin.
 - c. PBS & J publication of "Highlights".
 - d. Technical books on Understanding Landfill closure and Landfill Mining.

5. **From:** NATEC RESOURCES, INC.
 - a. Fact sheets about NaTec.
 - b. Technical Bulletins of PDSI.
 - c. Letter to Mr. Joseph Rearden.
 - d. CRS Sitrine Company/Business Profile.

<p align="center">E-95// RESOURCE RECOVERY FACILITY</p> <p align="center">FAIRFAX COUNTY, VIRGINIA</p>
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CLIENT: FAIRFAX COUNTY, VIRGINIA
THE FAIRFAX COUNTY SOLID WASTE AUTHORITY

OWNER/OPERATOR: OGDEN MARTIN SYSTEMS OF FAIRFAX, INC.

GUARANTEED CONSTRUCTION PRICE: \$195,000,000

CONSTRUCTION STARTED:	FEBRUARY, 1988
STARTUP:	MARCH, 1990
COMMERCIAL ACCEPTANCE	JUNE, 1990

PROJECT SITE: 23 ACRES IN LORTON, VIRGINIA

WASTE-TO-ENERGY SYSTEM: FOUR 750 TON PER DAY WATERWALL FURNACES WITH MARTIN REVERSE-RECIPROCATING STOKER GRATE TECHNOLOGY

AIR QUALITY CONTROLS: DRY FLUE GAS SCRUBBERS, FABRIC FILTER BAGHOUSES, AND CONTINUOUS EMISSIONS MONITORING CONTROLS (LINKED TO FAIRFAX COUNTY AIR BOARD).

RATED CAPACITIES:
MUNICIPAL SOLID WASTE PRODUCTION: 3,000 TONS PER DAY.
ELECTRICAL PRODUCTION: 80,000,000 WATTS

GUARANTEED FACILITY THROUGHPUT: 930,750 TONS PER YEAR.

OPERATING AVERAGES:

TONS PROCESSED	1,085,000
FURNACE AVAILABILITY	93%
TURBINE AVAILABILITY	98%

FEE STRUCTURE:
FAIRFAX COUNTY SYSTEM FEE \$45
OGDEN MARTIN SYSTEMS FEE \$29

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I-95 LANDFILL FACT & INFORMATION SHEET

DIVISION OF SOLID WASTE
DISPOSAL & RESOURCE RECOVERY

Administrative Offices
17000 Government Center Parkway
Fairfax, Virginia 22035
Phone (703) 324-5230

BACKGROUND:

A variety of functions occur at the I-95 Sanitary Landfill. A brief description of each is contained below.

LOCATION:

9850 Furnace Road, Lorton, Virginia 22079
Phone number: (703) 690-1703; (703) 690-6694

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EXISTING LANDFILL:

Facility land is owned by the Federal Government; the land is provided to the District of Columbia for its use, and through a memorandum of understanding, the landfill is operated by Fairfax County.

Started regional operation 1973. Fairfax County assumed control in 1982, and continues to be the operational party. Fairfax county holds a permit with the Virginia Department of Environmental Quality, regarding the operation of the landfill.

Landfill facility covers approximately 300 acres.

A total of 17,424,000 tons of material have been accepted to date.

Estimated municipal solid waste landfilling capacity until 1995, and ash disposal capacity through 2010.

An ash monofill has been permitted for the facility and is expected to begin operation in early 1995.

LANDFILL OPERATIONS:

The Facility is operated by 52 employees, 41 field personal and 11 technical and professional staff.

Average waste landfilled per day: (6 day week, FY1993)	Fairfax (MSW)	125 tons
	D.C.(MSW)	233 tons
	Art/Alex (Ash)	296 tons
	I-95 E/RRF (Ash)	848 tons
	D.C.(Ash)	68 tons

ON-SITE FACILITIES/SERVICES:

I-95 Energy Resource Recovery Facility

This facility began commercial operations in June 1990, and consumes over 3,000 tons per day of refuse. In return, it generates up to 80 megawatts (mW) of electricity for sale to Virginia Power Company. This facility is owned and operated by Ogden Martin Systems of Fairfax, Inc. This process reduces waste volume requiring landfilling by approximately 90%.

