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To: "Jonathan Rowley" <JGR@nrc.gov>
Date: Thu, Sep 7, 2006 12:01 PM
Subject: Vernon Hydro Station Safety Reports

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GEI Consultants, Inc.

SIXTH QUINQUENNIAL SAFETY INSPECTION
VERNON PROJECT
FERC PROJECT NO. 1904

Prepared for

New England Power Company
25 Research Drive
Westborough, Massachusetts 01582

GEI Consultants, Inc.
1021 Main Street
Winchester, Massachusetts 01890-1943

Project 92067
October 19, 1992

HYDCT 2.8.2.1 Vernon 6th Five Year Safety Inspection

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Project 92067

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1. SUMMARY

The Vernon Project is located on the Connecticut River in the Towns of Vernon, Vermont and Hinsdale, New Hampshire. The licensed project consists of a 600-foot-long spillway and a powerhouse (Fig. 1). The east abutment is a long natural soil ridge called Vernon Neck. The project was constructed between 1907 and 1910. A powerhouse addition was constructed between 1918 and 1921.

The effective date of the Federal Energy Regulatory Commission (FERC) license is June 1, 1979 and it expires on April 30, 2018.

Previous FERC quinquennial safety inspections for this project performed in accordance with Federal Power Commission (FPC) Order No. 315 were dated November 1967, November 1972, and November 1977. The 1982 and 1987 quinquennial inspections were conducted in accordance with FERC Order 122.

This report contains the findings of the Sixth Quinquennial FERC Safety Inspection of the project and was performed in accordance with Part 12 of FERC Order No. 122 effective March 1, 1981 and FERC letter dated March 18, 1992, Appendix H.

There have been no federal, state, or independent consultant reports relating to safety of project structures since the 1987 Quinquennial Safety Inspection Report.

The project structures are in very good condition and well maintained. The powerhouse superstructure is in good condition and all mechanical equipment, except decommissioned Unit No. 8, is well maintained and serviceable. The project spillway structure and powerhouse intake have been modified extensively to improve spillway crest control, obtain access to Vernon Neck, and to improve trash rack cleaning procedures.

The project structures are founded on hard massive gneiss. There are no adversely oriented bedding planes or joints observed at the site and there are no known active faults in the project's area.

Project instrumentation consists of an extensive powerhouse crack monitoring program. Until the 1987 Quinquennial Safety Inspection, there has been no indication of changes or trends other than seasonal (thermal) cyclic variations in the crack dimensions. It was recommended in the 1987 safety inspection report this program can be terminated; however, the gages should be maintained and read after major floods, or felt earthquakes.

A survey of four Vernon Neck cross sections is conducted at five-year intervals to detect upstream/downstream changes its configuration. No changes indicating any significant reduction in cross section have been detected to date. This program should continue at five-year intervals or after major floods ($Q \geq 150{,}000$ cfs).

The project spillway can pass up to 51 percent of the Probable Maximum Flood (PMF) at zero freeboard. The flood of record is 185,000 cfs or 32 percent of the PMF in March 1936. The estimated PMF is 567,100 cfs. At PMF, significant damage to project structures would result due to overtopping flows.

Stability analyses show the powerhouse structure meets stability guidelines for normal operating reservoir, ice loading, and zero freeboard using procedures, formulations, and criteria currently accepted by FERC (2, 4). Additional stability analyses were performed in the 1987 inspection report (5) to include 0.10 g earthquake loading, and analysis of the modified spillway structures. The structures satisfied FERC stability criteria for the loading conditions investigated. At PMF, the spillway structures become submerged weirs and the powerhouse will be damaged heavily.

Based on the information available from prior inspection reports and the observations made during this inspection, we conclude no emergency remedial actions are required at this time.

The rock scour downstream of the deep tainter gates should be evaluated, and the tree and brush growth on the Vernon Neck be controlled to aid annual inspections.

2. DESCRIPTION OF PROJECT

2.1 General

The Vernon Project was constructed by the Connecticut River Power Company and is presently owned and operated by the New England Power Company (NEP). Construction began in 1907 and was completed in 1910. The power plant was put into commercial operation on December 1, 1909. In 1910, the final three of the eight original generating units were placed in operation. An addition to the powerhouse and the installation of two additional generating units started in 1918 and was completed in 1921. These units were put into commercial operation on March 12, 1921.

The project is located on the Connecticut River in the towns of Vernon, Vermont and Hinsdale, New Hampshire (Fig. 1). The project structures include a gravity concrete spillway section equipped with stanchion bays, radial gates, hydraulic panels, tiedown anchors, and sluice gates, and a non-overflow section comprised of a trash sluice, fishway head works, and powerhouse.

2.2 Project Data

The following project data are taken from References 1 through 4. The gross drainage area above the project is approximately 6266 square miles. The reservoir extends upstream above the project for approximately 30 miles and has a surface area of 2550 acres at El. 220.13 NGVD. For reference, elevations are given as NGVD with equivalent project datum in parentheses.

Other statistics are as follows:

Normal Maximum Reservoir Elevation		220.13 feet
Normal Operating Reservoir Elevation		218.00 feet
Normal Tailwater Elevation		184.80 feet
Usable Storage (8 feet drawdown)		18,300 acre feet
Spillway -	Length - clear	542.50 feet
Crest El.	- 10 x 50 gates (4)	212.13 feet
	- 10 x 10 panels (10), flashboards 3 (bays)	212.13 feet
	- 20 x 50 gates (2)	202.13 feet
Discharge Cap.	- W.S. El. 220.13	83,200 cfs
	- W.S. El. 228.13	127,600 cfs

2.3 Powerhouse

The project powerhouse contains 10 generating units consisting of eight units rated at 2000 kw and two units rated at 4200 kw. The installed capacity is 24,400 kw. The

powerhouse has an integral intake structure with intake gates, trash racks, and trash rake. See Figs. 1 through 5 for location and details. An upstream trash boom protects the structures against floating debris. Unit No. 8 (2 mw) was removed from service in November 1991 due to mechanical failure. This original 1909 unit and units 5, 6, and 7 are proposed to be replaced by two 14 mw units in 1997.

2.4 Trash Sluice

A 7- by 9-foot trash and ice sluice abuts the left (east) side of the powerhouse and is controlled by a motor-driven drop gate, Fig. 6.

2.5 Spillway

The project spillway is 600 feet long. See Fig. 2 for spillway configuration and details. In 1990, stanchion beams and stoplogs were installed in the spillway to replace the three bays of flashboards. The modified spillway consists of the following:

Type	Number	Height (ft)	Width (ft)
Shallow Tainter Gates	4	10.0	50.0
Hydraulic Steel Panels	10	10.0	10.0
Stanchion bays	3	10.0	50.0
Deep Tainter Gates	2	20.0	50.0
Sluice Gates	8	9.0	7.0

2.6 Vernon Neck

The Vernon Project is located on a bend of the Connecticut River. Vernon Neck is a natural soil ridge that extends approximately ½ mile to the east of the project spillway. See Fig. B1 in Appendix B for additional information.

2.7 Spillway Warning Devices

In 1990, spillway warning devices and signage were installed to comply with a 1989 FERC order. The safety warning consists of fluorescent orange "drums" connected with cable to anchorages. Warning signs were installed upstream of the spillway cables.

2.8 Standard Operational Procedures

The Vernon Project is operated as a daily cycled reservoir hydroelectric project. Flows in excess of station generation requirements are released by operating the project spillway crest control structures.

3. CONSTRUCTION HISTORY AND DEVELOPMENT

The construction history of the Vernon project is summarized in Section III of the 1987 Quinquennial Inspection Report (5).

In 1987, concrete and riprap were installed along the spillway's east abutment to control erosion. Safety rails and related items were installed along the intake trash rake forebay area in 1988.

In 1990, stanchion beams and stoplogs were installed in the spillway to replace the three bays of flashboards, and a downstream migrant fish by-pass conduit was installed between units No. 4 and 5. See Fig. 1 for location of project features.

4. GEOLOGY

The geologic conditions at the Vernon project site are summarized in Section IV of the 1987 Quinquennial Inspection Report (5).

There has been no significant seismic activity at the project site since the 1987 safety inspection.

5. INSTRUMENTATION

5.1 Powerhouse

Numerous cracks in the project powerhouse are monitored for activity by use of trammel points, and tell-tale gages. New Avongard Calibrated Crack Monitoring gages were installed in 1980 to determine if any progressive expansion of the cracks was occurring which would warrant remedial repairs. Readings taken until 1987 indicated no significant changes or trends were discernible in the trammel points or Avongard gages other than seasonal (thermal) cyclic variations.

Avongard gage readings taken from November 26, 1988 to June 1, 1992 are presented in Figs. A1 to A18, Appendix A. Readings using other devices are presented in Fig. A19, Appendix A. These data continue to show no significant changes in the crack dimensions other than seasonal temperature variations.

Water leaking through cracks in the sluice gate operator gallery has been monitored since 1984. Measurements of the total seepage are given in Figs. A20 to A21, Appendix A. A total seepage of 1-2 gallons per minute is measured when the trash sluice gate is opened, and leakage occurs in the stairway. There is negligible seepage but damp conditions exist when the trash sluice gate is in the up (closed) position.

5.2 Vernon Neck

At five-year intervals, NEP conducts cross-section surveys at four locations on Vernon Neck. The most recent surveys were taken on June 3, 1992 (See Fig. B-1 in Appendix B). When superimposed on surveys taken since 1924, no significant changes are indicated in the main neck section. Some continuing minor changes at the downstream toe caused by seasonal river erosion and deposition during flood flows is considered insignificant since the toe is protected by riprap. Future surveys of Vernon Neck should be conducted as part of the next quinquennial safety inspection or following a major flood ($Q \geq 150{,}000$ cfs).

5.3 Adequacy

The current program of instrumentation and monitoring of project structures is adequate, and no new or supplemental programs are required. The original data are on file at the project office.

The crack monitoring and sluice gate operation gallery leakage monitoring programs be terminated. However, the gages should be maintained so they can be read following major floods or felt earthquakes.

6. FIELD INSPECTION

6.1 General

The project structures were inspected on May 12, 1992 by Messrs. Alton P. Davis, Jr., and William H. Walton of GEI accompanied Mr. Denton E. Nichols of the NEPSCo and Messrs. Hugh W. Sullivan, Charles M. Harrington, and Brian R. Dame of NEP. Water surface elevations at the time of inspection were approximately as follows:

Headwater Elevation	219.6 NGVD
Tailwater Elevation	185.6 NGVD

An inspection checklist is included as Appendix C while inspection photographs are included in Appendix D.

