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/Gulf Islands
National Seashore
Mississippi District
Ocean Springs, Mississippi

**POTENTIAL USE OF
RENEWABLE ENERGY POWER
AT HORN AND SHIP ISLANDS**

December 6, 1994

SCANNED

5/10/01

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RENEWABLE ENERGY POWER
AT HORN AND SHIP ISLANDS**

Gulf Islands National Seashore

**Atlanta, Georgia
December 6, 1994**

**Report Prepared by Leon Folsom, Mechanical Engineer
Engineering and Park Facilities Management Division
U.S. Department of the Interior
National Park Service
Southeast Region**

POTENTIAL USE OF RENEWABLE ENERGY POWER AT HORN AND SHIP ISLANDS

INTRODUCTION

On November 8, 1994, Mike Thomas and Hal Post from the Photovoltaic Design Assistance Center (PVDAC) of Sandia National Laboratories visited Gulf Islands National Seashore at Ocean Springs, Mississippi. Doug DeNio, Senior Environmental Engineer from the Denver Service Center, National Park Service (NPS), accompanied them on the visit. With significant assistance from the park staff, the team surveyed electrical energy usage at park facilities on Horn and Ship Islands in the Gulf of Mexico.

This visit was made as a result of a project request from the Chief of Maintenance, Jack Wilburn, and was for the investigation of potential use of renewable energy resources at several facilities located at these islands in the park. At the conclusion of the visit, a brief, informational presentation was made to the park staff on November 9 summarizing the findings of the team.

The technical report of the investigations performed by the PVDAC team is being prepared separately and the details of the team's report will not be repeated here. In addition to making renewable energy recommendations, their report will also address pertinent operational recommendations for energy conservation. The PVDAC team report will state the Objective of their efforts and contain sections entitled *Site Assessment, Description of Facilities, Load Management and Energy Efficiency, On-Site Power Options, and Recommendations*.

The NPS Regional Energy Manager, Leon Folsom, accompanied the PVDAC team and assisted with these investigations. As a member of the study group, he effected the photographic documentation of the facilities which were investigated. His photographs and descriptions of the facilities are the subject of this report.

DOCUMENTATION OF FACILITIES

Horn Island

Located approximately 12 miles off the coast, across the Mississippi Sound, Horn Island is accessed from Davis Bayou by the dock located on the north side of the island, the seaward approach to which is shown in Photograph 1.16, looking south toward the island. In this photograph can be seen the tall tower supporting National Guard communications antennæ. The very visible nature of this isolated tower can be observed as it stands out among the few tall trees.

From the shore, an overall view of the dock is given as Photograph 1.00, showing the park boat moored along side. Two photovoltaic panels are affixed to the roof of the boat shelter on the dock and are shown in a more detailed picture as Photograph 1.01. Also visible in this photograph is the NPS boat which has been winched out of the water by the photovoltaic-supplied power.

A trail is cleared southward from the dock to a residential area in the island interior. The view from the northeast approach to this area is shown in Photograph 1.07, Quarters 31A, B and C. Some 75 feet south of this building can be seen the base of the National Guard communications tower previously mentioned. To the right, and out of the field of the photograph, is the pumphouse supplying potable water for the area. To the left, also out of the field of view, is the maintenance shed housing various pieces of equipment and storage of supplies of maintenance-related material.

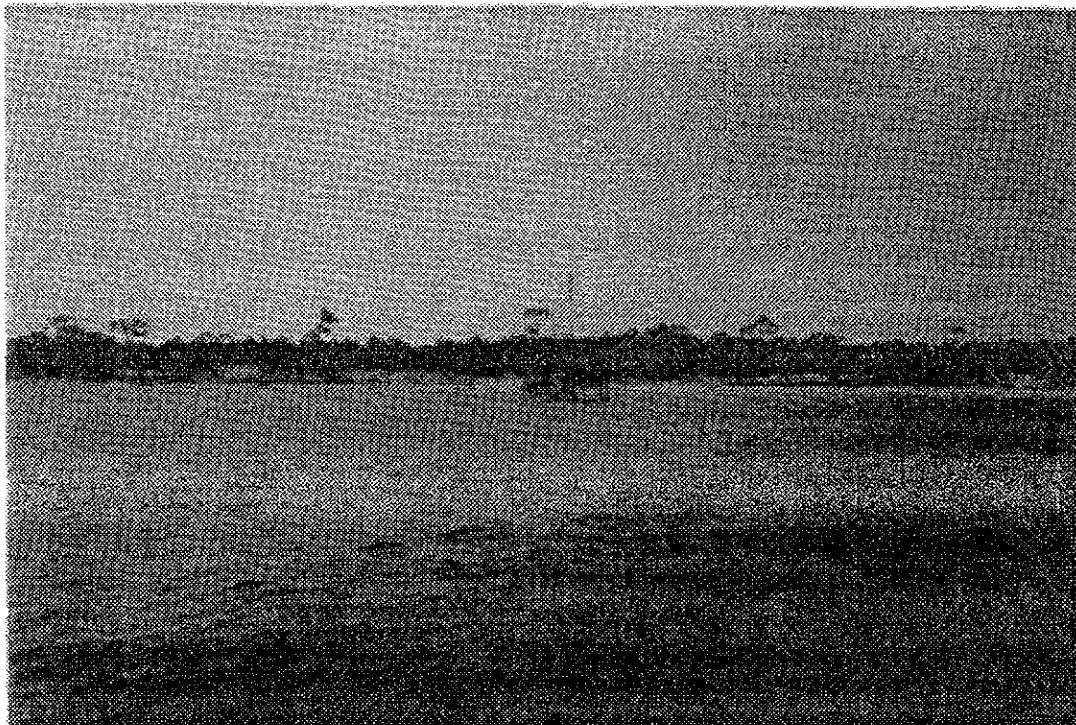
Another view of Quarters 31A, B and C, Photograph 1.06, is taken from the southeast. It shows various antennæ, propane cylinders and their storage shelter, and the location of a photovoltaic power panel on the roof of the building. The panel is designed to supply charging current to batteries for operating a radio in the Quarters 31A, B and C building. On the far side of the storage shed is the water supply pressure tank. While the building is located within trees on the island, the roof has a full solar exposure.

Quarters 31A, B and C is located near the National Guard Radio Installation as shown in Photograph 1.05, taken looking north. Again the base of the communications tower shows in the photograph. The array of photovoltaic power panels has an almost unobstructed solar exposure as can be seen in Photograph 1.02. A close-up view of a portion of the

photovoltaic power panels is shown in Photograph 1.03. Some of the structural details of panel supports and foundation are visible in the picture. The equipment buildings and tower are discernable behind the panels in these photographs. Photograph 1.04 is a close-up of a section of one of the panels in this section, showing some cell deterioration which has occurred since installation.

A generator shed is located some 150 feet north of Quarters 31A, B and C. This separation affords some sound isolation for the Diesel generators located within the shed. Generator 1, with the engine and its controls, is shown in Photograph 1.09 (taken looking north) and Generator 2, likewise with the engine and its controls, is shown in Photograph 1.10 (taken looking south). The shared, 1000 gallon fuel tank is shown in Photograph 1.11. To the left-hand end of the tank can be seen the fuel delivery piping coming through the north wall of the building and the vent from the tank exhausting under the eaves. Also in this photograph, looking east, is shown some of the building ventilation. Photograph 1.12 shows an exterior view of the east wall, the screened ventilation above the fuel tank, shown in the previous photograph, and additional screened ventilation below the fuel tank. To the left can be seen the exhaust from Generator 2.

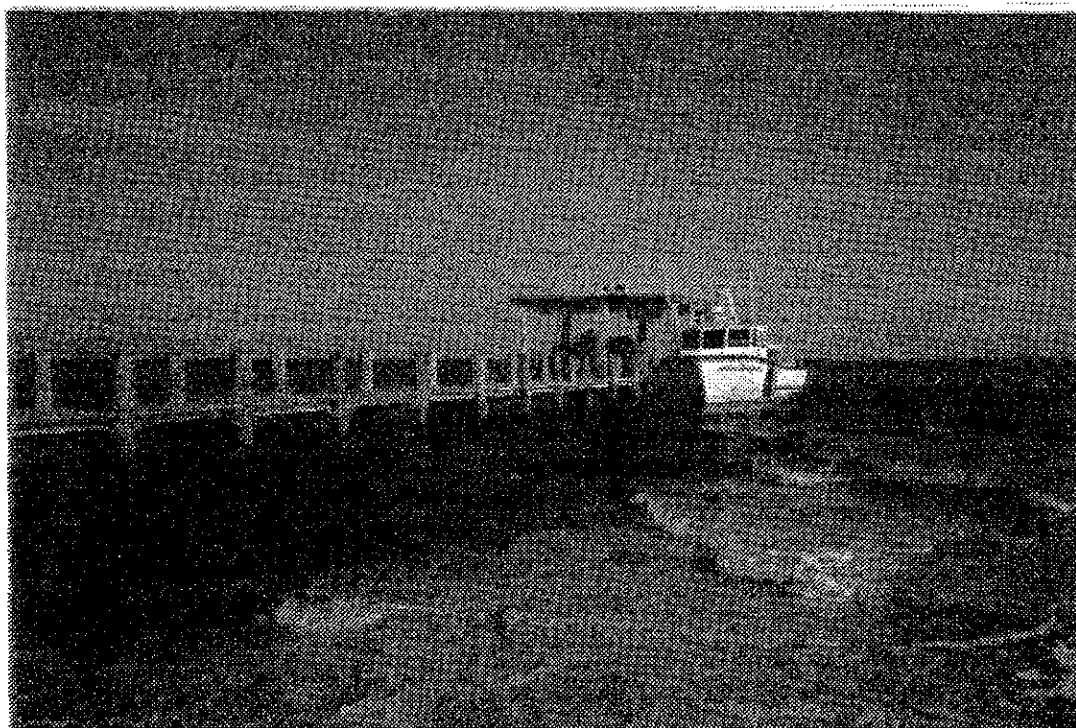
This exhaust can also be seen in Photograph 1.13, a view of the south wall exterior of the generator shed. Photograph 1.14 shows an exterior view of the west wall of the generator shed with the entrance door and two spring-loaded louvers for the exhaust of air passing through the Diesel engine radiators. To the right can be seen the exhaust pipe from Generator 2 and to the left the muffler and exhaust from Generator 1. Photograph 1.15, an exterior view of the north wall of the generator shed, shows this muffler again, and the piping coming from below grade with its control valves. The pipe passes through the generator shed north wall and connects to the storage tank.