I-95 Landfill Gas To Electricity Project

Phase I of this facility began operation January 1, 1992, Phase II was completed in February 1993. These two identical plants utilize landfill gas (LFG), a mixture of methane and carbon dioxide

I-95 LANDFILL GAS-TO-ELECTRICITY PROJECT

FACT & INFORMATION SHEET

ANNEX C

DIVISION OF SOLID WASTE
DISPOSAL & RESOURCE RECOVERY

Administrative Offices
12000 Government Center Parkway
Fairfax, Virginia 22035
Phone: (703) 324-5230

LOCATION:

9898A Furnace Road, Lorton, Virginia 22079
Plant Phone number: (703) 690-5965

PROJECT DESCRIPTION:

In December 1991, Michigan Cogeneration Systems completed construction of its first 3000 KW facility which is fueled solely on the landfill gas produced by the I-95 Landfill. Nearly one year later in February 1993, Michigan Cogeneration Systems started operation of its second 3000 KW plant.

LANDFILL GAS: A VALUABLE ENERGY RESOURCE

Landfill gas is essentially a 50/50 mixture of methane and carbon dioxide, which is a by-product resulting from the anaerobic decomposition of organic matter buried in sanitary landfills. In the past it was common practice to vent or flare the gas once it was collected.

LANDFILL GAS COLLECTION SYSTEM

Landfill gas is recovered from the I-95 Landfill through a number of gas wells which are drilled into the landfill and connected, by a network of pipes, to the power plant. A gas blower, located at the plant draws the landfill gas from the wells by creating a vacuum. The gas is then boosted to a pressure sufficient for use in the power generation plant operated by Michigan Cogeneration Systems. The gas extraction wells and the collection network are operated by Fairfax County, Division of Solid Waste Disposal and Resource Recovery.

POWER GENERATION SYSTEM

The power generation system is owned and operated by Michigan Cogeneration Systems and consists of eight (8) Caterpillar 3516 spark ignited engines, each capable of producing 800 KW, for a two plant total of 6000 KW of power for sale to the local utility, Virginia Power. This is enough electricity to serve several thousand homes.

PROJECT SUMMARY:

Location:	I-95 Landfill, Lorton, Virginia
Location Size:	300 acres
Refuse in Place:	Currently 17.5 million tons
Gas Collection System:	Over 50 wells
Generator Packages:	Eight Caterpillar 3516 gas engines
Net Power Produced:	6000 KW
Local Utility:	Virginia Power
Project Life:	20 Years
Project Developer:	Michigan Cogeneration
System Energy Savings:	Equal to 116,000 barrels of oil per year

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Michigan Cogeneration Systems Inc
2500 Novi Road
Novi, Michigan 48375-1624

Contact Person: William Owen
Phone (619) 689 7327

APPENDIX B
BUSINESS CARDS OF PERSONS VISITED

BUSINESS CARDS

TECHNOLOGY ASSESSMENT PROGRAM

WEC World Environment Center 

Joseph D. Rearden
Project Assistant

World Environment Center
1600 Wilson Blvd.
Suite 500
Arlington, VA 22209 U.S.A.

Phone (703) 524-2805 Ext 23
Fax (703) 524-2808

WORLD ENVIRONMENT CENTER

RODNEY A TRUE
CHIEF ENGINEER



**OGDEN MARTIN SYSTEMS
OF FAIRFAX, INC.**

9898 FURNACE ROAD
LORTON VA 22079
TEL (703) 690 6860
FAX (703) 690 4223



KURT ASPELIN
ENGINEER TECHNICIAN
DIVISION OF SOLID WASTE
DISPOSAL & RESOURCE RECOVERY

I-95 FACILITY
(703) 324-5057
(703) 324-3950 FAX

COUNTY OF FAIRFAX
DEPARTMENT OF PUBLIC WORKS
12000 GOVERNMENT CENTER PARKWAY
SUITE 324
FAIRFAX, VIRGINIA 22035-0059

**I-95 RESOURCE
RECOVERY FACILITY
OGDEN MARTIN
SYSTEM OF FAIRFAX, INC.**

**I-95 SANITARY LANDFILL
DEPARTMENT OF PUBLIC
WORKS
COUNTY OF FAIRFAX**

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BUSINESS CARDS

TECHNOLOGY ASSESSMENT PROGRAM

PBSJ POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.

ENGINEERING
PLANNING

JON C. DYER, P.E.
VICE PRESIDENT
FEDERAL PROGRAMS

4201 NORTH VIEW DRIVE, SUITE 302, BOWIE, MARYLAND 20716
TELEPHONE: 301/464-5700 • FAX: 301/464-5701

PBSJ POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.

ENGINEERING
PLANNING

JOSEPH J. DAVID, JR., P.E.

620 HERNDON PARKWAY, SUITE 330, HERNDON, VIRGINIA 22070
TELEPHONE: 703/471-7275 • FAX: 703/471-8021

POST, BUCKLEY, SCHUH & JERNIGAN, INC.