In general, the various project features contain many detailed points of interest and significance relating to their current condition, such as cracks, seepage, instrumentation performance, and concrete spalling. In previous inspection reports, these conditions have been discussed in detail, and, to avoid repetition, only changes or previously unreported conditions are highlighted in the following subsections.

6.2 Powerhouse and Intake

The powerhouse superstructure brickwork, structural steel, and roof are in very good condition. Refer to Figs. 3, 4, 5, and 6 for powerhouse features. The gantry crane appeared in good operating condition. The El. 226.38 generator floor was in very good condition (see Photo No. 1), with only minor floor cracks. The substructure was observed with no evidence of structural displacement or severe cracking. The unit wheel pits are in generally good condition. Unit No. 8 turbines (triple runner style) are no longer operational; therefore, the unit is decommissioned leaving nine operational turbine generators at this project. The turbine pits appear unchanged from conditions noted in the 1982 Quinquennial Inspection Report (4).

The El. 189.13 walkway over the draft tubes was observed. The 1987 observed concrete erosion on the downstream piers at the water line was not visible due to high tailwater. However, the piers for Units 1-4 are scheduled for concrete work before the next 5-year inspection. On the exterior wall of the tailrace gallery at Units 7 and 8, the concrete is heavily spalled with patterned cracks and efflorescence (see Photo No. 2). These conditions are surficial and have not changed since the 1987 Report. In 1991, NEP installed a new downstream migrant fish by-pass conduit between Units 4 and 5 in the old exciter unit draft tubes (see Photo No. 3).

The powerhouse intake structure has been modified since the last inspection to include installation of safety rails and related items along the intake/trash rake area. The intake/trash rake structure is in excellent condition (see Photo No. 12). The trash and ice booms are in place and observed free of debris.

The right abutment upstream and downstream training walls are in good alignment, and the earthfill behind the wall is stable with no signs of sinkholes, settlement, or erosion.

6.3 Trash Sluice

The sluice was operational during the inspection (see Photo No. 4 and Fig. 1 for location). The El. 226.38 deck, upstream and downstream piers are in good condition. The 1987 inspection reported a light to moderate spalled ogee, and chute and concrete erosion on the powerhouse wall below the stairs was not observable due to discharge flows.

6.4 Spillway

The spillway ogees, piers, and concrete along the upstream waterline appeared to be in good condition. See Fig. 2 for spillway location and details. The spillway chutes show light to moderate spalling and erosion. There was heavier concrete erosion along the toe of the shallow tainter gate spillway chutes Nos. 3 through 6 at the tailwater line (see Photo No. 5).

The two east deep tainter gates (Nos. 1 and 2) were closed. The gate, seals, mechanical equipment, and hoisting mechanism are in good condition. In 1990, NEP installed stanchion beams and stoplogs in the three former pin flashboard controlled spillway bays. The beams, release mechanisms, and timber boards were in good condition (see Photo No. 6). Nominal leakage was observed between the boards and at the concrete spillway contact. The six hydraulic controlled flashboard spillway bays were in closed position and showed no signs of significant leakage. The gates, seals, and mechanical equipment were in good condition (see Photo No. 7). The steel grated and plate girder spillway bridge was in good condition.

The spillway inspection tunnel and sluice gate operator gallery were observed. The two easterly gates (Nos. 1 and 2) have been plugged with concrete. See Fig. 2 for gate locations. The eight remaining gates were reported operational. The sluice gate operators appeared in good condition (see Photo No. 8).

At the west end of the sluice gate gallery is a room with storage tanks containing hydraulic fluid for operation of the gates. The right wall of the room has a heavy buildup of efflorescence. Seepage continues to emanate from cracks in concrete near the access stairwell from the powerhouse to the gallery. Along the downstream crown of the gallery, a lift line continues to make seepage and show efflorescence. There is a lift line on the upstream wall approximately 1 foot above the gallery floor that makes light seepage (see Photo No. 8). Seepage locations and quantity of flow have not increased since the 1987 Inspection Report.

According to NEP reports, all mechanical operated gates were operated during 1991. Emergency power was used to operate the gates in 1991, as reported in Appendix F. An emergency gasoline driven generator provides power for the tainter gates. Standby power for the spillway tainter gates is any one of the nine operational generating units, which are capable of "black start."

The east abutment upstream and downstream spillway training walls are in good alignment. The wall concrete is in very good condition. Since the last inspection, NEP installed new concrete (see Photo No. 9) and riprap downstream of the east spillway training wall to retard erosion.

6.5 Fish Ladder

The fish ladder was not operational during this inspection. Figure 3 shows a plan of the fish ladder system. However, the structural and mechanical works appeared in good condition. The fish ladder was placed in service in 1981 and has operated seasonally since that time.

6.6 Vernon Neck

Vernon Neck is a natural soil ridge of high ground between the reservoir and the downstream river channel and forms the east abutment the reservoir and spillway. No toe seepage was emanating from the slope, and there was no evidence of upstream or downstream sloughs or wet areas. Minor erosion and deposition was noted at the toe of slope due to seasonal river flooding. The area is inspected regularly by NEP personnel and no significant changes have occurred to date (see Photo No. 10). Brush control on the Neck is scheduled as a periodic basis.

6.7 Emergency Action Plan

The Emergency Action Plan (EAP) is visibly posted in the control room and the Station Superintendent knowledgeable of its contents. The EAP was updated in September 1991.

The Vermont Yankee Nuclear Power Station is sited ½-mile upstream of the Vernon powerhouse (see Photo No. 11). The EAP has provisions of evacuation in case of a declared radiological emergency condition at the Vermont Yankee Nuclear Power Station.

6.8 Miscellaneous Items

The required summertime spillway warning control devices (i.e., floats) were being installed immediately upstream of the spillway during the inspection (see Photo No. 12) and safety signage was observed in place. These were installed based upon the FERC 1989 order. NEP reported there are no state or federal inspection reports since the 1987 Inspection Report.

NEP reported there are no state or federal inspection reports since the 1987 Inspection Report.

The reservoir rim was scanned in the vicinity of the Development. There are no areas observed which appear to present a potentially hazardous condition relating to the overall safety of the development. There are no observed changes in the river channel downstream of the dam and spillway.

7. SPILLWAY ADEQUACY

Spillway adequacy is addressed in the first four inspection reports and their supplements (1 through 4) and summarized in Section VII of the 1987 Inspection Report. Conversion of the three pin flashboard spillway bays to stanchion stoplog sections does not change spillway geometry or the spillway rating curves.

Appendix E contains the spillway rating curve and the 50 percent PMF flood hydrograph for the project (2). The project spillway can pass up to 51% of the PMF at zero freeboard. The flood of record in March 1936 was 185,000 cfs or 32 percent of the PMF. The estimated PMF is 567,000 cfs. At PMF, significant damage to the project powerhouse and spillway superstructures would result due to overtopping flows.

8. STRUCTURAL STABILITY

8.1 Visual Observations

As noted in Section 6, the project structures continue to be well maintained and are in very good condition with no significant deterioration or structural distress observed.

8.2 Analysis

The results of analyses on project structures for various loading cases are summarized in Appendix G. The change from pin flashboards to stanchion stoplogs for three spillway bays does not alter the structural adequacy of the piers and spillway ogee. For convenience, the stability analysis summary from the 1987 Inspection Report is included as Appendix G herein.

8.3 Evaluation

From the results of the analyses summarized in Appendix G, GEI concludes that the project structures meet stability guidelines for loading conditions up to zero freeboard flood using procedures, formulations, and criteria currently accepted by FERC. Although the structures meet stability guidelines for the PMF, the spillway structures would become submerged weirs and there would be substantial damage to the powerhouse and spillway superstructures.

9. ADEQUACY OF OPERATION AND MAINTENANCE

Operation and maintenance methods at the project are well planned and executed. The condition of all facilities is of a high order.

There are no observations made during this inspection requiring any emergency actions or repairs.

On October 1, 1991, Aqua Tech, Inc. conducted an underwater survey of the spillway sluice gate chambers. Aqua Tech, Inc. reported some minor erosion downstream of the sluice gate guides due to cavitation. No action is required at this time. The concrete plugs in abandoned sluice gates No. 1 and 2 (Fig. 2) were reported to be in good condition.

10. CONCLUSIONS

Based on this inspection, the results of monitoring programs, and review of prior inspection reports, GEI concludes the project structures do not require any emergency remedial work at this time.

The project structures meet stability guidelines for loading conditions up to the zero freeboard flood using procedures, formulations, and criteria currently accepted by FERC. The spillway is adequate to pass approximately 51 percent of the PMF at zero freeboard. The flood of record in March 1936 equaled 32 percent of the PMF. At PMF, the project will experience overtopping flows up to 18 feet above the top of the spillway piers. Heavy damage to the project structures is likely at PMF.

Project instrumentation consists of numerous crack monitoring gages in the powerhouse. This program has shown no significant movements in crack widths to date except for seasonal (thermal) cycles. In our opinion, this program may be terminated. However, the gages should be retained to permit reading after high flood flows or felt earthquakes. No additional instrumentation is required at this time.

The Vernon Neck surveys show no significant changes in the cross section of the neck. These surveys should continue on a 5-year basis and after major floods exceeding 150,000 cfs.

Project maintenance is very good. Surveillance and operational procedures are adequate. The EAP was posted in the control room and was updated in September 1991. Plant personnel receive an annual EAP training program. The plan includes a Radiological Response plan for the Vernon Nuclear Plant ½ mile upstream. There are no changes in the downstream channel.

The spillway gates are operable and were used during the April 1992 spring freshet. Standby power is provided by any one of the nine operational generating units. The eight spillway sluice gates are operable. An emergency generator provides power to operate the tainter gates.

The spillway toe erosion previously observed downstream of the sluice gate and tainter gate sections is of less concern since the spillway has been modified and post-tensioned to bedrock. This area should be inspected after major floods and at 5-year intervals to detect any changes that might warrant future remedial work. Concrete repair work is scheduled to repair the tailrace piers in the draft tube area.

NEP has compiled with all recommendations from prior inspection reports for the Vernon Project.

11. RECOMMENDATIONS

Based on the information available from prior inspection reports and the observations and analyses made during this inspection, we conclude no emergency remedial actions are required for this project at this time.

Based on the visual inspection reported herein and review of past inspection reports, we have the following recommendations for the Vernon Project:

- Evaluate the surficial concrete erosion downstream of the right tainter gate Nos. 3 through 6, sluice gates, draft tube piers at Units 1 through 4, and schedule for repair.
- Routinely clear the tree and brush growth on Vernon neck to permit annual inspection of the upstream and downstream slopes.
- Maintain and read the powerhouse and spillway inspection gallery crack monitoring devices after major floods or felt earthquakes.