HORN ISLAND
Dock
Seaward Approach
November 8, 1994

GUS

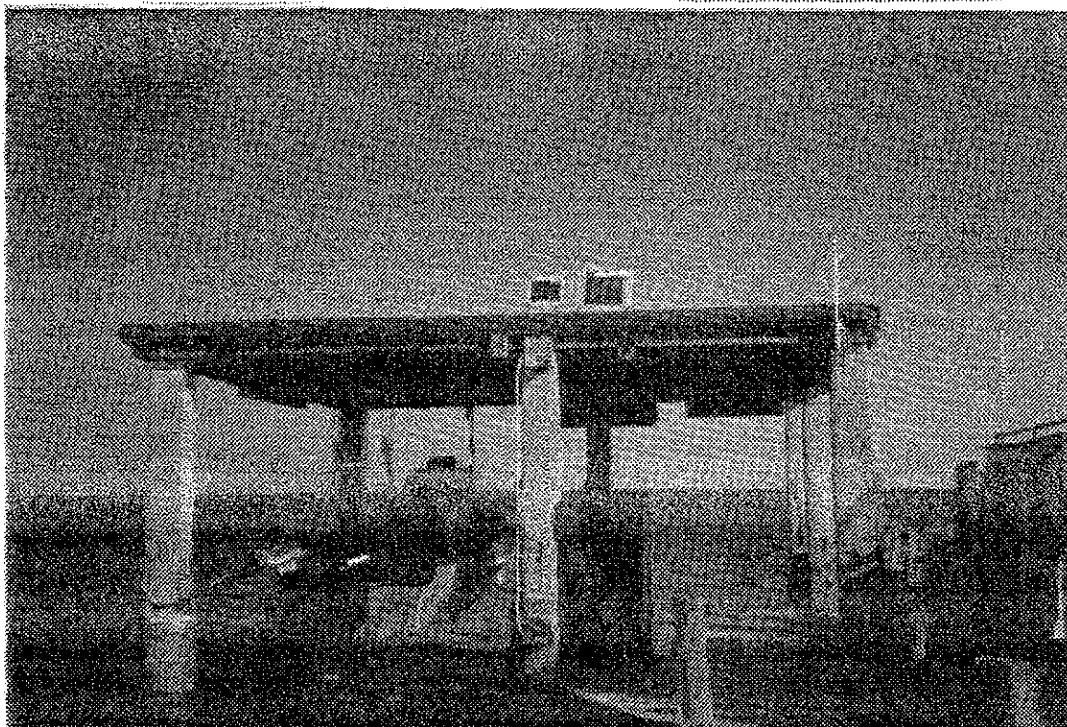
L16



HORN ISLAND
Dock
Overall View
November 8, 1994

GUS

L00



HORN ISLAND
Boat Shelter
Detail of Photovoltaic Panels
November 8, 1994

GUIS

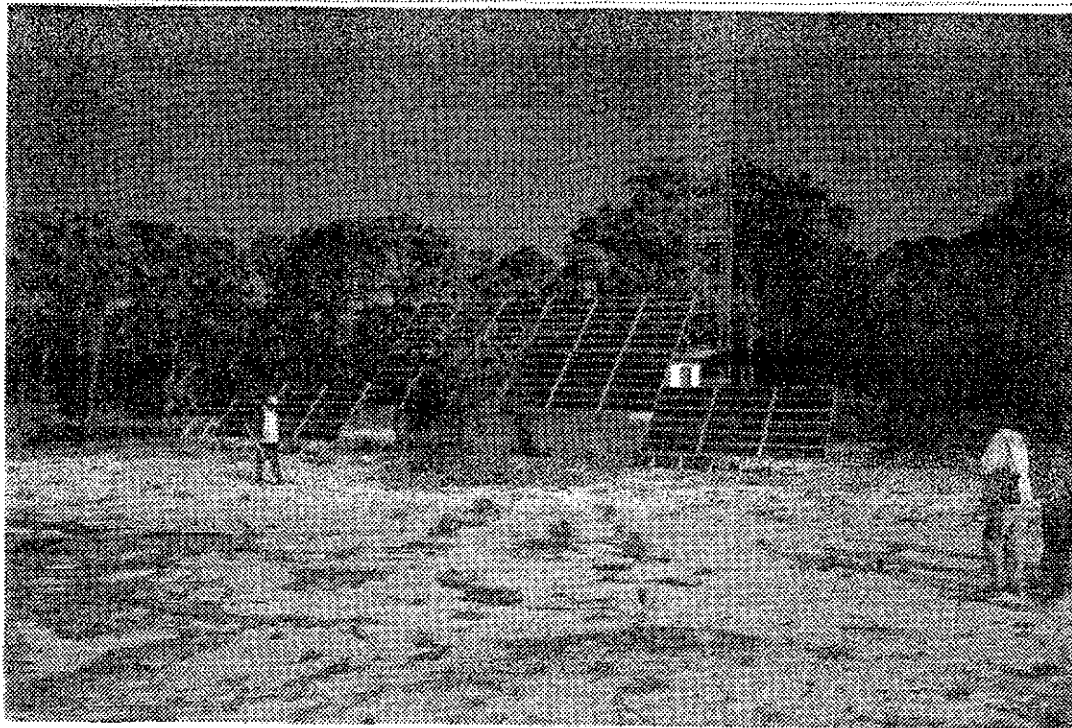
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HORN ISLAND
Quarters 31A, B, C
Overall View
November 8, 1994

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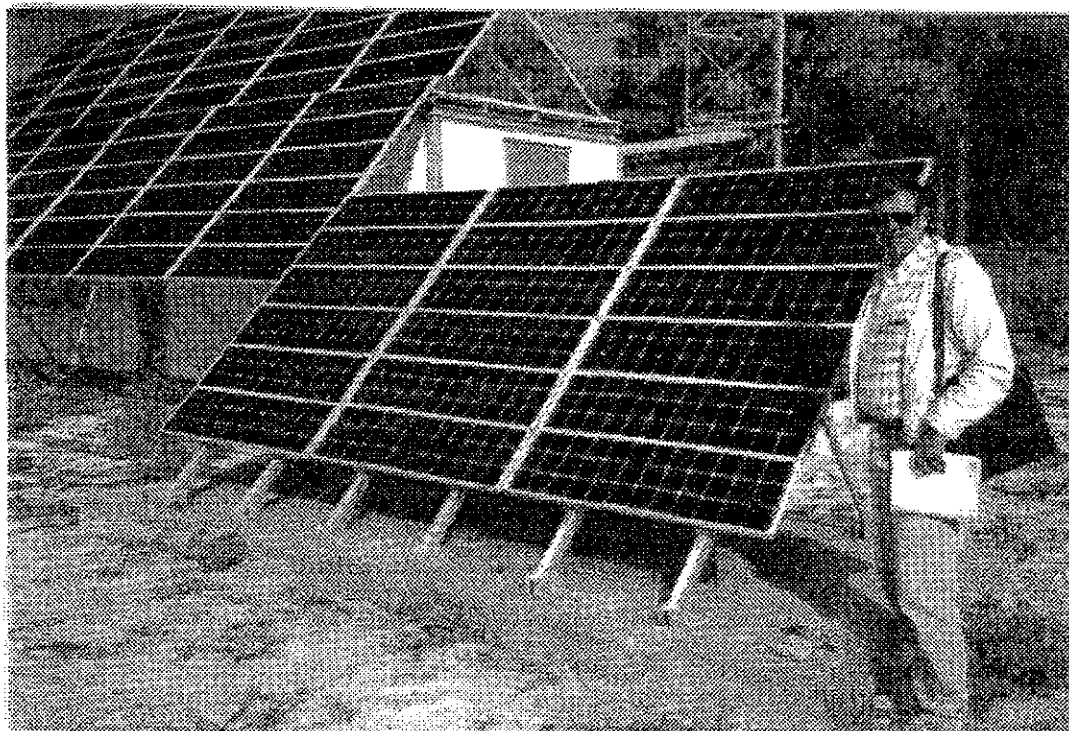
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HORN ISLAND
National Guard Radio Installation
Overall View
November 8, 1994

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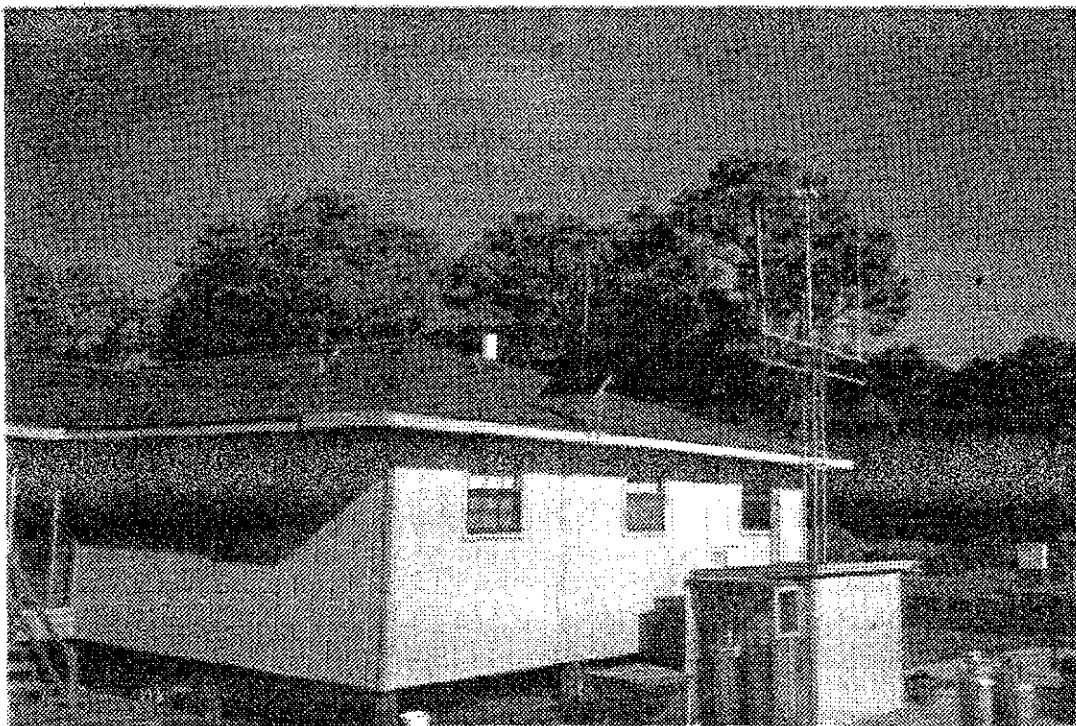
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HORN ISLAND
National Guard Radio Installation
Close-up of Photovoltaic Panel
November 8, 1994