NaTec

NaTec Resources, Inc.
1177 West Loop South
P O Box 56571
Houston, Texas 77256-6571
713 552-2552
Fax 713 552-2538

Robert P. Bennett, Ph.D.
Process Consulting



NaTec

NaTec Resources, Inc.
Environmental Systems Division
1177 West Loop South
P O Box 56571
Houston, Texas 77256-6571
713 552-2221
Fax 713 552-2538

Paul D. Chaffee
Vice President

TIM COX

CONSTRUCTION SUPERINTENDENT
PORT WASHINGTON INSTALLATION
WISCONSIN ELECTRIC POWER CO.

NATEC RESOURCES, Inc.

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APPENDIX C
PHOTOGRAPHS

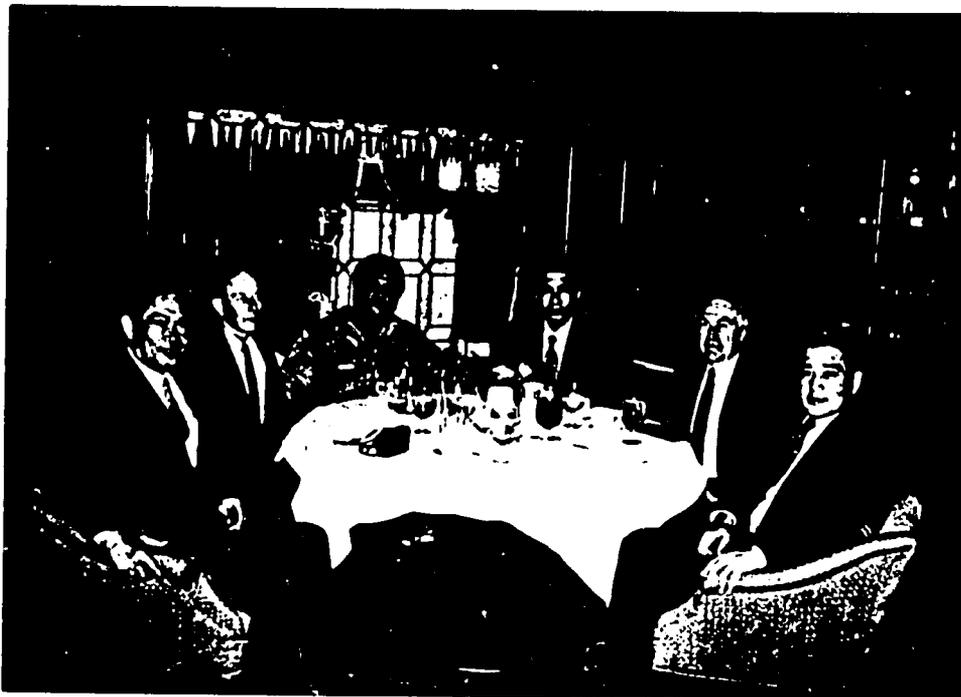
AT WASHINGTON , D C



From left Atanasio Vercide, Edmond Sese, Joseph Rearden, Reghis Romero and Raul Arellano.

AT HOUSTON, TEXAS

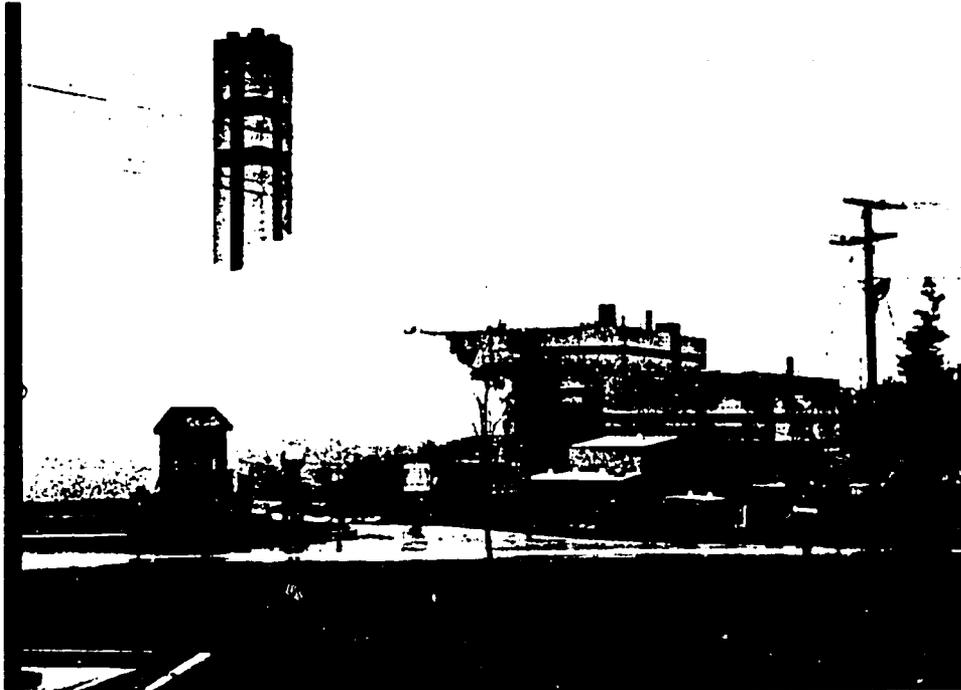
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R-II Builders Volunteers with NaTec Robert Bennett and Paul Chaffee.