12. CERTIFICATION

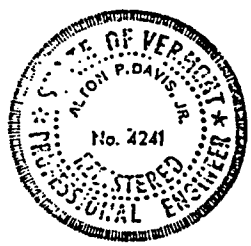
This report covers our inspection of the project carried out in accordance with Part 12 of FERC Order No. 122. The project inspection and preparation of this report was done under the direction of the undersigned. The assistance of NEP project staff in conducting the inspection and assembling project data is gratefully acknowledged.

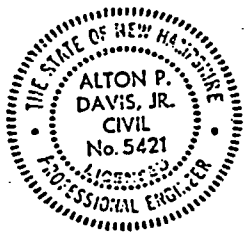
We certify all work performed in connection with the inspection and investigation of this project and preparation of this report has been done in compliance with Part 12 of FERC Order No. 122 dated March 1, 1981. All conclusions and recommendations in this report are made independently of the licensee, its employees, and its representatives as required by paragraph 12.37(c)(7) of that order.

Respectfully submitted,

GEI CONSULTANTS, INC.

Alton P. Davis Jr., P.E.
Vice President
Design Division Manager





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2. Main, Chas T., "Inspection Report of the New England Power Company Vernon Project," FPC Project No. 1904," November 1972.

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4. Main, Chas T., "Fourth Five Year Safety Inspection of the New England Power Company Vernon Project, FERC Project No. 1904," November 1982.

5. Geotechnical Engineers, Inc., "Fifth Quinquennial Safety Inspection, Vernon Project, FERC Project No. 1904," October 30, 1987.

H-42372

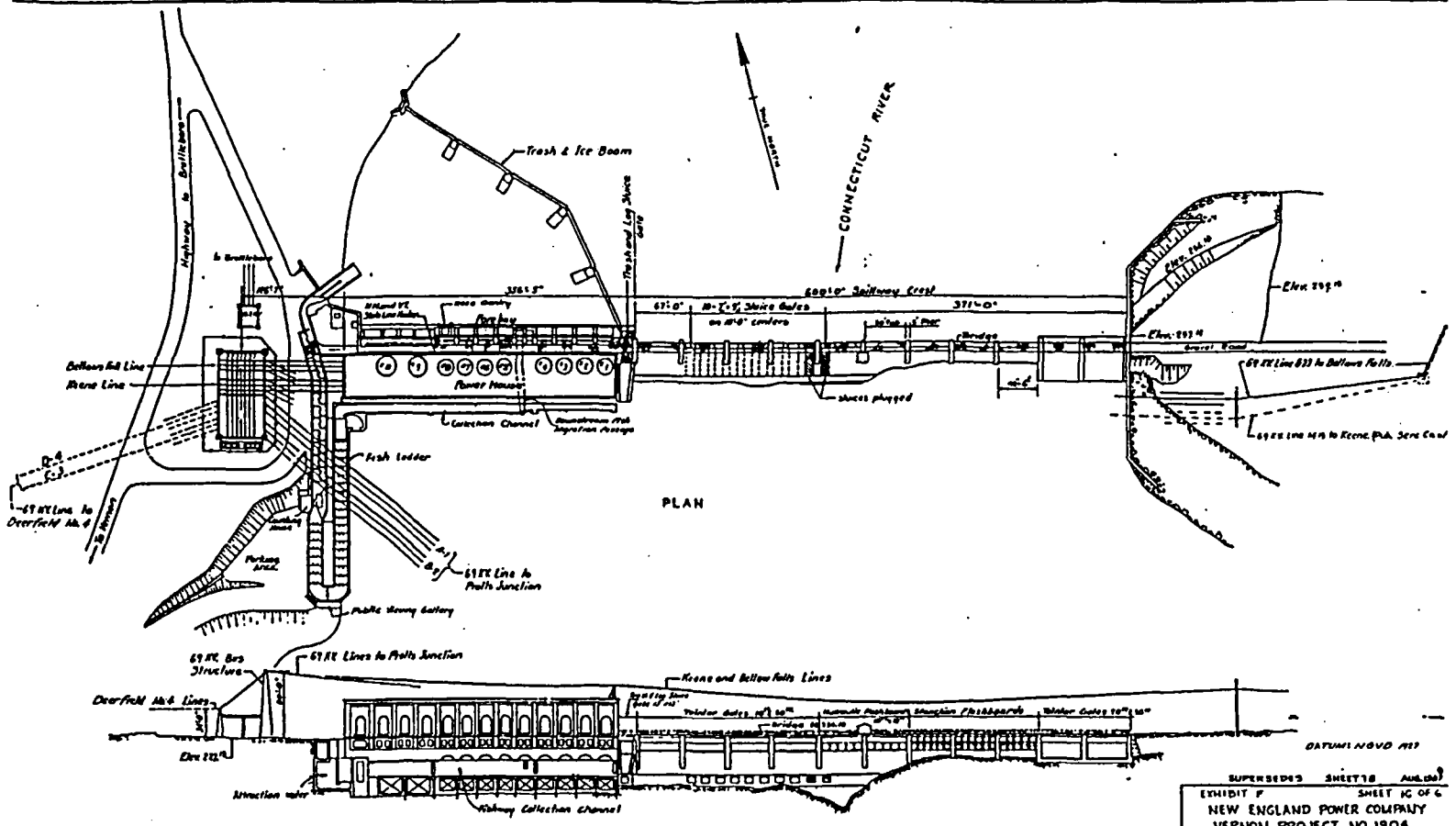

EXHIBIT F SHEET 16 OF 6

NEW ENGLAND POWER COMPANY
VERNON PROJECT NO. 1904
GENERAL LAYOUT OF PLANT

SCALE 1 INCH = 50 FEET FEBRUARY 19

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NEW ENGLAND POWER COMPANY
By GP Barrow
Vice President