GUIS

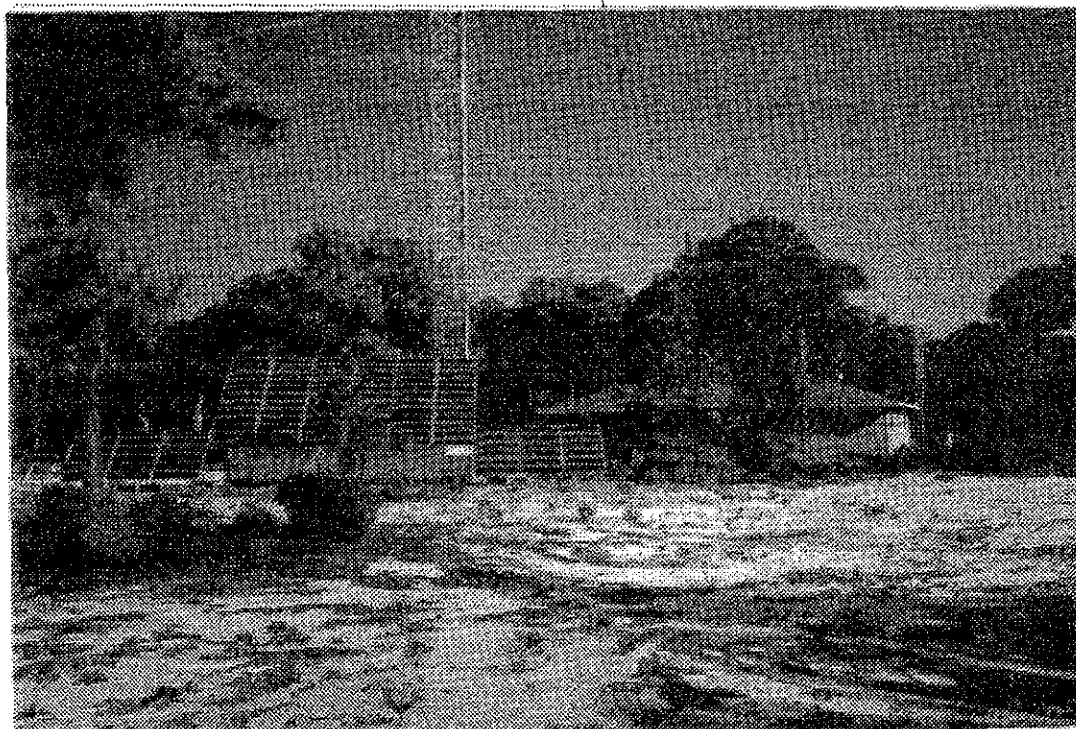
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HORN ISLAND
Quarters 31A, B, C
Photovoltaic Panels on Building Roof
November 8, 1994

GUIS

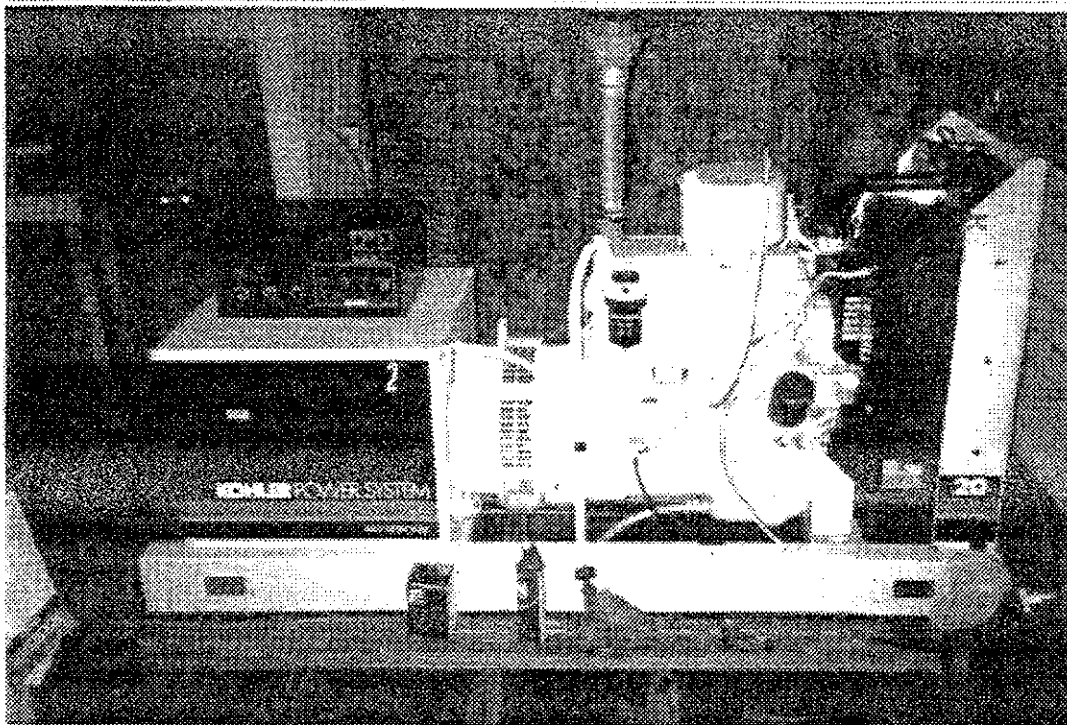
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HORN ISLAND
Quarters 31A, B, C
Location near National Guard Radio Installation
November 8, 1994

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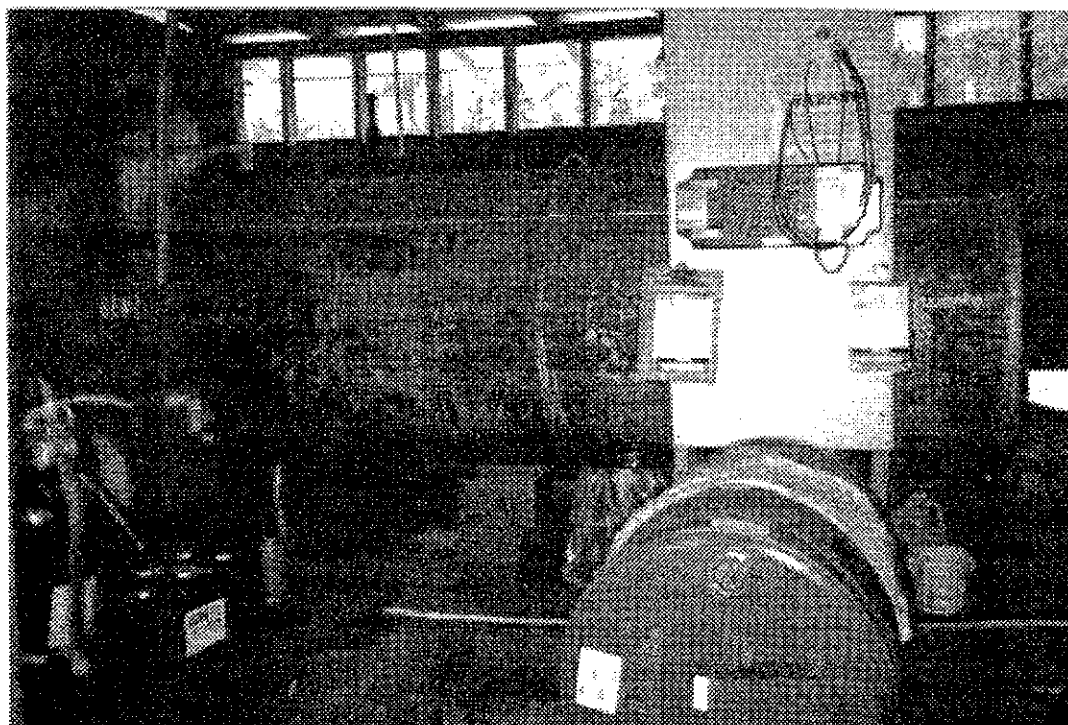
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HORN ISLAND
Generator Shed
Generator 2
November 8, 1994

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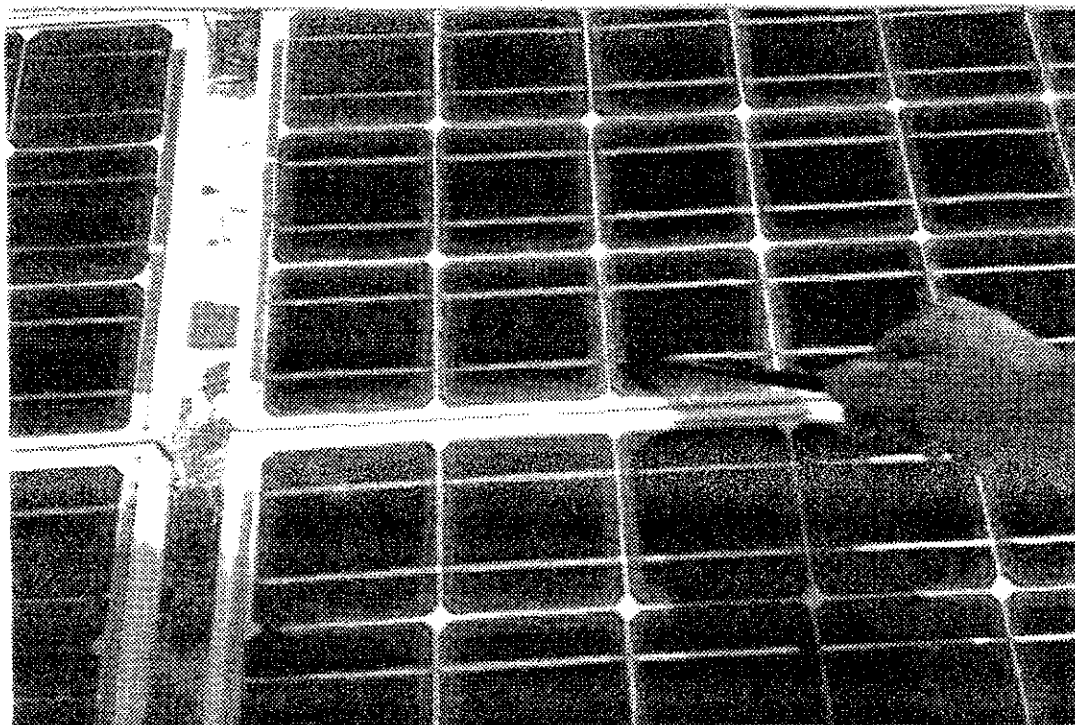
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HORN ISLAND
Generator Shed
Fuel Tank
November 8, 1994