I-95 RESOURCE RECOVERY FACILITY

Lorton, Fairfax County, Virginia



3000 TPD Waste to Energy
Ogden Martin Incinerator

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Central Instrumentation Control Room

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I - 95 RESOURCE RECOVERY FACILITY

Fairfax County, Lorton, Virginia



From left, Joseph Rearden (WEC), Raul Arellano, Rodney True (Ogden Martin), Reghis Romero II and Edmond Sese.

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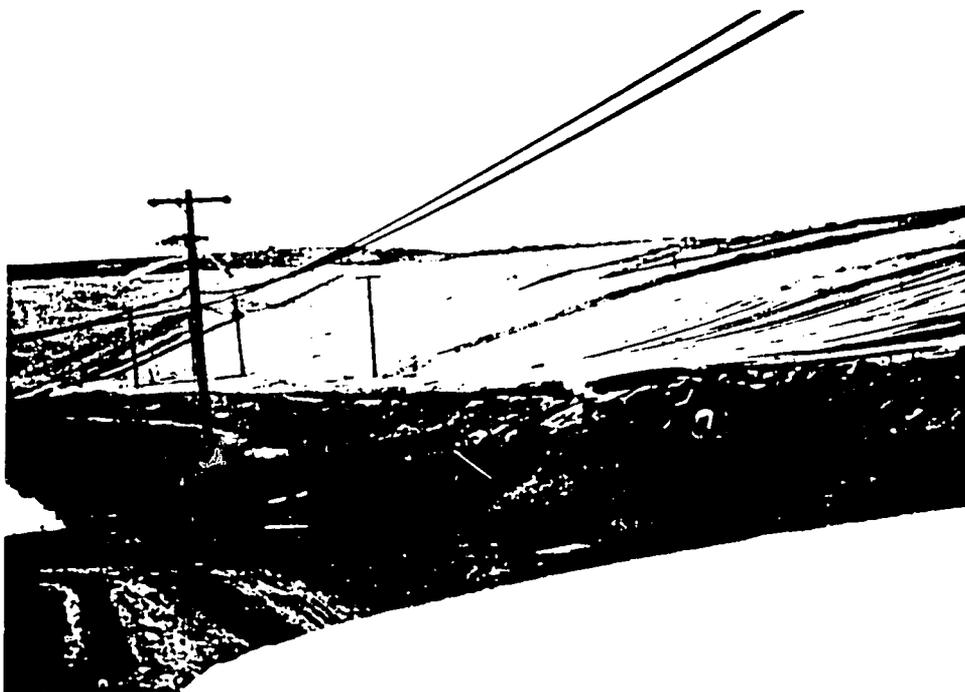
Rodney A. True, Chief Engineer of Ogden Martin Systems of Fairfax, Inc. discussing incinerator flow process.