FIGURE 1

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H-4237A

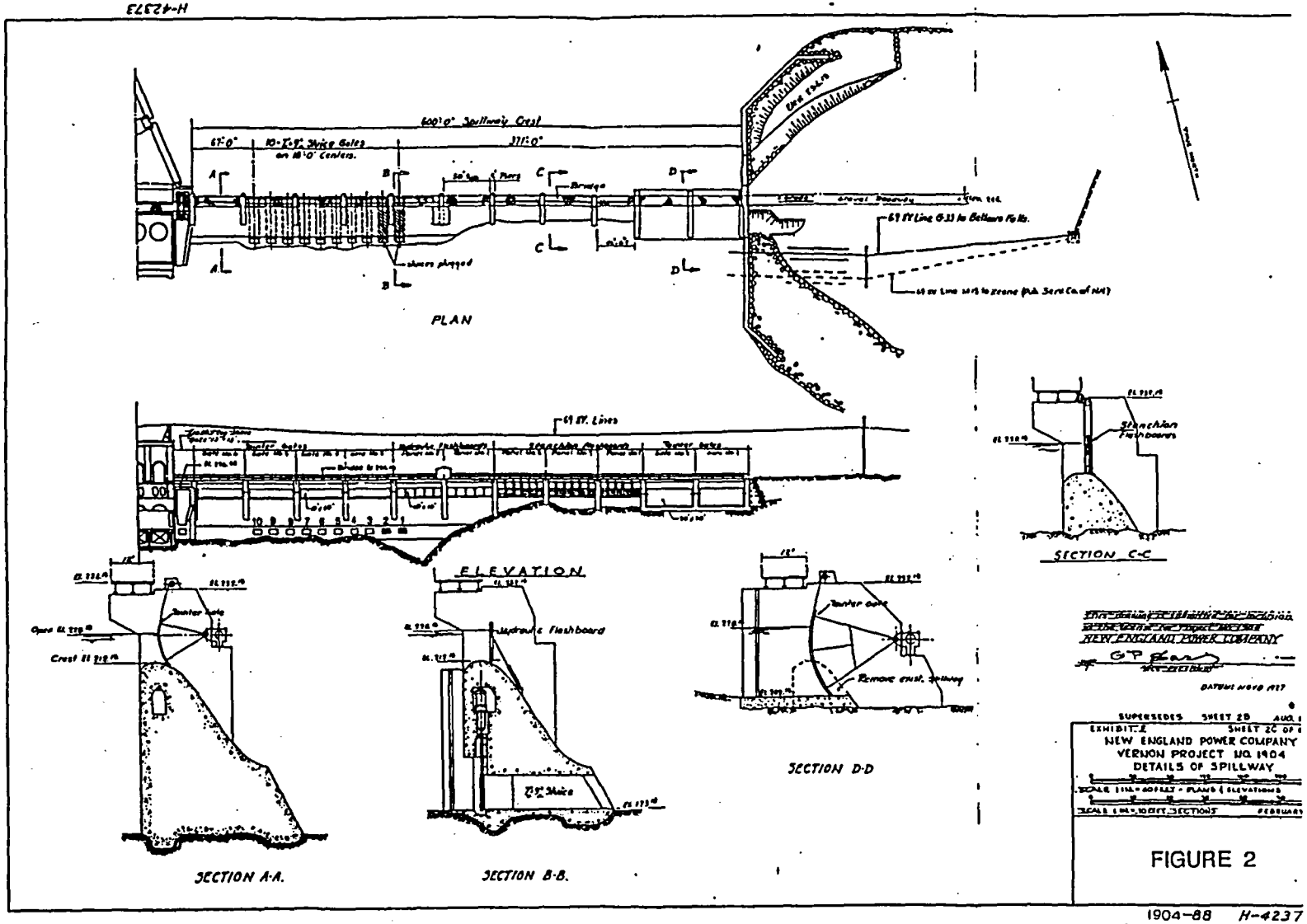

FIGURE 2

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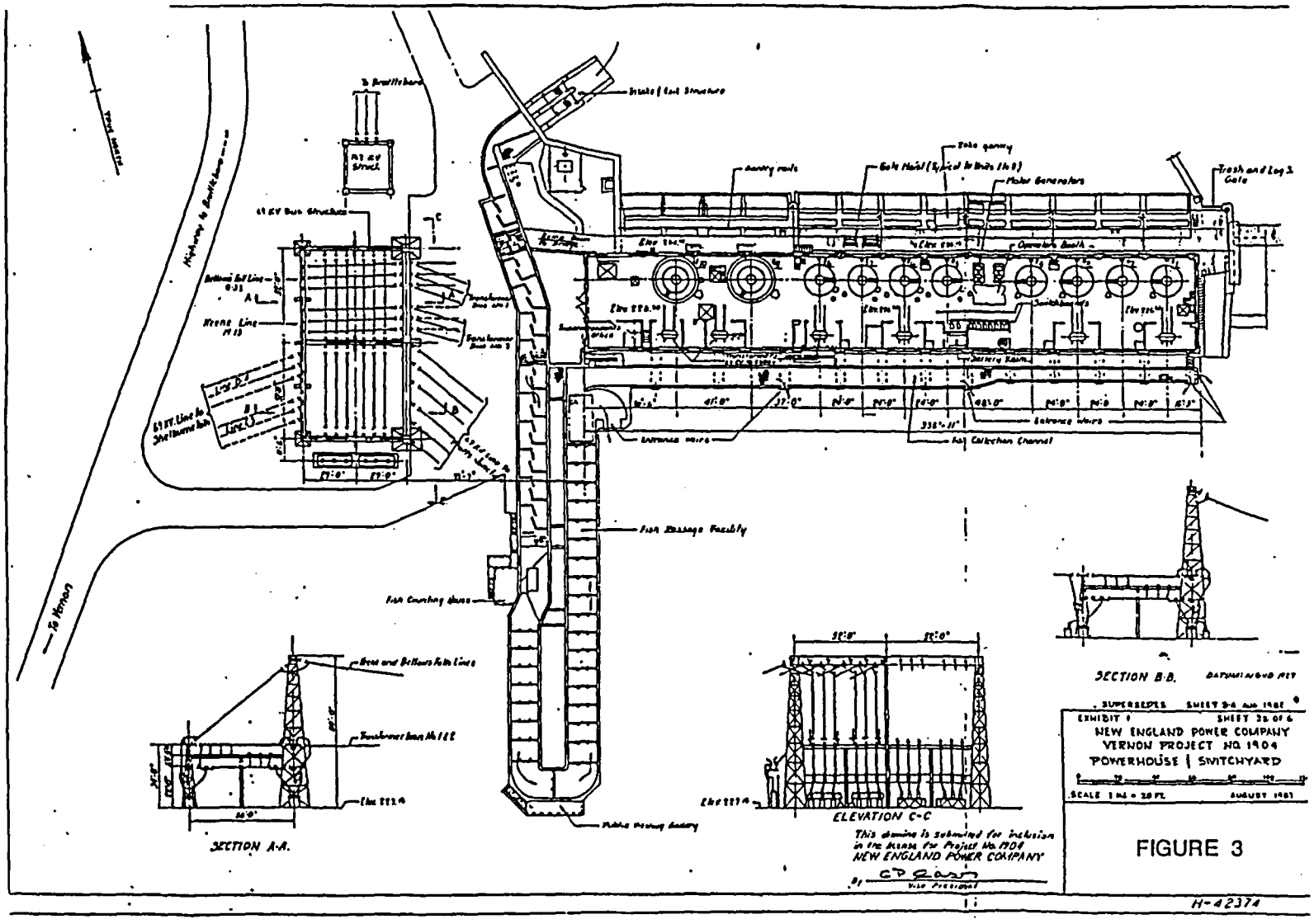
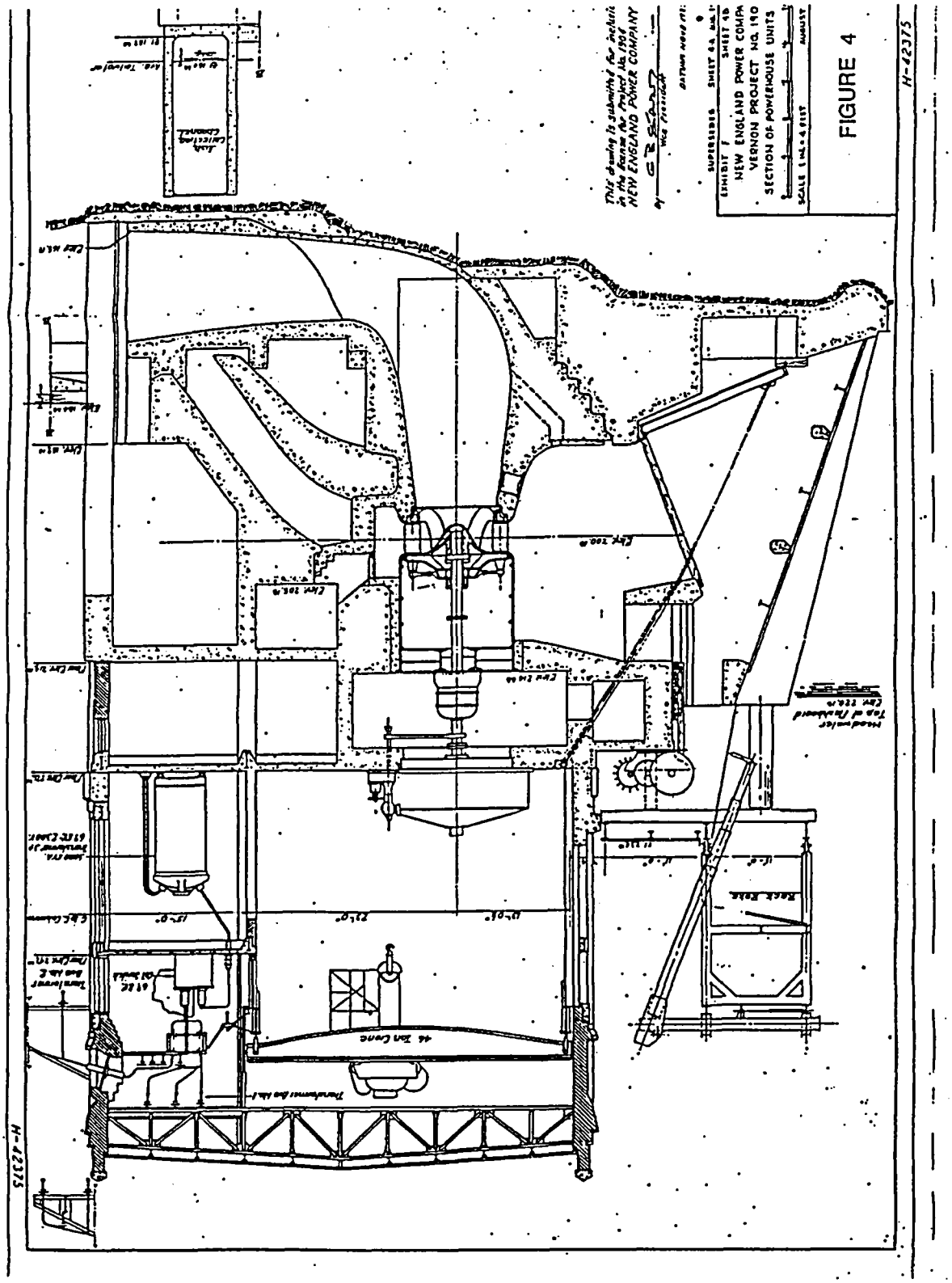


FIGURE 3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NEW ENGLAND POWER COMPANY
by G R Stone
Vice President
DATUM USED ON:
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EXHIBIT I SHEET 4B
NEW ENGLAND POWER COMPA
VERNON PROJECT NO. 190
SECTION OF POWERHOUSE UNITS
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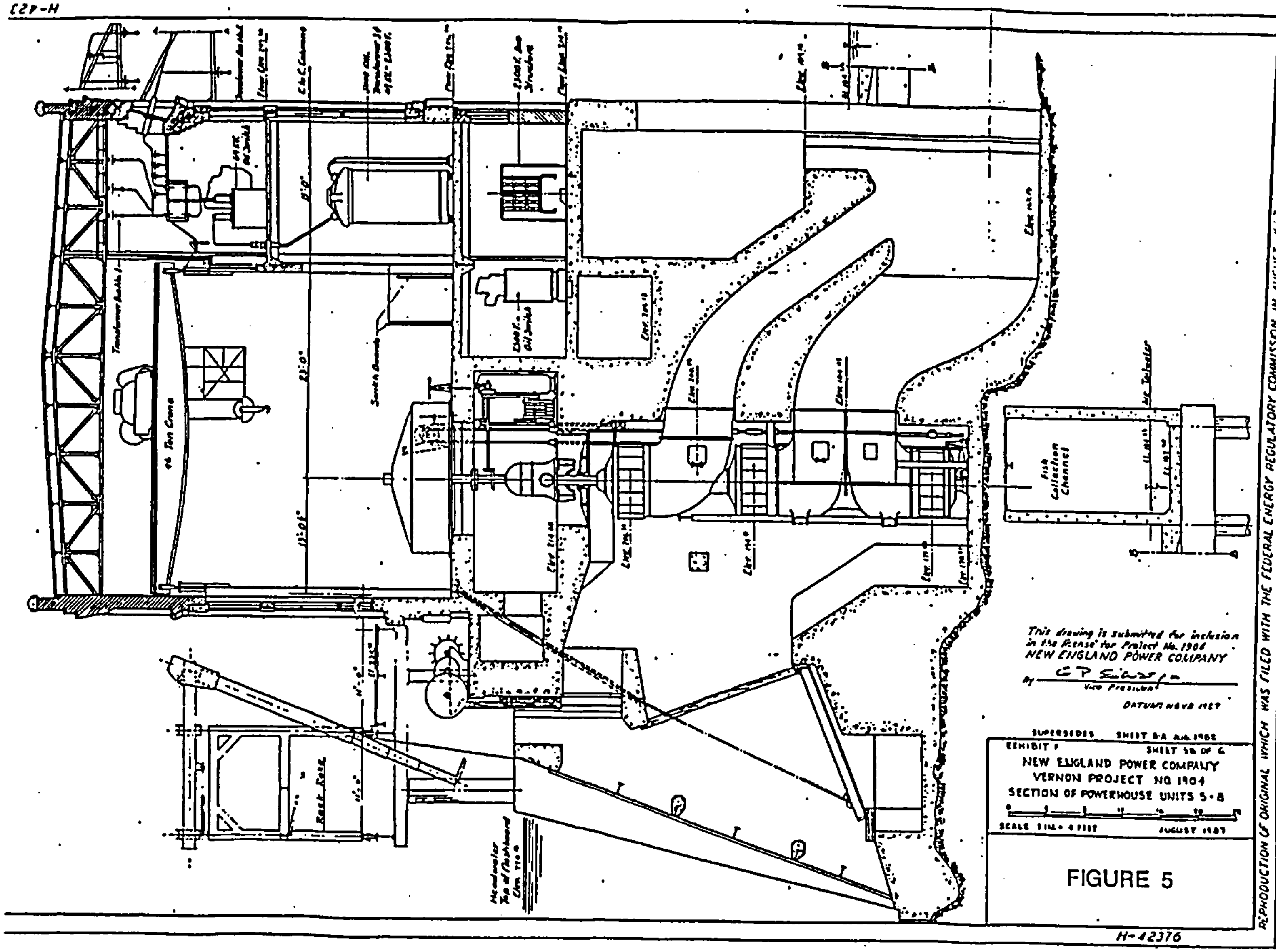
FIGURE 4
H-42375
H-42375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46 Ton Crane
Fish Collection Channel
Rack Rake
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NEW ENGLAND POWER COMPANY
Vice President
EXHIBIT F
NEW ENGLAND POWER COMPANY
VERNON PROJECT NO. 1904
SECTION OF POWERHOUSE UNITS 5-8
H-42376