GUIS

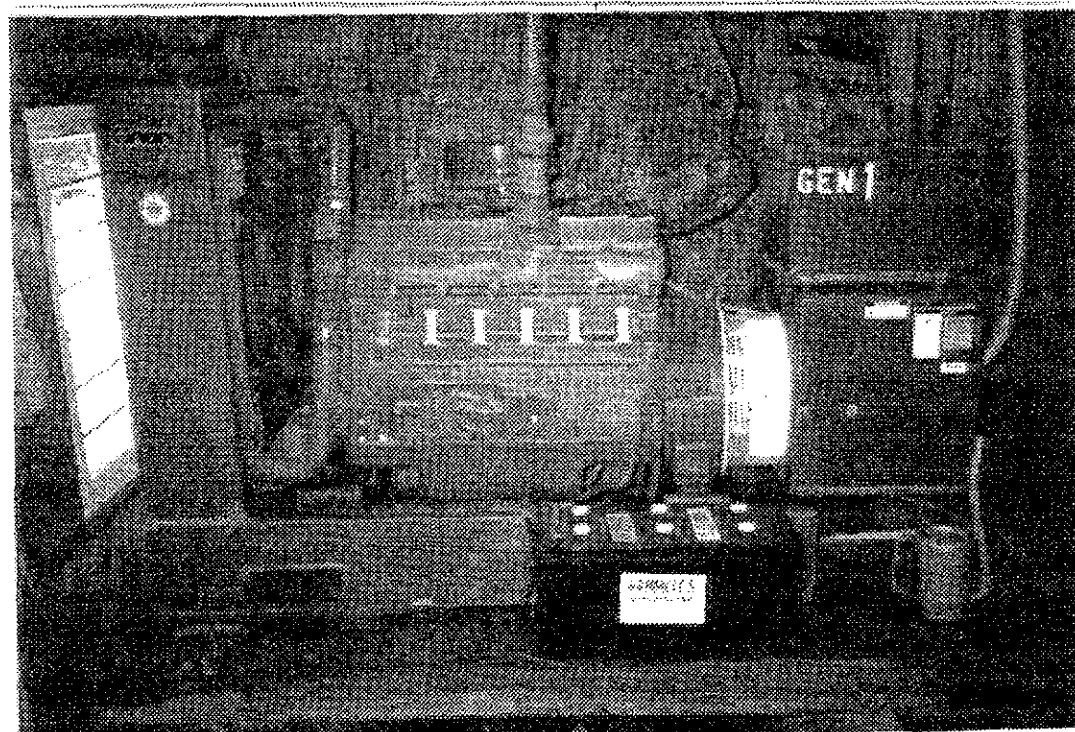
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HORN ISLAND
National Guard Radio Installation
Close-up Showing Cell Deterioration
November 8, 1994

GUS

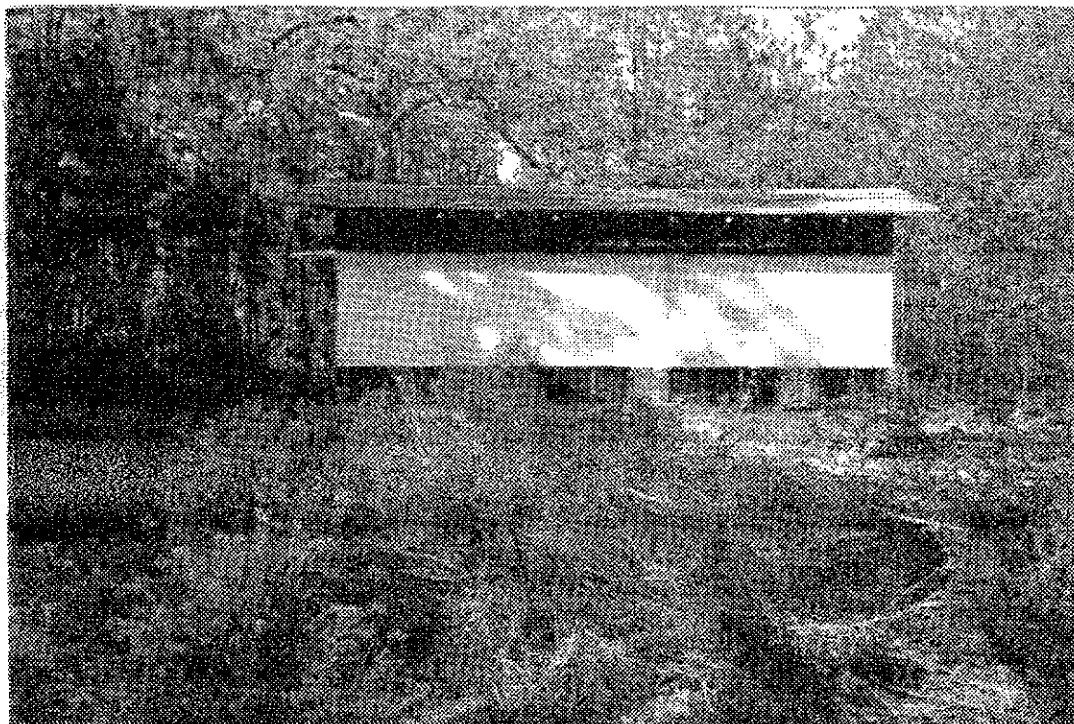
1.04



HORN ISLAND
Generator Shed
Generator 1
November 8, 1994

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1.09



HORN ISLAND
Generator Shed
East Wall Exterior
November 8, 1994

GUS

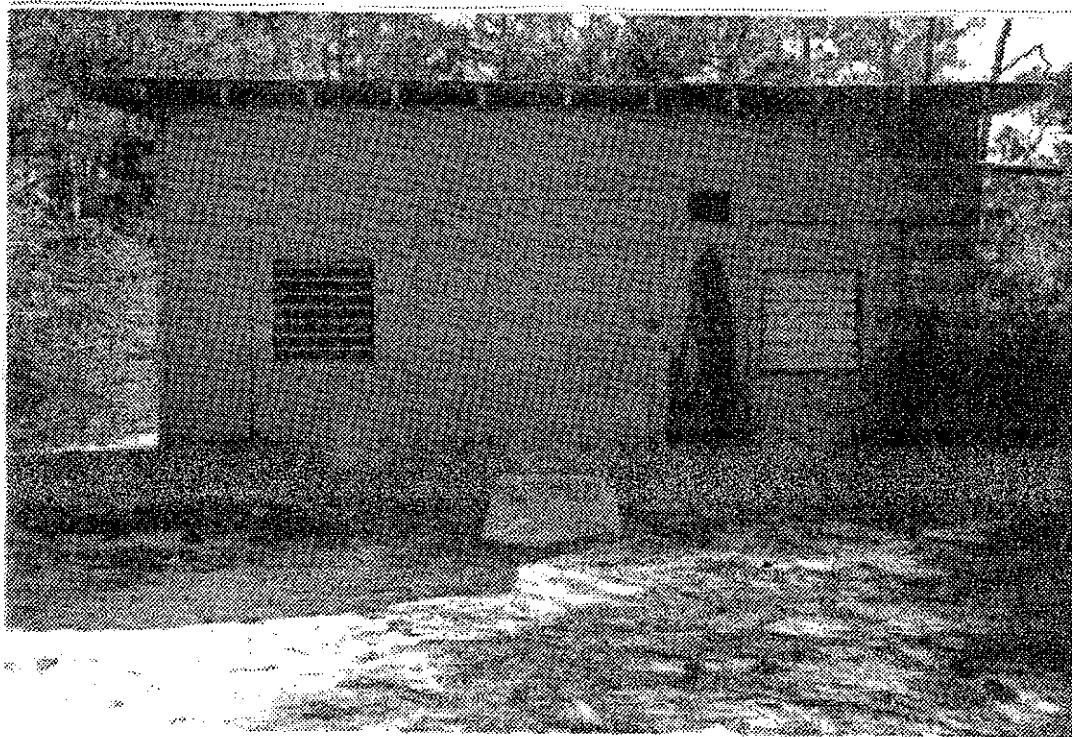
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HORN ISLAND
Generator Shed
South Wall Exterior
November 8, 1994

GUS

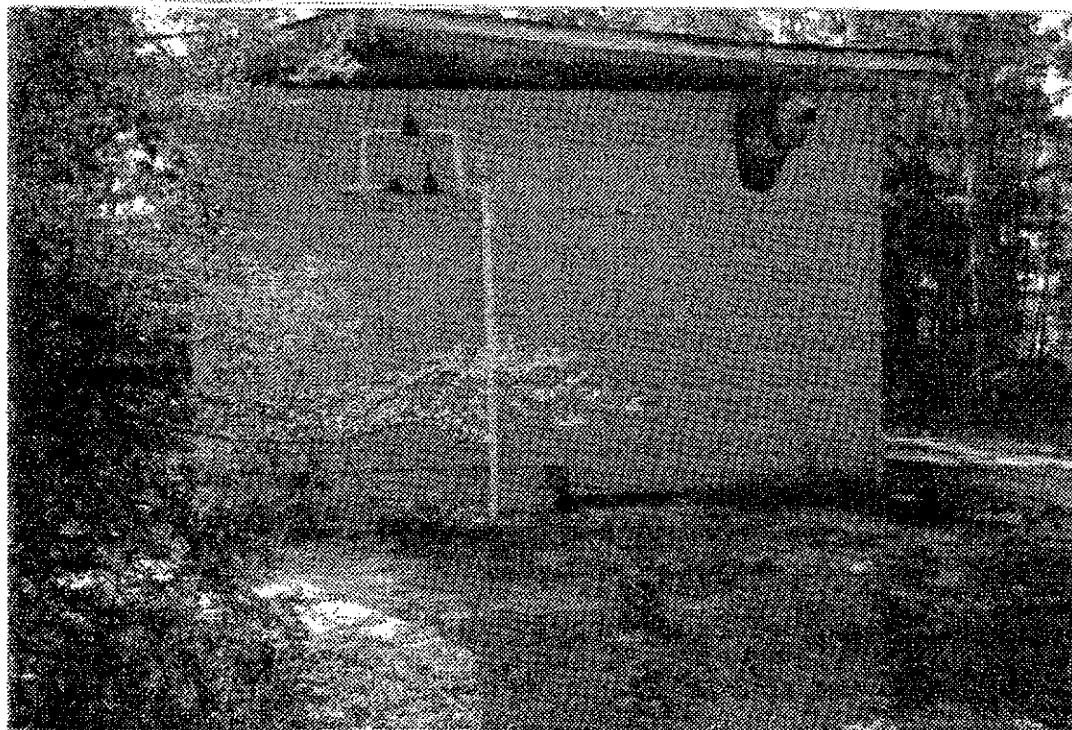
1.13



HORN ISLAND
Generator Shed
West Wall Exterior
November 8, 1994

GLIS

1.14



HORN ISLAND
Generator Shed
North Wall Exterior
November 8, 1994

GLIS

1.15

Ship Island

Ship Island is also located across the Mississippi Sound from Davis Bayou, and to the west of Horn Island. Actually there are two Ship Islands, East Ship Island and West Ship Island. *Fort Massachusetts*, a large masonry coastal fortification is on West Ship Island. Access to the facilities on this island is by way of the dock on the north shore of the island, shown in Photograph 1.18, looking north along the dock. The boat shelter here is similar to that on Horn Island, with details of the photovoltaic panels shown in Photograph 1.17. This boat winch, like that on Horn Island, is also powered by photovoltaic-supplied energy.