I-95 LANDFILL

Fairfax, Virginia



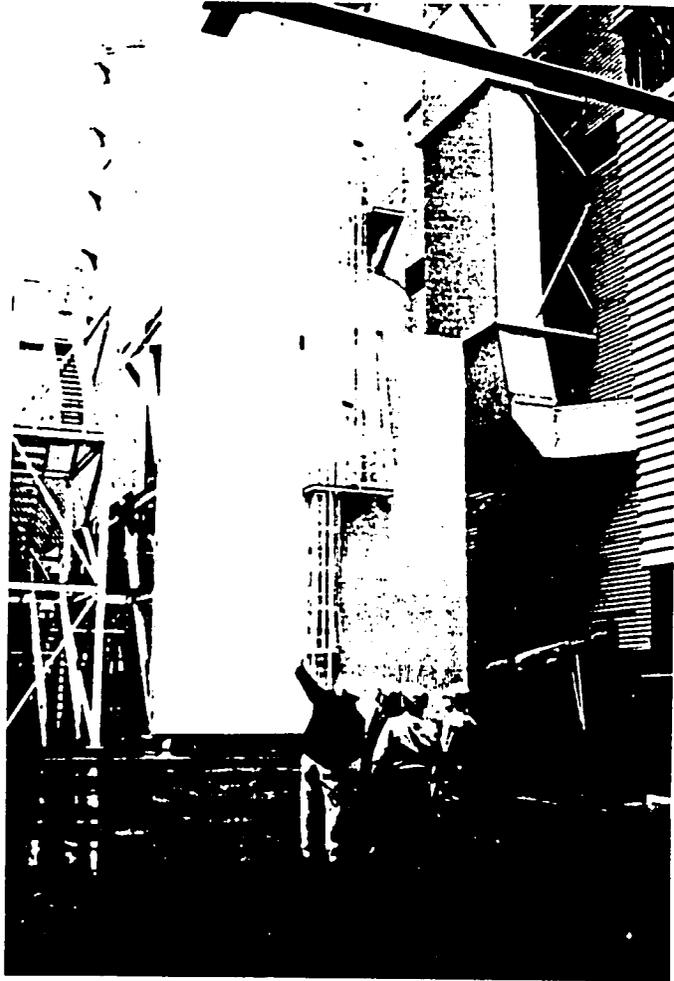
Existing Sanitary Landfill synthetic liner, part of final cover.



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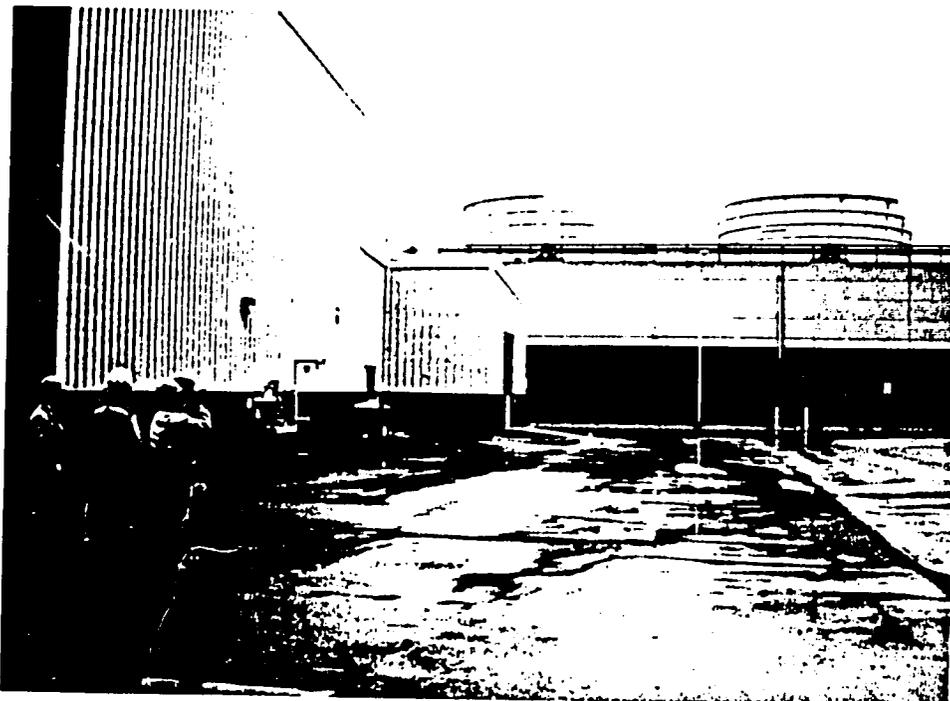
I - 95 RESOURCE RECOVERY FACILITY

Lorton , Fairfax County , Virginia



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Plant visit, Rodney True in white hat with R-II Builders Volunteers.