To protect the delicate island vegetation, the decking of the dock continues as boardwalks throughout the visitor use area. These boardwalks tie together the facilities on West Ship Island.

The West Island Complex consists of *Fort Massachusetts*, a Ranger Station, Visitor Center, Employee Housing buildings with their shared Utility Building, and the North Generator Building. All of these except the fort and the North Generator Building can be seen in Photograph 1.21, taken looking west into the complex. Additional detail of the Utility Building is provided by Photographs 1.19 and 1.20, of the exterior and interior, respectively. In the north wall of the Utility Building, shown in Photograph 1.19, are the doors to the shelter for water heaters and propane tanks. Within the building, shown in Photograph 1.19, are the ice machine, clothes washer and clothes dryer.

A view of the North Generator Building, looking west, is given in Photograph 1.22. Power for the West Island Complex is supplied by Diesel generators located within this building. A water storage tank is prominent in this photograph, which is taken looking west toward the building. Within this building, the East Generator, with the engine and controls, is shown in Photograph 1.23 (looking west) and the West Generator, with its engine and controls, is shown in Photograph 1.24 (viewed toward the north-west). The Diesel fuel tank for this building is shown in Photograph 1.25, looking northeast. The supply piping, coming from its subterranean passage from the dock, appears to the right of the tank, and the exhaust connection and piping is seen to the left of the tank.

The South Area, primarily supporting beach activities, consists of two wings: a shelter wing and a snack bar and inside shower wing. The Snack Bar is operated by a concessioner, seasonally. Outside showers

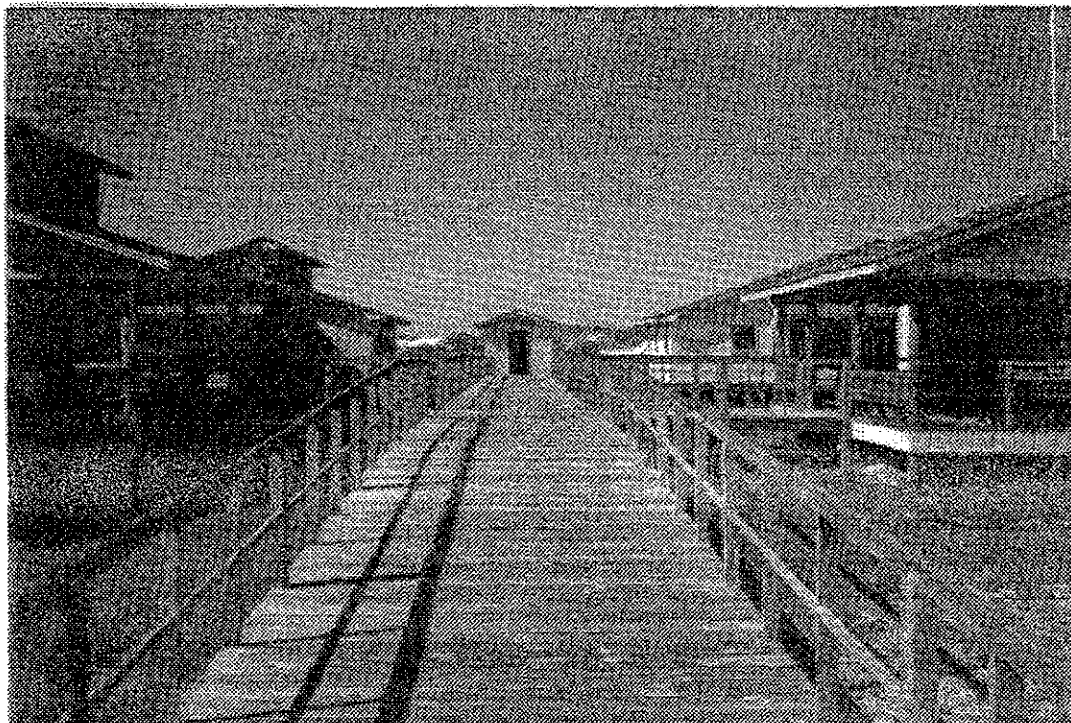
are provided adjacent to a section of the boardwalk from the beach to the Southeast Shelter area, and are not energy conservation responsive for the purpose of this study, so are not pictured.

The Southeast Shelter is pictured in Photograph 2.06, looking northwest, and the Southwest Shelter, seen from within the covered passageway, in Photograph 2.05. These two areas have minimal power requirements, being primarily open, un-conditioned spaces.

Immediately north of this area is the South Area Snack Bar housing most of the concessioner's facilities such as freezers, coolers, air conditioning, lights, water heating and various appliances. This Snack Bar is the primary energy user of the entire complex. It is shown in Photograph 2.03, taken looking north.

The Inside Shower building is shown, viewed toward the northwest in Photograph 2.04. This building is not a primary power consumer.

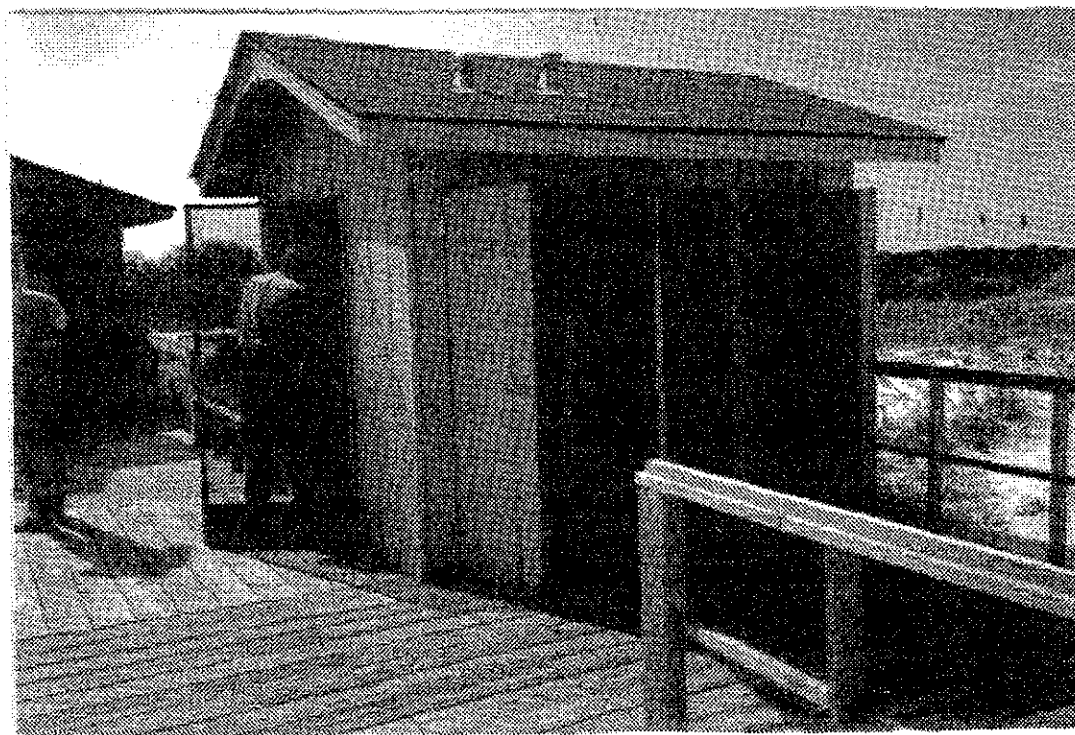
Supplying power to the South Area are the two generators in the South Generator Building. The West Generator, with its engine and accompanying controls, is shown in Photograph 2.00, taken toward the southwest; and the East Generator, with its engine and controls, is shown in Photograph 2.01, looking toward the northeast. Fuel for these two generators is supplied from the tank located to the west of the building and shown in Photograph 2.02, taken looking toward the north-northwest. The fuel supply piping is visible at the far end of the tank, and the vent with its associated piping shown at the near end of the tank.



SHIP ISLAND
West Island Complex
Overall Area
November 8, 1994

GUS

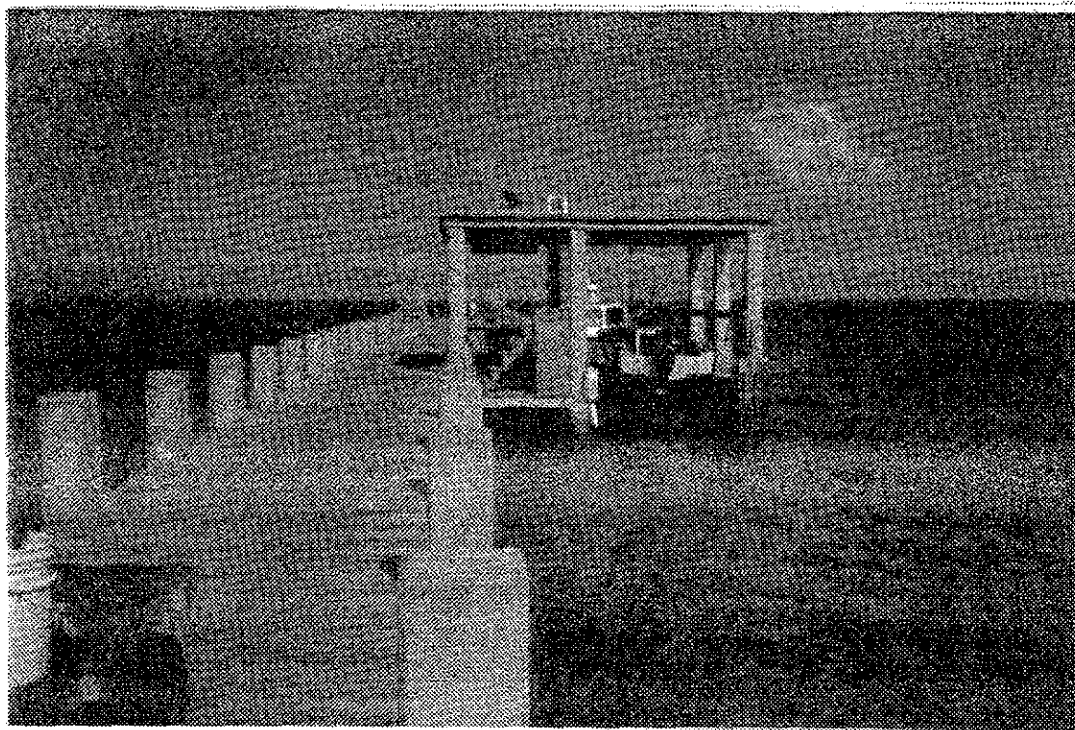
L21



SHIP ISLAND
Utility Building
Exterior
November 8, 1994

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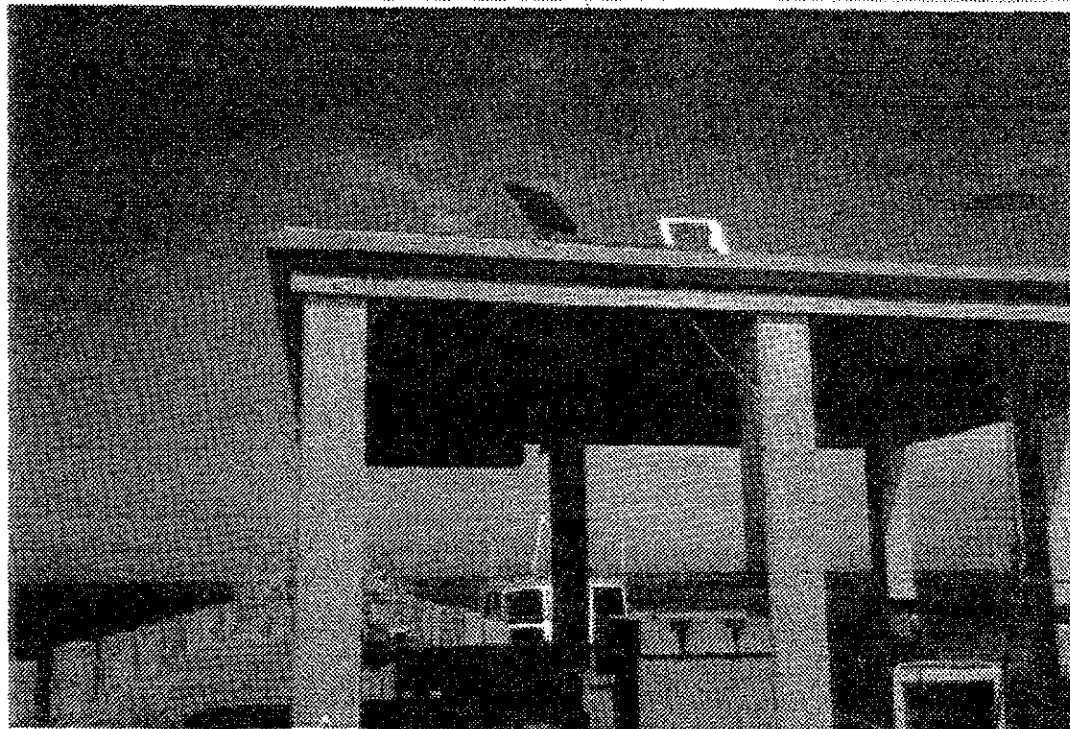
L19



SHIP ISLAND
Boat Shelter
Overall View
November 8, 1994

GUS

1.18



SHIP ISLAND
Boat Shelter
Detail of Photovoltaic Panels
November 8, 1994

GUS

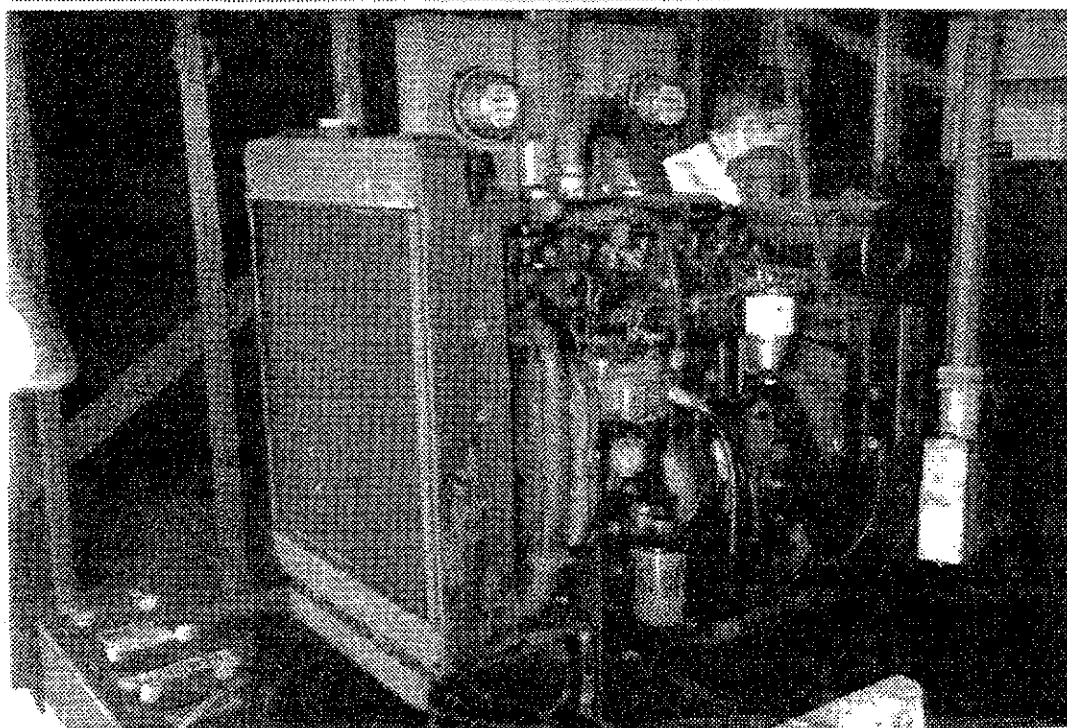
1.17



SHIP ISLAND
North Generator Building
East Generator
November 8, 1994

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1.23



SHIP ISLAND
North Generator Building
West Generator
November 8, 1994

GUS

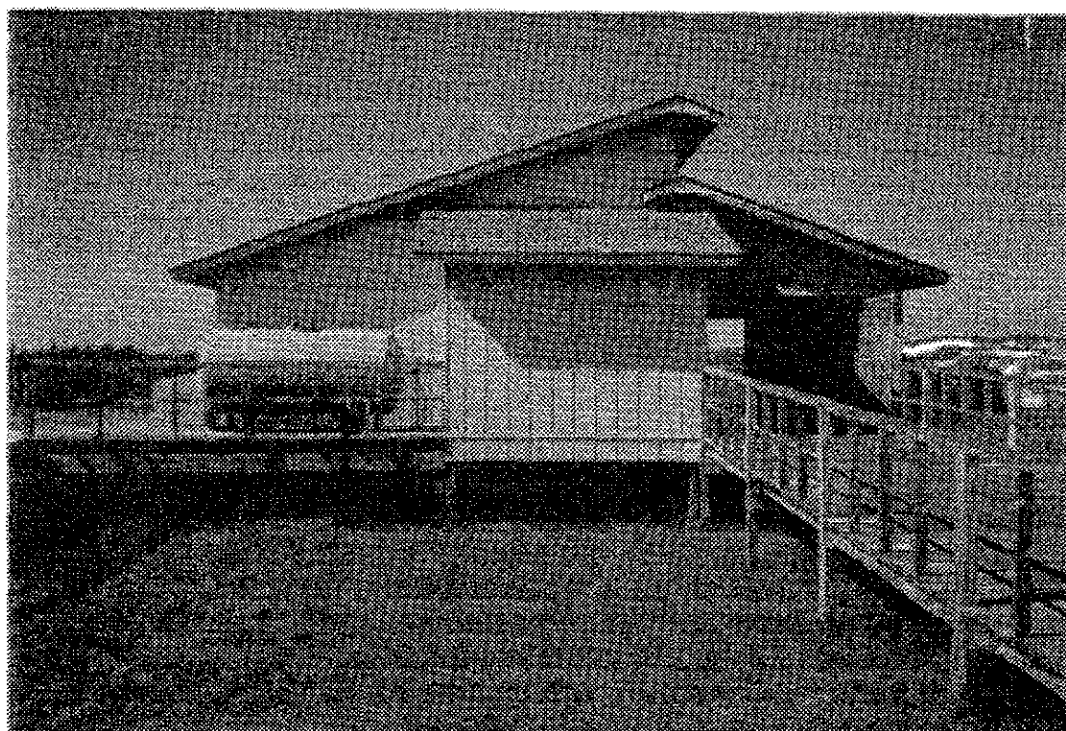
1.24



SHIP ISLAND
Utility Building
Interior
November 8, 1994

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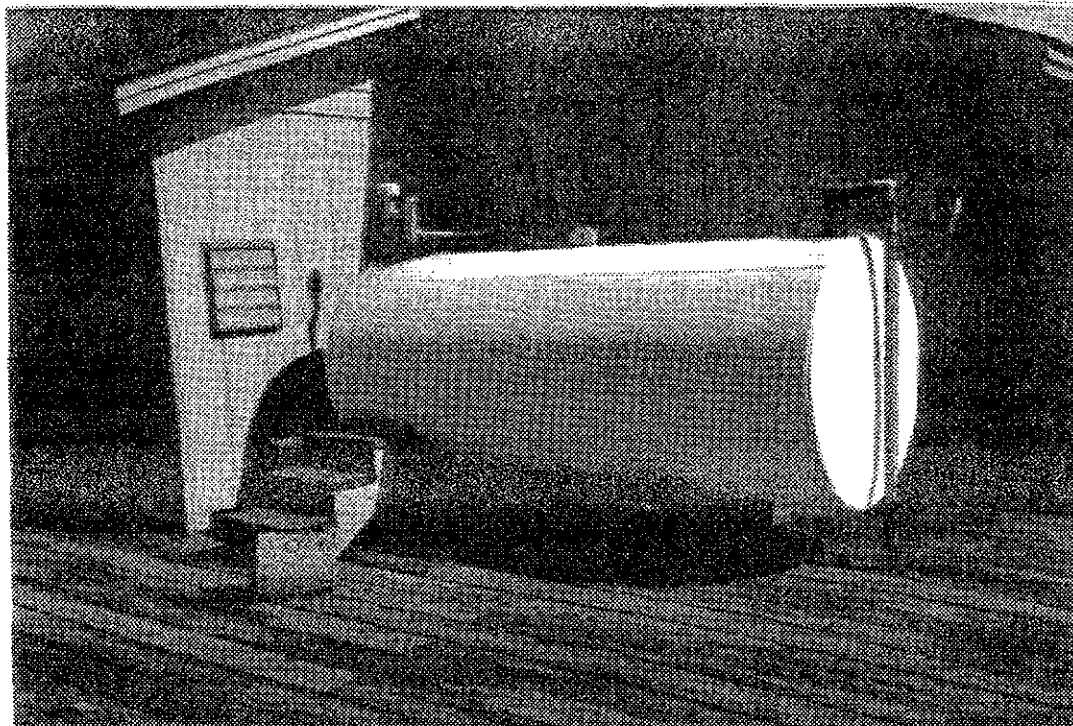
1.20