I-95 LANDFILL

Fairfax, Virginia



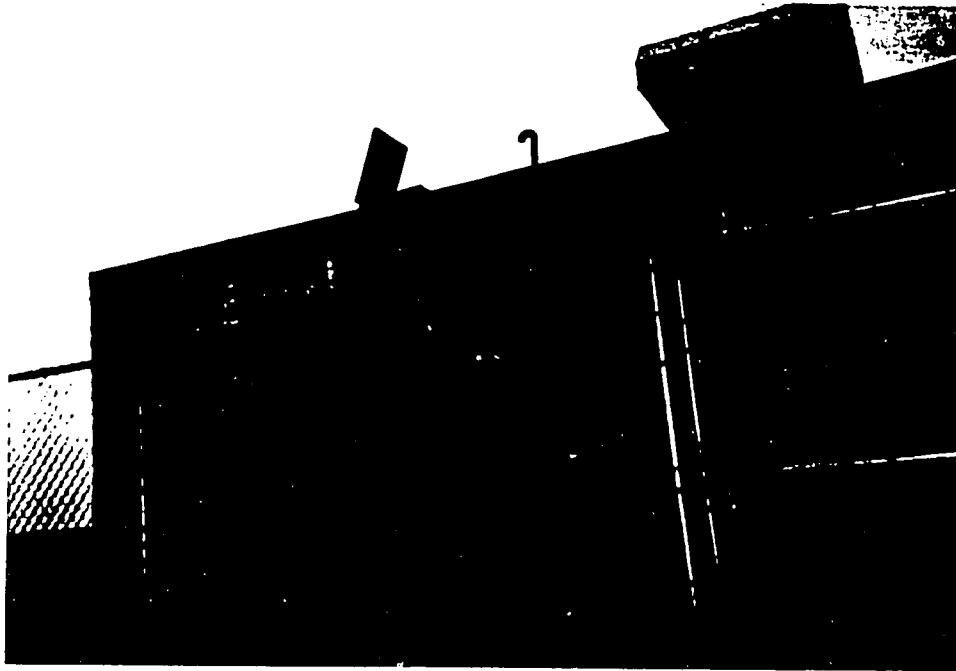
Kurt Aspelin (blue denim) explaining the closure of the existing Sanitary Landfill to Joseph David, Jr. of PBS&J, Reghis Romero II, Edmond Q. Sese of R-II Builders and Joseph Rearden of WEC.



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I-95 LANDFILL GAS - TO - ELECTRICITY PROJECT

Fairfax County, Virginia



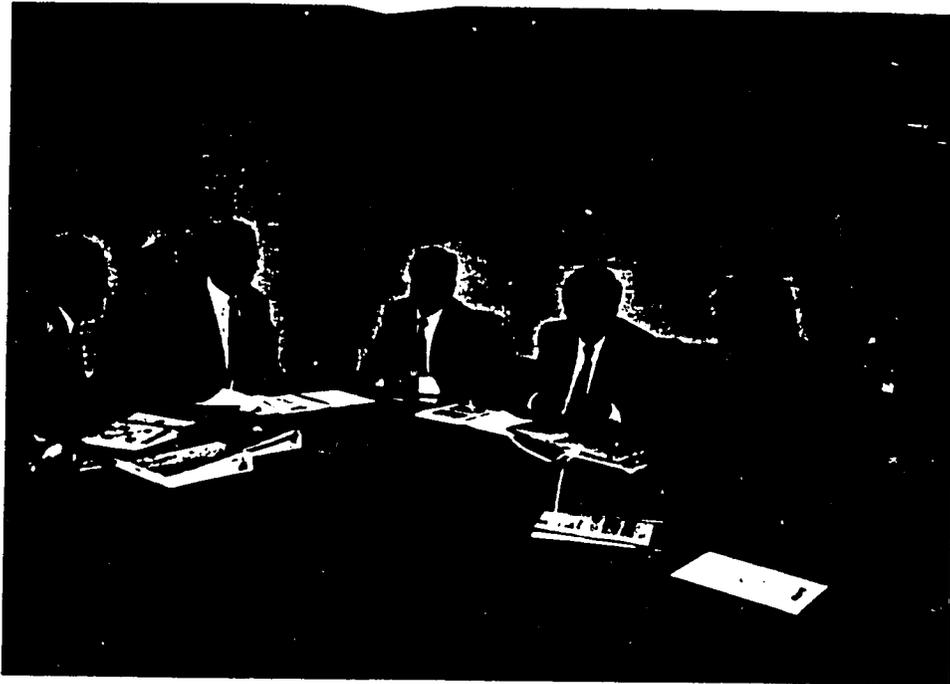
Plant visit of Michigan Cogeneration Systems
6000 kw Facility.



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POST , BUCKLEY , SCHUH & JERNIGAN
Bowie , Maryland



Meeting with Post, Buckley, Schuh & Jernigan, Inc.
from left Jon C. Dryer, Vice President, Joseph J.
David, Jr., P.E., Reghis M. Romero II, Chairman of
the Board, Edmond Q. Sese, President and Raul A.
Arellano, V.P.-Equipment.



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NATEC RESOURCES, INC.
Port Washington, WI



Processed Dry Sodium Injection Installation at Wisconsin Electric Company, Port Washington, WI with Tim Cox of NaTec Resources, Inc.



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R - II BUILDERS, INC. AT NATEC CORPORATE OFFICE Houston, Texas



R-II BUILDERS, INC. Chairman, Reghis M. Romero II explaining the Smokey Mountain Project to NaTec Vice President Paul Chaffee & Dr. Rober Bennett.



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NATEC RESOURCES ,INC. CORPORATE OFFICE
Houston, Texas



Presentation of NaTec Vice President Paul D. Chaffee and Dr. Robert P. Bennett of the PDSI Technology.



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APPENDIX D
CURRICULUM VITAE OF MISSION EXPERTS

PERSONAL INFORMATION SHEET

Name : REGHIS M. ROMERO II
Address :
Date of Birth :
Civil Status :
Profession : Businessman

DEPENDENTS:

<u>Name</u>	<u>Date of Birth</u>	<u>Relationship</u>
Michael Romero		son
Nathaniel Romero		son

EDUCATIONAL ATTAINMENT:

	<u>Name of School and Address</u>	<u>Year Graduated</u>
Elementary	Holy Family Academy - Angeles City	1957
High School	Republic Central Colleges - Angeles City	1966
College/University	University of the Philippines - Quezon City	1972

EMPLOYMENT HISTORY:

<u>Name of Company</u>	<u>Date</u>	<u>Position</u>
Hydro-Pipes Phils., Inc.	1975-1980	Sales Manager
Concept Builders, Inc.	1980-1983	Vice-Pres./Project Coordinator
Pentad Dev. Corp.	1983-1988	Vice-Pres. for Marketing
R-II Builders, Inc.	1988 to present	Chairman of the Board

MEMBERSHIP IN OTHER PROFESSIONAL/ CIVIC/ INTERNATIONAL ORGANIZATION:

1. Chamber of Real Estate & Builders Association, Inc. (CREBA)
2. Philippine Constructors Association (PCA)

SEMINARS/PROGRAMS ATTENDED:

1. World Environment Center: Technology Assessment Programs
Washington, D.C. USA
December 14 - 19, 1993

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R E S U M É

A. PERSONAL INFORMATION

NAME : EDMOND Q. SESE
ADDRESS :
BIRTHDATE :
SEX :
CIVIL STATUS : Married
CITIZENSHIP : Filipino

B. EDUCATIONAL ATTAINMENT

	SCHOOL	COURSE	YEAR GRADUATED
PRIMARY	: San Fernando Elem. School	Elementary	1958
SECONDARY	: Pampanga High School	High School	1962
COLLEGE	: Mapua Institute of Technology	BSCE	1967
	: Mapua Institute of Technology	BSSE	1968
PRC REG. 9008	: Civil Engineer	-	1968
PRC REG. 305	: Environmental Sanitary Engineer		

C. WORK EXPERIENCES

NAME OF EMPLOYER	POSITION	YEAR FROM - TO
DCCD Eng'g. Corp. Makati, M.M.	Sanitary Engr.	1968 - 1970
BF Homes, Inc. Cervantes, M.M.	Chief Engineer	1970 - 1975
Concept Builders, Inc. Valenzuela, M.M.	Executive Vice President	1975 - 1983
Pentad Dev't. Corp. Makati, M.M.	Executive Vice President	1983 - 1986
Hardesty & Hanover New York, N.Y.	Highway Engineer	1986 - 1989
R-II Builders, Inc. Diliman, Q.C.	President	1990 Present

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D. SPECIAL COURSES, TRAINING AND SEMINARS

1. LBM S/360 - Cobol Programming
2. PERT/CPM Seminar
3. Management Seminar for Supervisor
4. Subdivision Development and Management Seminar
5. Dale Carnegie Courses
6. Supervisory Management Seminar
7. Project Feasibility Study and Development
8. Management by Objectives
9. Genco II Koepner Tregoe - Problem Analysis
10. 1978 International Water Supply Congress, Kyoto, Japan
11. 1980 International Water Supply Congress, Manila, Phil.
12. 1982 Austrian Technological Symposium
13. 1992 US Environmental Training Institute
Sanitary Landfill and Incinerator

E. REFERENCES:

AVAILABLE UPON REQUEST

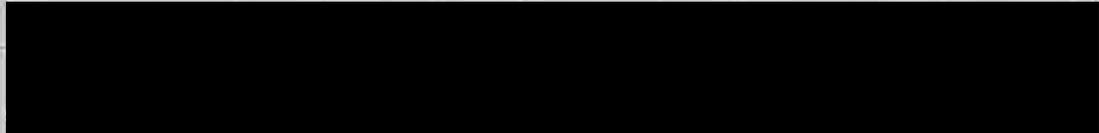


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ATANASIO T. VERCIDE

BIO-DATA

BORN :



EDUCATIONAL BACKGROUND:

- 1946 - 1952 - Mabolo Elementary School
- 1952 - 1956 - Abellana Technical High School
- 1956 - 1958 - Cebu School of Arts and Trades

WORK EXPERIENCE:

- 1956 - 1964 - Hayco Engineering, Cebu City
From apprentice to machinist to plant superintendent. Was assigned as head trainer for every batch of under graduate mechanical engineers gathering actual field experience.