SHIP ISLAND
North Generator Building
Water Tank
November 8, 1994

GUS

1.22



SHIP ISLAND
North Generator Building
Fuel Tank
November 8, 1994

GUIS

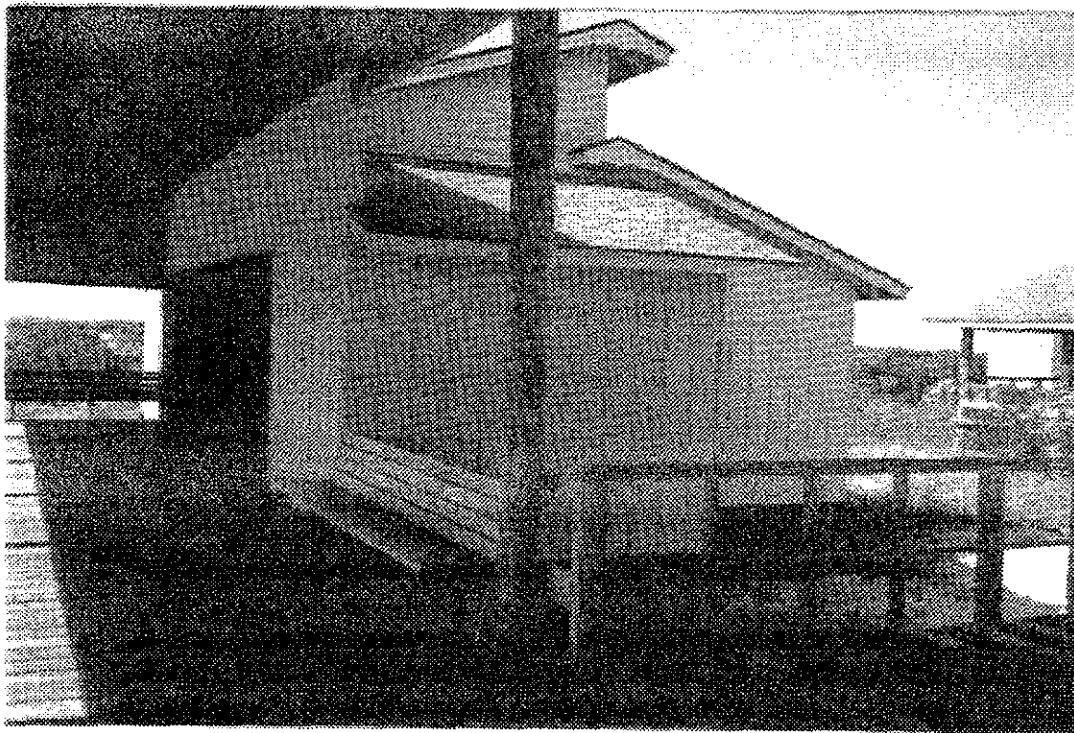
1.25



SHIP ISLAND
South Area
Southeast Shelter
November 8, 1994

GUIS

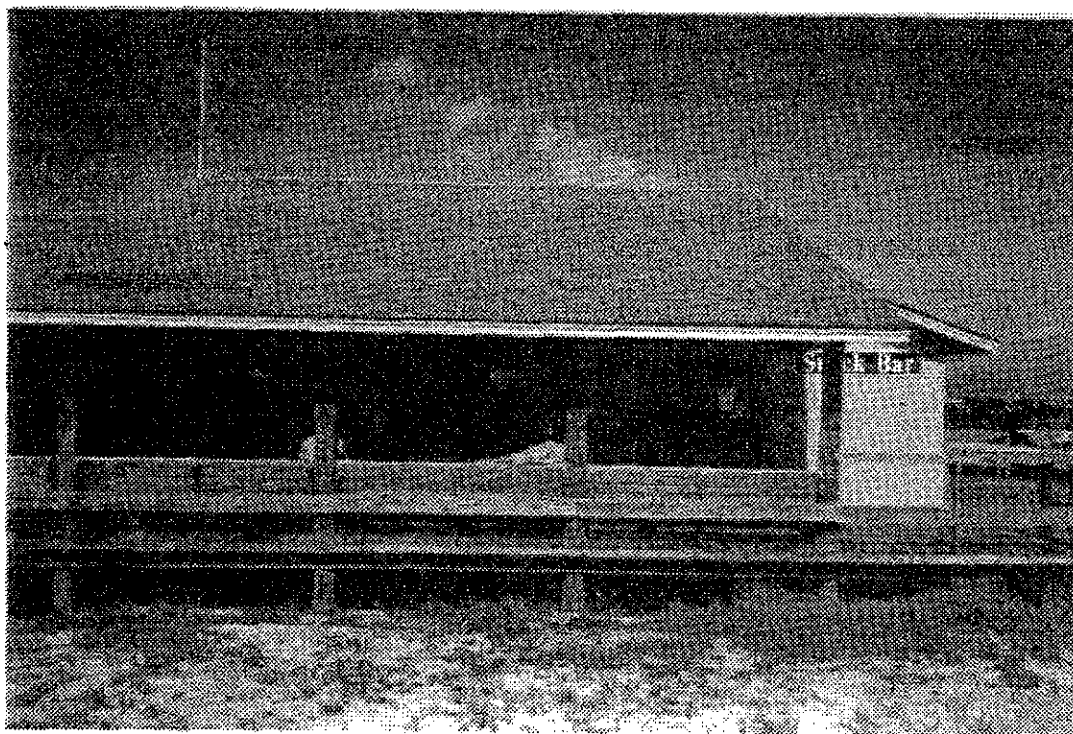
2.06



SHIP ISLAND
South Area
Southwest Shelter
November 8, 1994

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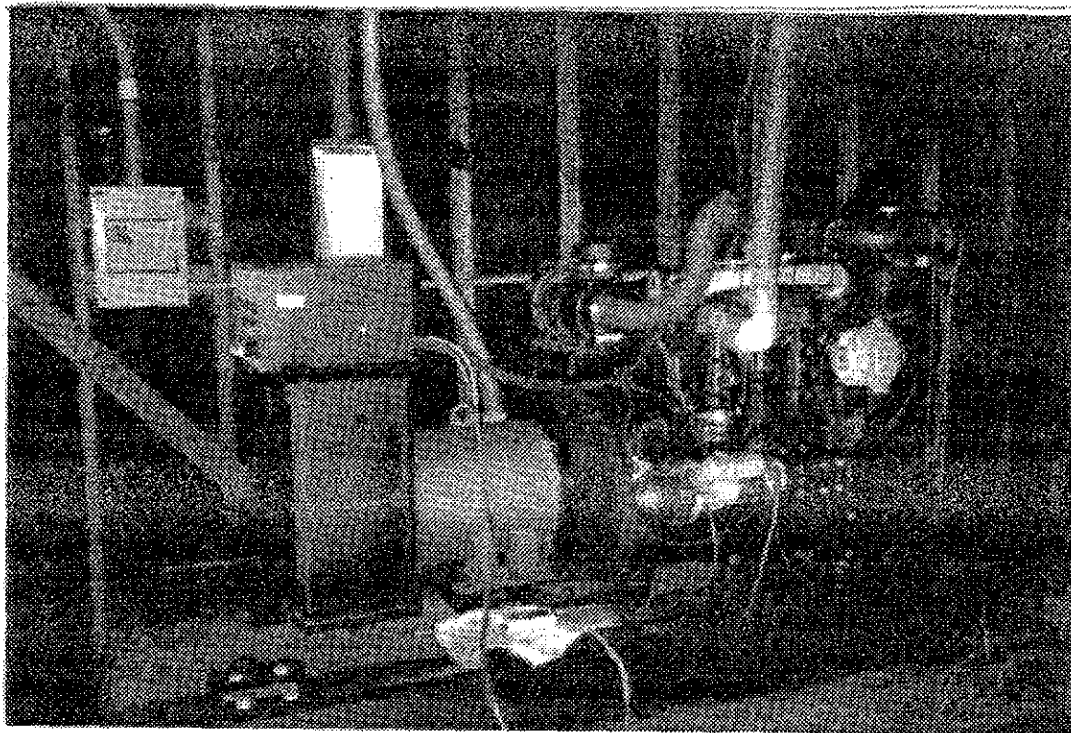
2.05



SHIP ISLAND
South Area
Snack Bar
November 8, 1994

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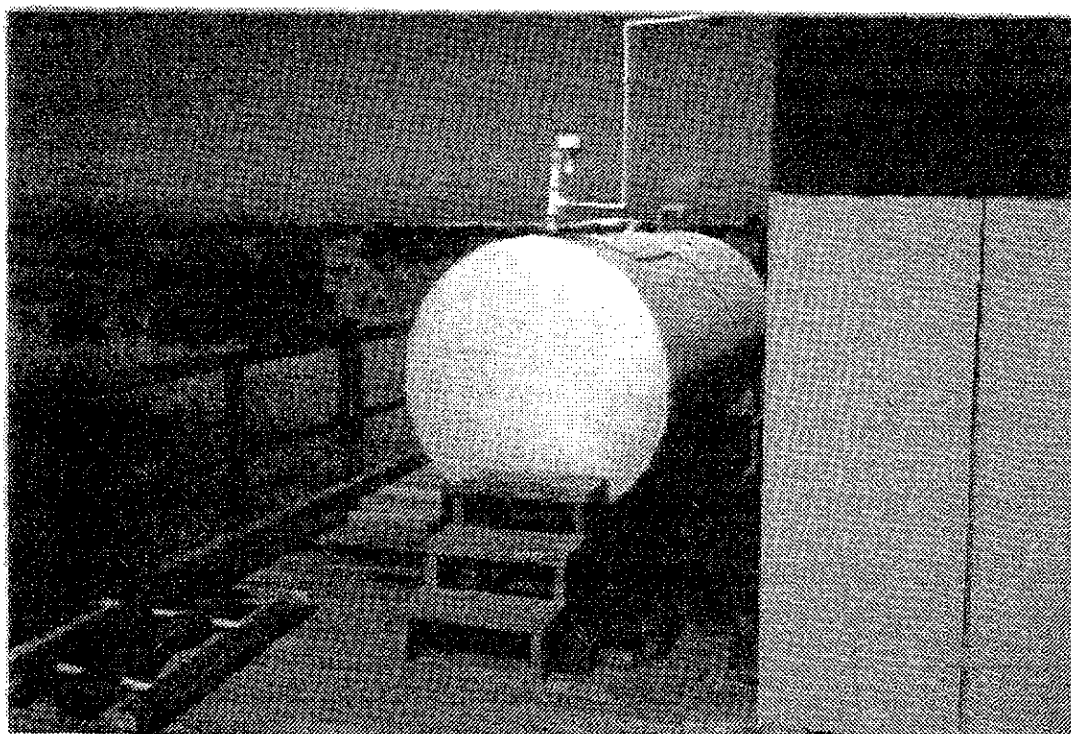
2.03



SHIP ISLAND
South Generator Building
East Generator
November 8, 1994

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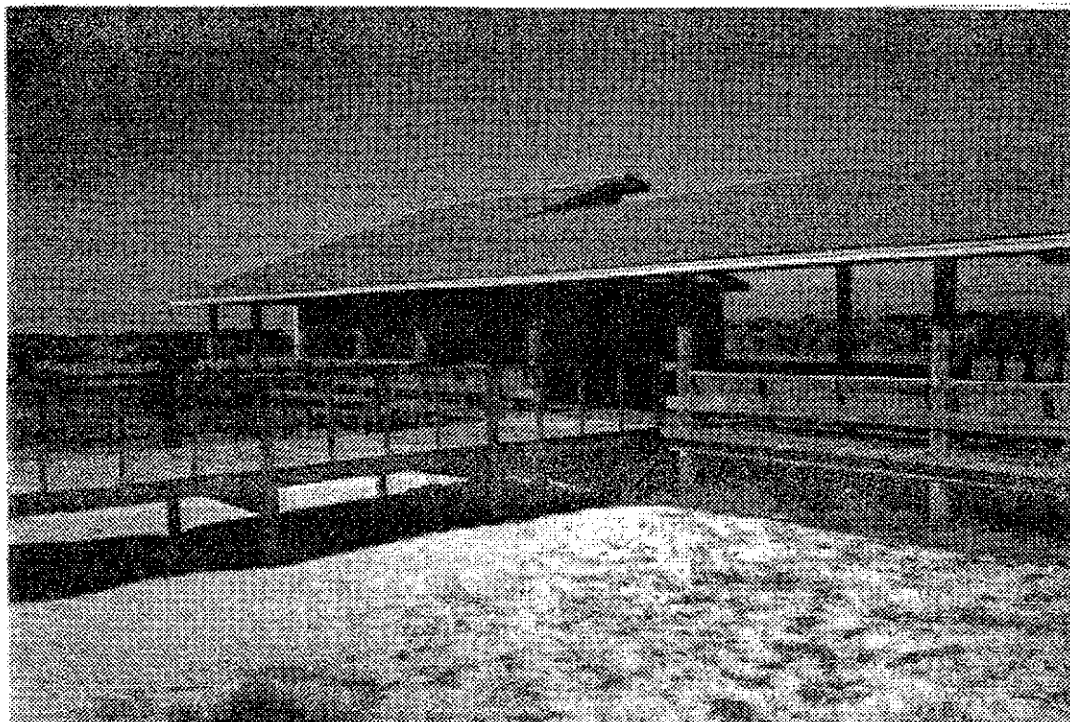
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SHIP ISLAND
South Generator Building
Fuel tank
November 8, 1994

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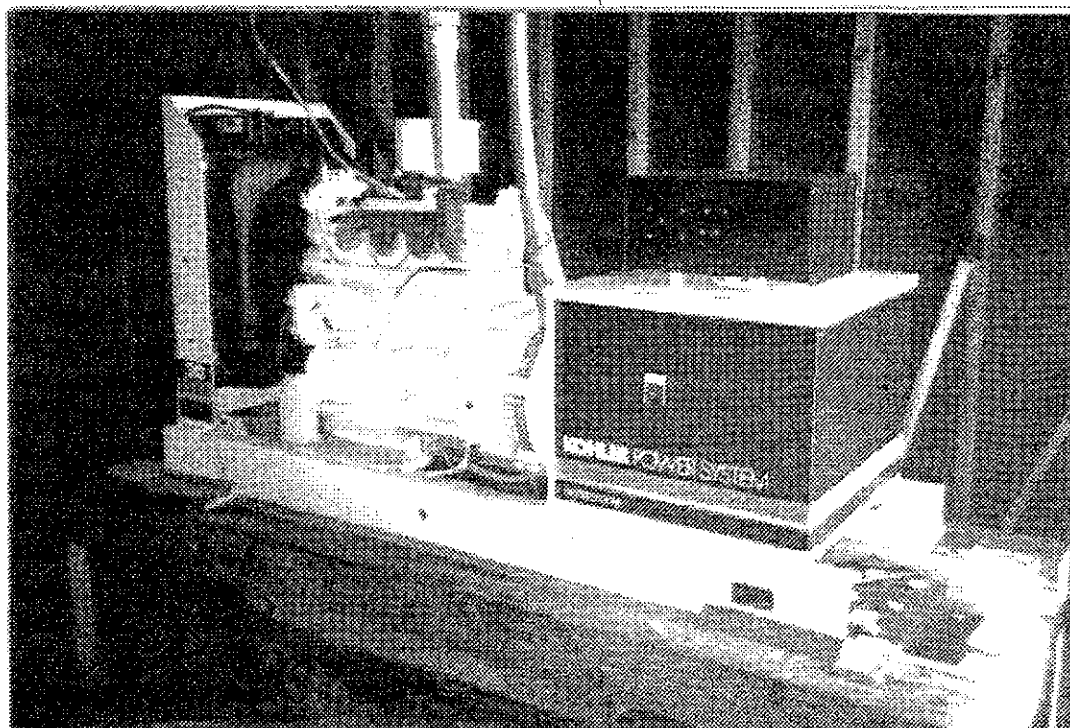
2.02



SHIP ISLAND
South Area
Inside Showers
November 8, 1994

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2.04



SHIP ISLAND
South Generator Building
West Generator
November 8, 1994

GLIS

2.00

RESULTS

These photographs document those conditions present at the sites on these two islands of Gulf Islands National Seashore. Use of the photographs with numeric data provided by the park for fuel usage, electrical energy consumption, and meteorological data will permit the development of alternative plans for the incorporation of renewable energy power at these sites. The report, *An Engineering Assessment of the Potential for Renewable Energy Power Systems at Gulf Islands National Seashore*, prepared by Hal Post and Mike Thomas of PVDAC, Sandia National Laboratories, will address this development.

A tabulation of data pertinent to the photographs presented herein is entitled *Gulf Islands Photovoltaic Survey - Photographs Taken November 8, 1994*. The table is included with this report.

GULF ISLANDS PHOTOVOLTAIC SURVEY - PHOTOGRAPHS TAKEN NOVEMBER 8, 1994

NEGATIVE NUMBER	LOCATION	BUILDING	DESCRIPTION	VIEW	TIME
1.00	HORN ISLAND	DOCK	OVERALL VIEW	LOOKING NORTHWEST	08:30 AM
1.01	HORN ISLAND	DOCK	DETAIL OF PV PANELS	LOOKING NORTHWEST	08:32 AM
1.02	HORN ISLAND	NATIONAL GUARD RADIO	OVERALL INSTALLATION	LOOKING NORTHWEST	08:40 AM
1.03	HORN ISLAND	NATIONAL GUARD RADIO	PANEL CLOSEUP	NEARBY	08:55 AM
1.04	HORN ISLAND	NATIONAL GUARD RADIO	CELL DETERIORATION	CLOSE-UP	08:57 AM
1.05	HORN ISLAND	QUARTERS 31A, B, C	ADJACENT TO NATIONAL GUARD RADIO	LOOKING NORTH	09:00 AM
1.06	HORN ISLAND	QUARTERS 31A, B, C	PV PANELS ON ROOF OF BUILDING	LOOKING NORTHWEST	09:01 AM
1.07	HORN ISLAND	QUARTERS 31A, B, C	HORIZONTAL VIEW	LOOKING SOUTH	09:18 AM
1.08	HORN ISLAND	QUARTERS 31A, B, C	VERTICAL VIEW	LOOKING SOUTH	09:19 AM
1.09	HORN ISLAND	GENERATOR SHED	GENERATOR 1	LOOKING NORTH	09:22 AM
1.10	HORN ISLAND	GENERATOR SHED	GENERATOR 2	LOOKING SOUTH	09:23 AM
1.11	HORN ISLAND	GENERATOR SHED	FUEL TANK	LOOKING EAST	09:24 AM
1.12	HORN ISLAND	GENERATOR SHED	EAST WALL	LOOKING WEST	09:26 AM
1.13	HORN ISLAND	GENERATOR SHED	SOUTH WALL	LOOKING NORTH	09:27 AM
1.14	HORN ISLAND	GENERATOR SHED	WEST WALL	LOOKING EAST	09:28 AM
1.15	HORN ISLAND	GENERATOR SHED	NORTH WALL	LOOKING SOUTH	09:29 AM
1.16	HORN ISLAND	DOCK	APPROACH	LOOKING SOUTH	09:50 AM
1.17	SHIP ISLAND	DOCK	DETAIL OF PV PANELS	LOOKING NORTH	10:45 AM
1.18	SHIP ISLAND	DOCK	OVERALL VIEW	LOOKING NORTH	10:47 AM
1.19	SHIP ISLAND	UTILITY BUILDING	EXTERIOR	LOOKING SOUTHWEST	11:00 AM
1.20	SHIP ISLAND	UTILITY BUILDING	INTERIOR	LOOKING SOUTHWEST	11:01 AM
1.21	SHIP ISLAND	WEST ISLAND COMPLEX	AREA VIEW	LOOKING WEST	11:03 AM
1.22	SHIP ISLAND	NORTH GENERATOR BUILDING	WATER TANK	LOOKING WEST	11:08 AM
1.23	SHIP ISLAND	NORTH GENERATOR BUILDING	EAST GENERATOR	LOOKING WEST	11:10 AM
1.24	SHIP ISLAND	NORTH GENERATOR BUILDING	WEST GENERATOR	LOOKING NORTHWEST	11:12 AM
1.25	SHIP ISLAND	NORTH GENERATOR BUILDING	FUEL TANK	LOOKING NORTHEAST	11:14 AM
2.00	SHIP ISLAND	SOUTH GENERATOR BUILDING	WEST GENERATOR	LOOKING SOUTHWEST	11:32 AM
2.01	SHIP ISLAND	SOUTH GENERATOR BUILDING	EAST GENERATOR	LOOKING NORTHEAST	11:33 AM
2.02	SHIP ISLAND	SOUTH GENERATOR BUILDING	FUEL TANK	LOOKING NORTHWEST	11:34 AM
2.03	SHIP ISLAND	SOUTH AREA	SNACK BAR	LOOKING NORTH	11:45 AM
2.04	SHIP ISLAND	SOUTH AREA	INSIDE SHOWERS	LOOKING NORTHWEST	11:46 AM
2.05	SHIP ISLAND	SOUTH AREA	SW SHELTER	LOOKING NORTHWEST	11:47 AM
2.06	SHIP ISLAND	SOUTH AREA	SE SHELTER	LOOKING NORTHWEST	11:49 AM