Self study with application on Tool and Die making, Jigs and Fixtures, Fabrication techniques and procedures, non-ferrous Foundry and Investment Castings.
- 1964 - 1968 - Davao Speed Machine Shop & Foundry Davao City
Design, fabrication and installation of cornmills, sawmills, ricemills, flour mills, feedmills, etc.
- 1968 - 1970 - Self-employed
As consultant on mills.
- 1970 - 1980 - Partner, Silavan Engineering Corp., General Santos City
Fabrication of Agro-industrial machineries.
- 1980 - Founder, VERCIDE Integrated Engineering, General Santos City
 - Manufacture of Complete roll forming line.
 - Manufacture of container vans 10 and 20 footer.
 - Manufacture of foodgrade quality stainless steel equipment.

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1984 - 1987 - Consultant

Complae SDN. BHD. K.L. Malaysia
Biopost SDN. BHD. K.L. Malaysia
M.I.T. Chemical Terminal SDN. BHD.
Johor Bahro. Johor. Malaysia

AS CONSULTANT ON CASE TO CASE BASIS

Grandspan Development Corp. - largest fabrication firm in
South East Asia.

H.R. Lopez Co. Inc. - one of the top construction companies
in the country.

Macro Metallurgical Eng'g. - feedmill manufacturer.

SIGNIFICANT ACCOMPLISHMENT -

- Have extensively travelled to most ASEAN countries, some cities in Europe and the United States to improve personal knowledge in modern fabrication techniques and machineries.
- Have patented a low cost, high capacity continuous batch feed mill.
- Have patented a system and machine for extraction of abaca fibers.
- Despite the absence of proper engineering education, have trained several engineers now holding key positions on top companies in the country.

PRESENTLY - Vice President of Fabrication of R-II BUILDERS, INC.
A private company currently undertaking the largest single project in the country.

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R E S U M E

A. PERSONAL INFORMATION

N A M E : RAUL A. ARELLANO, JR.
ADDRESS : 
BIRTH DATE : 
SEX : Male
CIVIL STATUS : Married
CITIZENSHIP : Filipino

B. EDUCATIONAL ATTAINMENT

	SCHOOL	COURSE	YEAR GRADUATED
Primary	Ateneo De Manila	Elementary	1960
Secondary	Ateneo De Manila	High School	1967
College	Ateneo De Manila	AB Gen. Studies	1971

C. WORK EXPERIENCES

NAME OF EMPLOYER	YEAR		
	From	To	
Spectron Fuji Xerox	1971	1972	- Sales Engineer
ABS - CBN TV/Radio Company	1972	1973	- Field Correspondent
BF Homes. Inc.	1973	1974	- Procurement Officer for Equipment
Construction Components (Int'l.) Inc.	1974	1975	- V.P. for Equipment
Concept Builders. Inc.	1975	1981	- V.P. for Equipment
Central Diesel Clinic	1981	1993	- Proprietor
R-II Builders. Inc.	1989	1993	- V.P. for Equipment

D. REFERENCES

Available upon request

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APPENDIX E
ITINERARY

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R-II Builders - Itinerary

Tuesday, December 14

Fly from Manila to Washington, DC

Wednesday, December 15

9:00AM - Tour of the Ogden Martin "I-95 Energy/Resource Recovery Facility,"
11:00AM Fairfax, Virginia

11:30AM - Installation Tour/ Lunch / Discussion with PBS&J (environmental services,
3:00PM lecheate recovery systems, etc.)

3:00PM - Break
6:00PM

7:10PM - Fly from Washington, DC to Milwaukee

Thursday, December 16

7:30AM - Pick-up at hotel by Tim (Manager-Port Washington Installation)

9:00AM - Installation Tour - Port Washington Station - Dry Sodium Injection Process
11:00AM

1:05PM - Fly from Milwaukee to Houston

7:30PM - Meet at hotel for dinner with Bob Bennet, President, NaTec; Paul Chaffe, VP

Friday, December 17

9:00AM - (Tentative) Meetings with NaTec Resources
NOON

5:00PM - Fly from Houston to Seattle

Saturday, December 18

12:20PM - Fly from Seattle to Manila

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