FIGURE 5

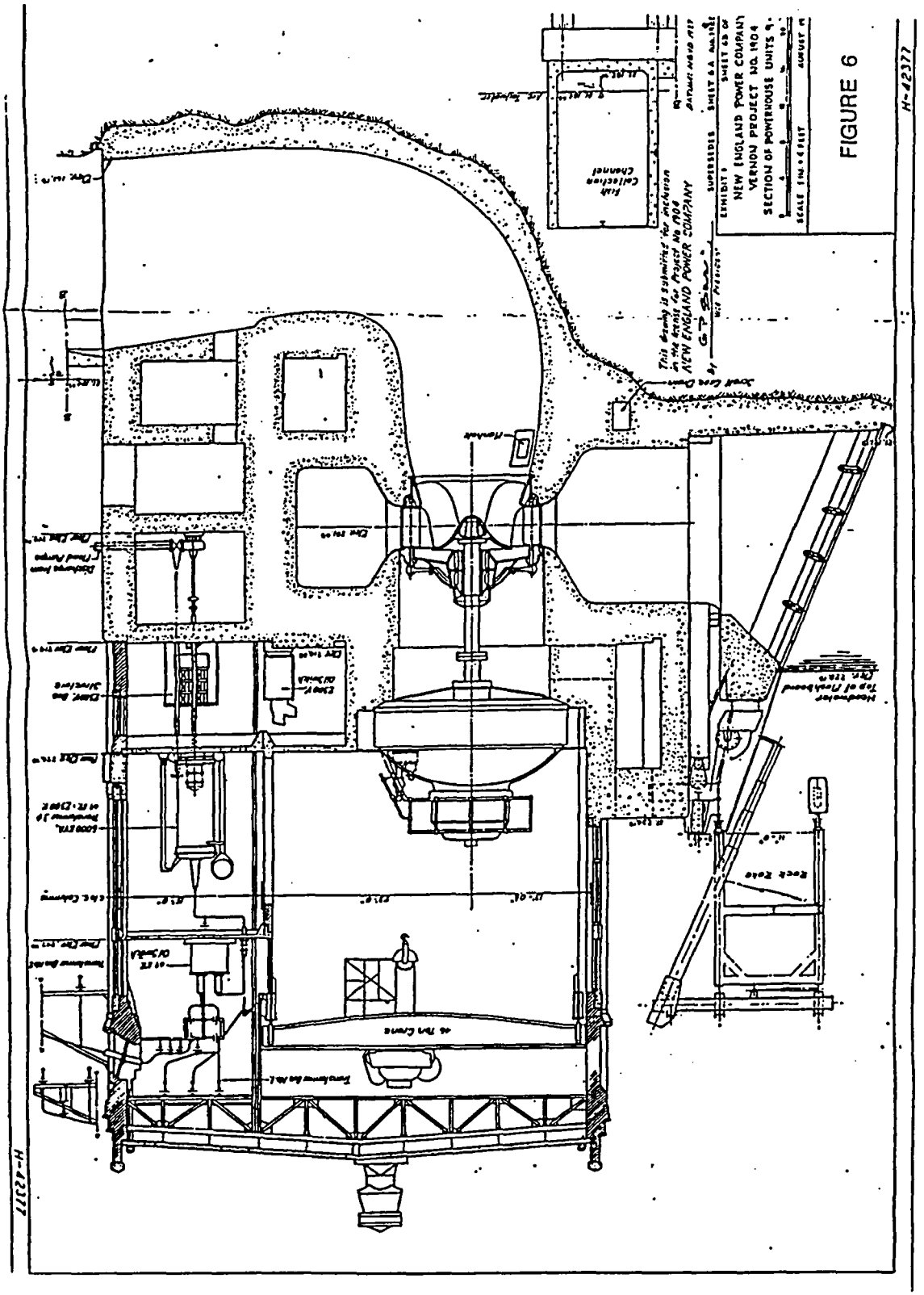


FIGURE 6
NEW ENGLAND POWER COMPANY
VERNON PROJECT NO. 1904
SECTION OF POWERHOUSE UNITS 9-
H-42377

APPENDIX A

Instrumentation

APPENDIX A

LIST OF FIGURES

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VERNON

Location of Monitor GEN. ROOM #1 TRANSF. BAY - S. WALL #5 TOP

Indicate on the diagrams below the "Monitor" movement at each reading:

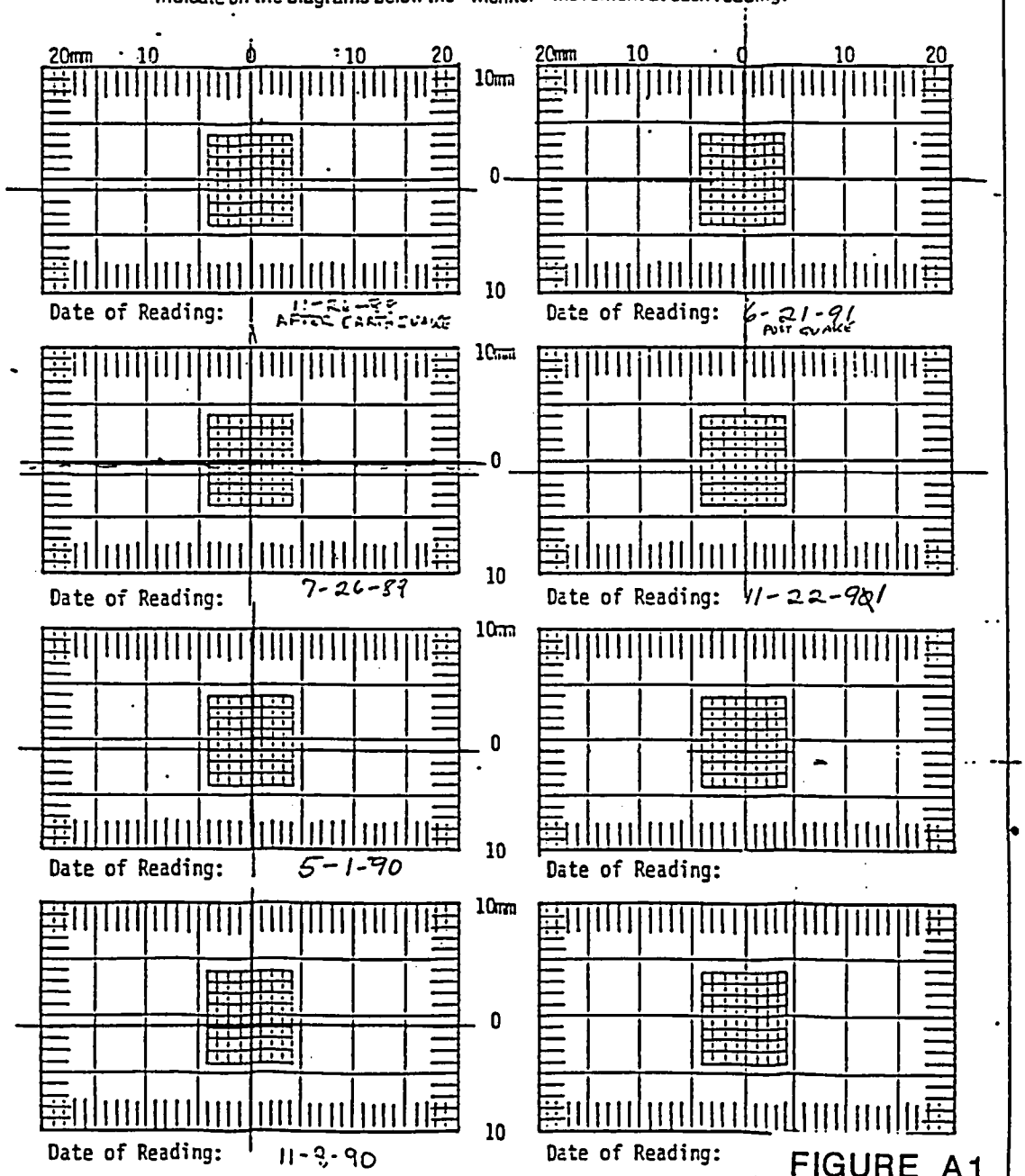


FIGURE A1

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen Room - #1 Trans. Bay - South Wall #5 Top

Indicate on the diagrams below the "Monitor" movement at each reading:

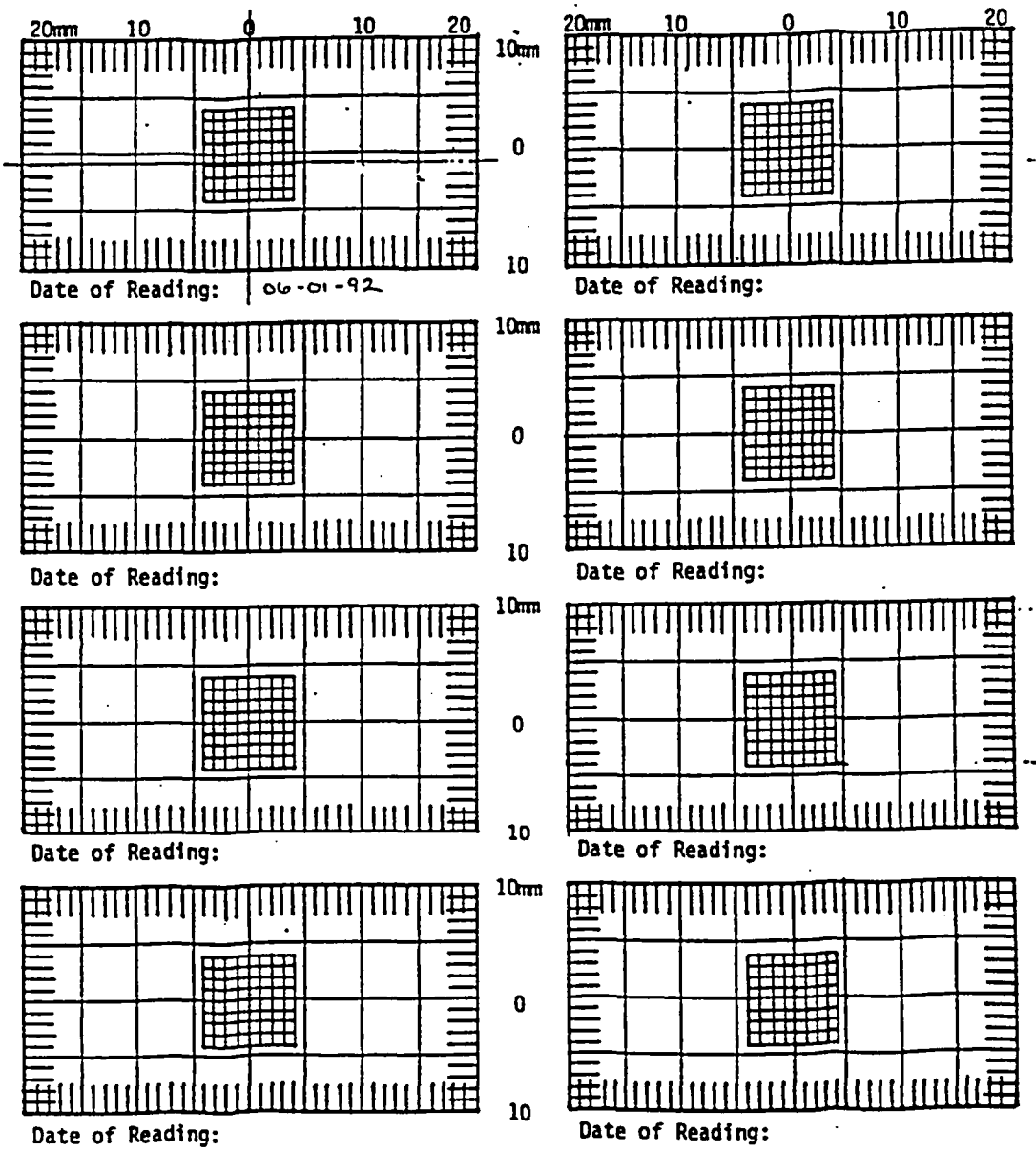


FIGURE A2

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Various

Location of Monitor Gen. Room #1 Transf. Bay - So. Wall #5 BGT.

Indicate on the diagrams below the "Monitor" movement at each reading:

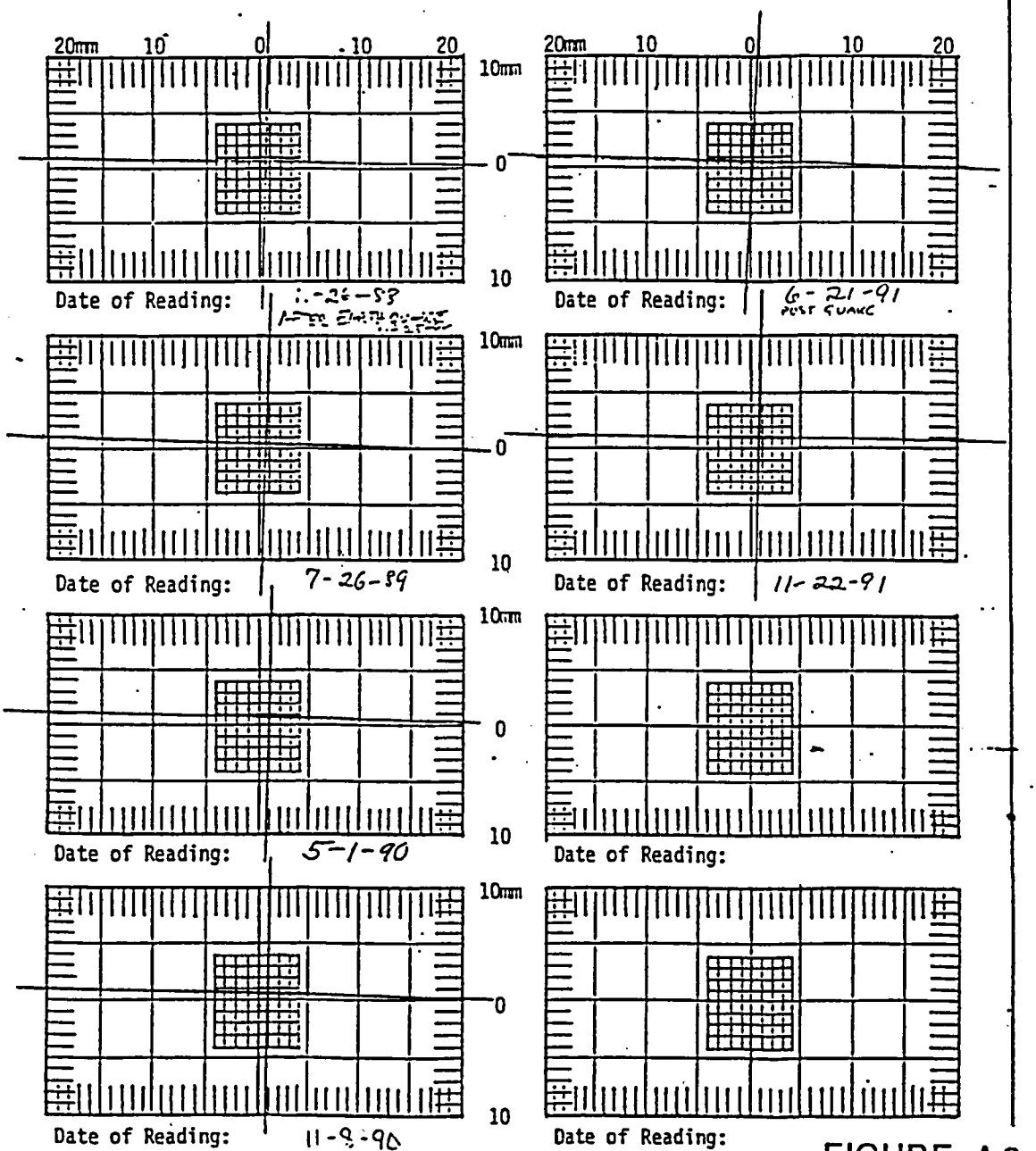


FIGURE A3

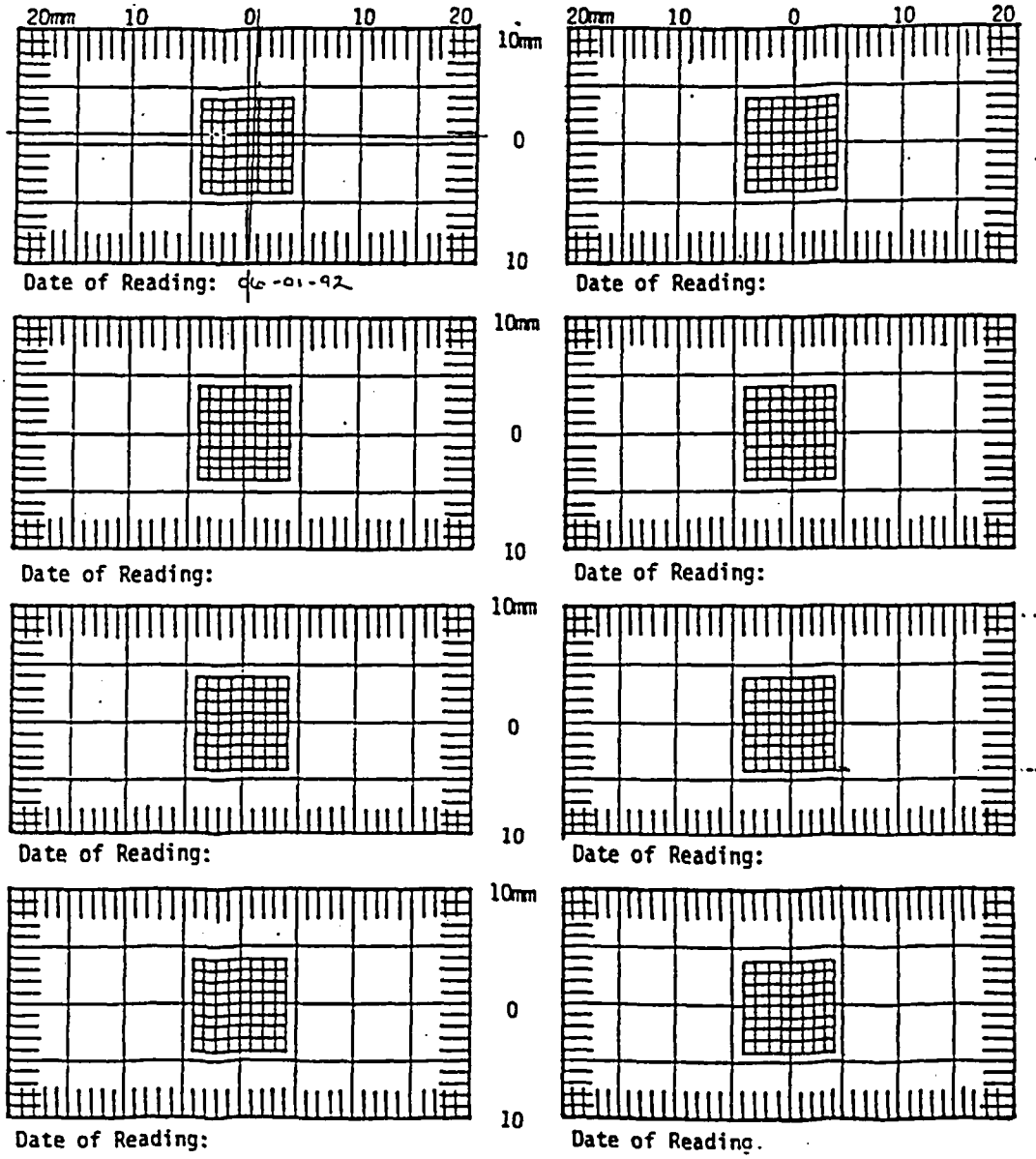
Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen Room - #1 Trans. Bay - South Wall #5 Bottom

Indicate on the diagrams below the "Monitor" movement at each reading:



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Avongard

AVONGARD CALISRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VIENNA

Location of Monitor GEN. RM: EAST WALL-BEHIND WINDOW #6 TCF

Indicate on the diagrams below the "Monitor" movement at each reading:

THIS GAUGE APPEARS TO HAVE BEEN "JARRED" & FORCED DOWN BY EARTHQUAKE

20mm 10 0 10 20 — 10mm 0 10

Date of Reading: 10-25-89 AFTER EARTHQUAKE

Date of Reading: 4-21-91 POST QUAKE

Date of Reading: 7-26-89

Date of Reading: 11-22-91

Date of Reading: 5-1-90

Date of Reading:

Date of Reading: 11-8-90

Date of Reading:

FIGURE A5

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen Room East Wall - Below Window #6 Top

Indicate on the diagrams below the "Monitor" movement at each reading:

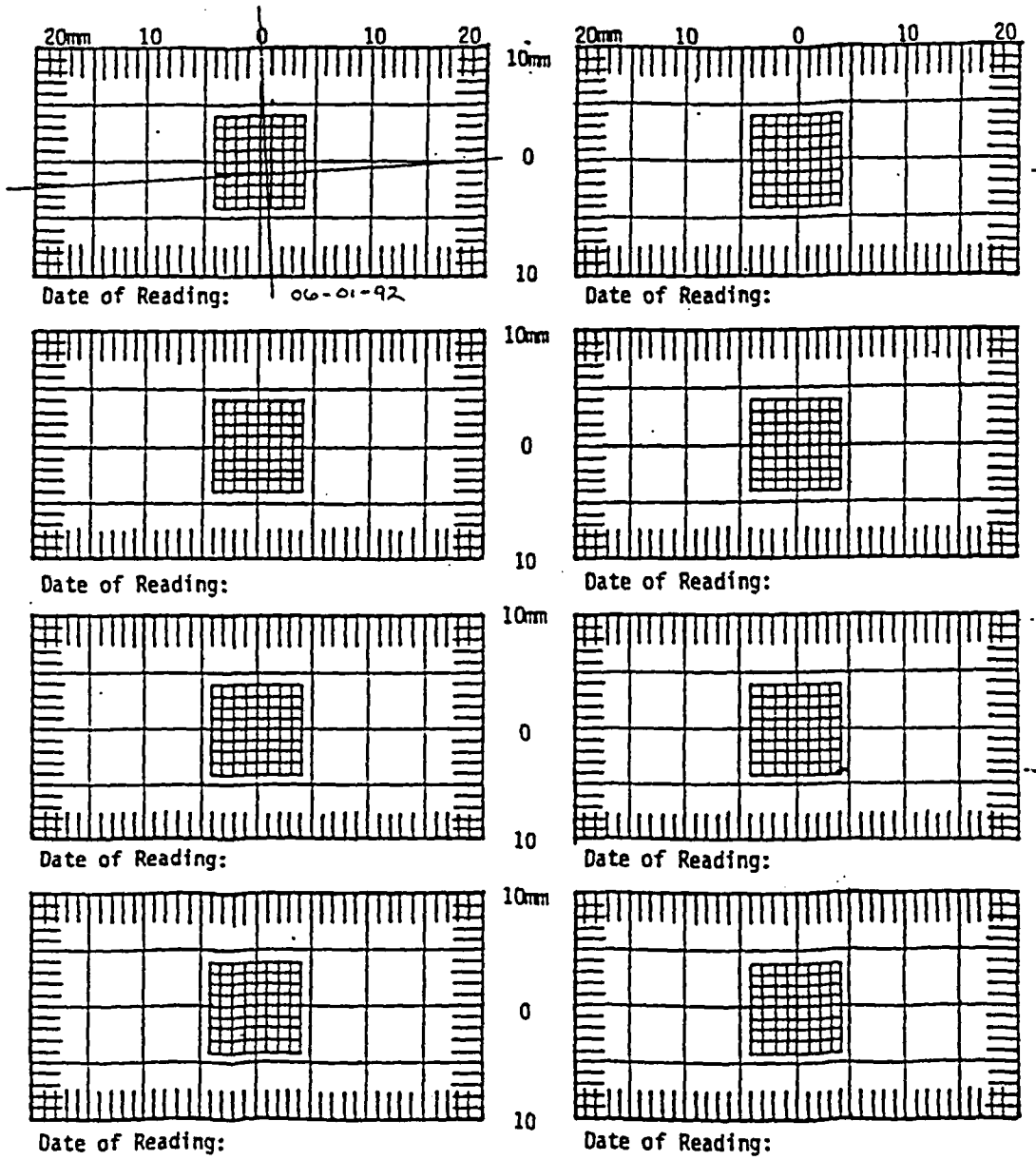


FIGURE A6

Avongard

AVONGARD CALISRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vertical

Location of Monitor Cen. Rim-East Wall-Radial Mon. #6 DCT.

Indicate on the diagrams below the "Monitor" movement at each reading:

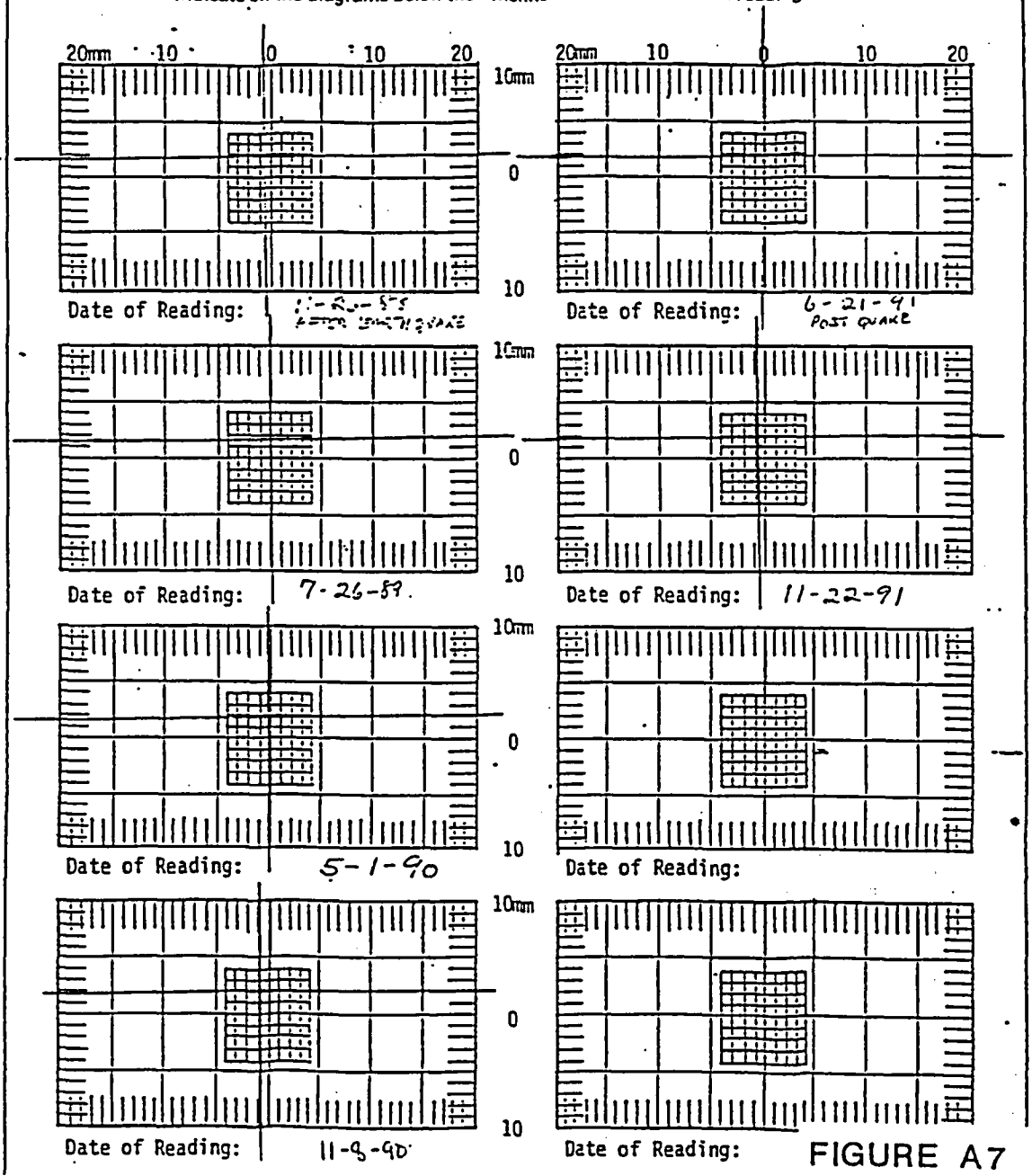


FIGURE A7

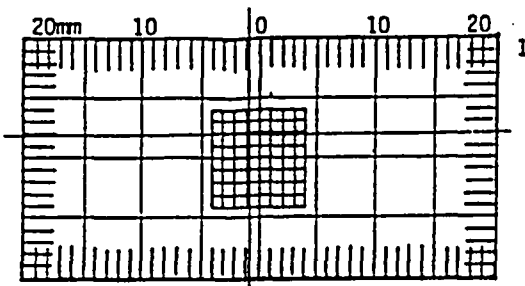
Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

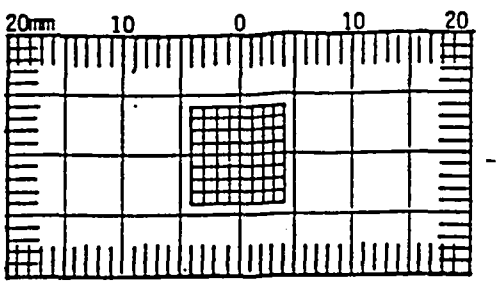
Project: Vernon

Location of Monitor: Gen Room - East Wall Below Window #6 Bottom

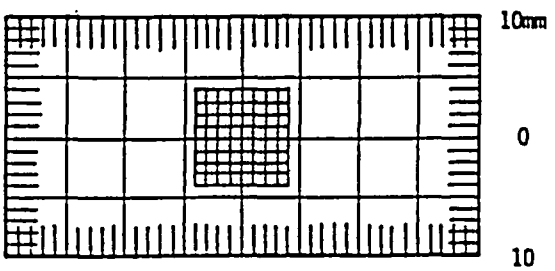
Indicate on the diagrams below the "Monitor" movement at each reading:



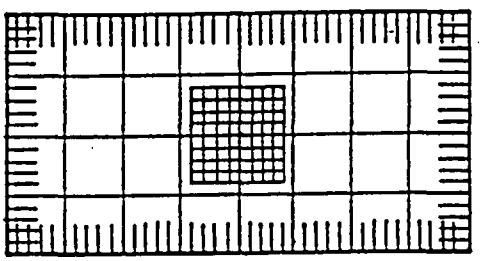
Date of Reading: 06-01-92



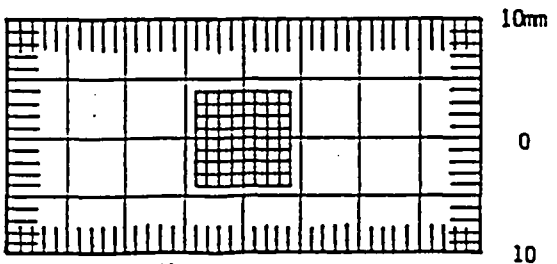
Date of Reading:



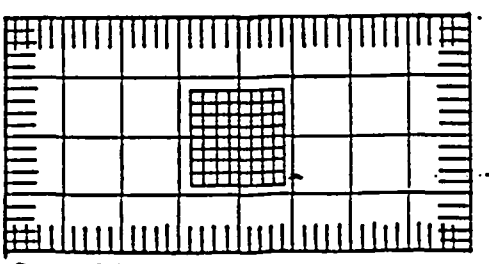
Date of Reading:



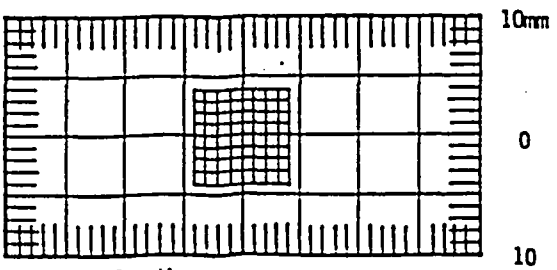
Date of Reading:



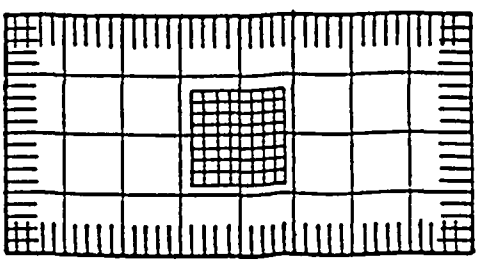
Date of Reading:



Date of Reading:



Date of Reading:



Date of Reading:

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FIGURE A8

Avongard

AVONGARD CALISRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VERMONT

Location of Monitor GEN. RM - NORTH WALL - E/7 TOP

Indicate on the diagrams below the "Monitor" movement at each reading:

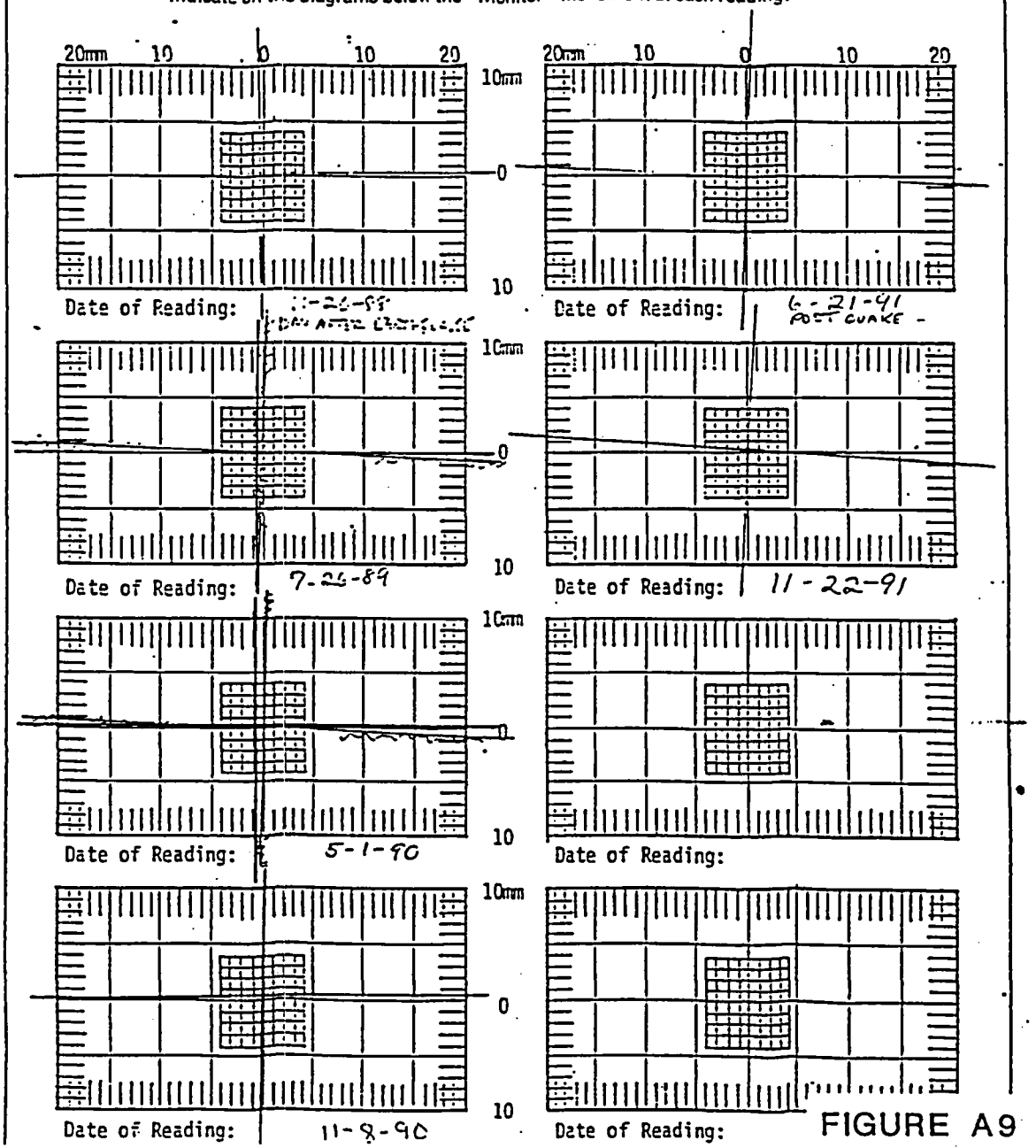

FIGURE A9

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen Room - North Wall - F7 Top

Indicate on the diagrams below the "Monitor" movement at each reading:

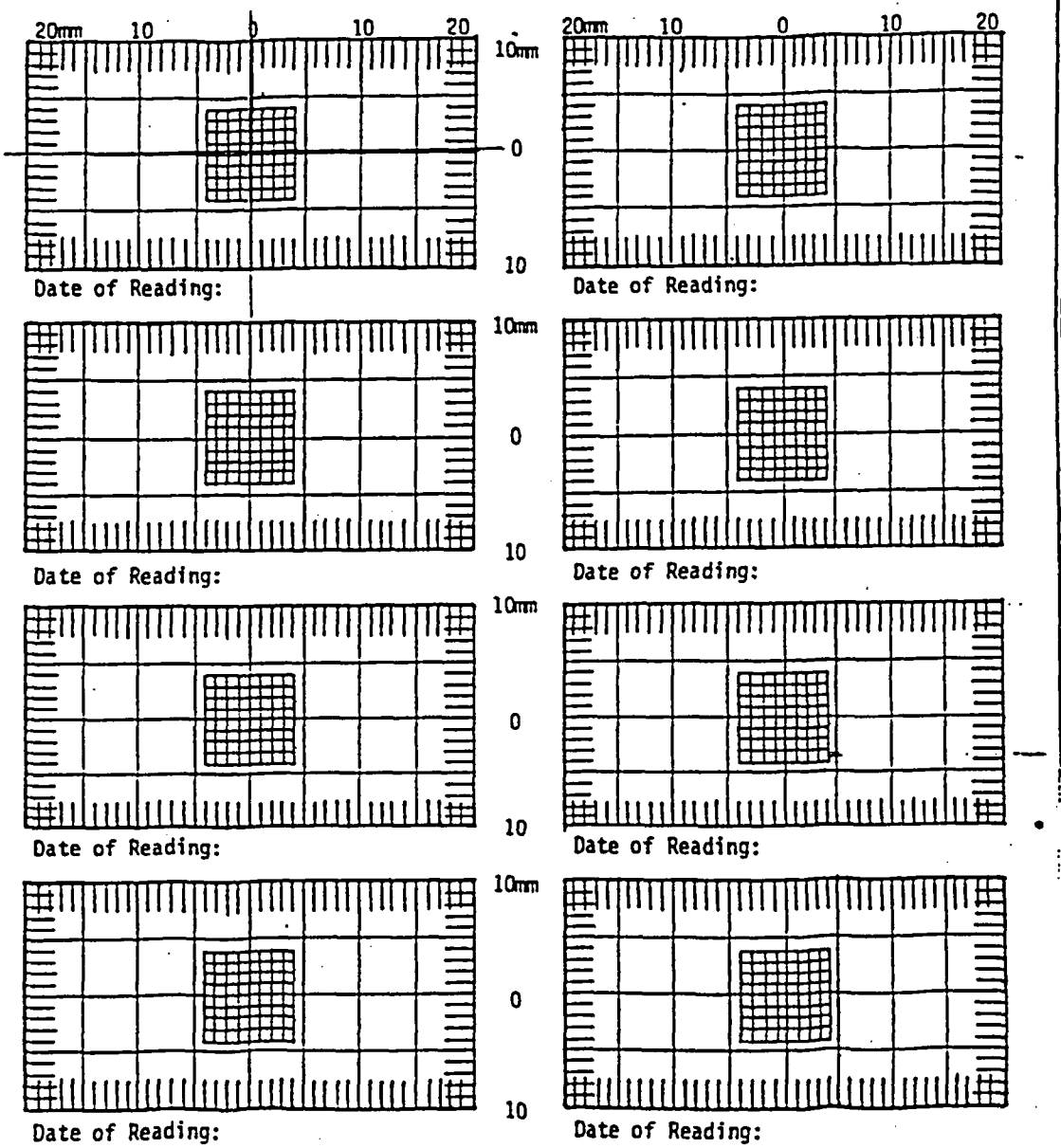

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FIGURE A10

Avongard

AVONGARD CALISRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VERDUN

Location of Monitor GEN. ROOM NORTH WALL - #7 FACT.

Indicate on the diagrams below the "Monitor" movement at each reading:

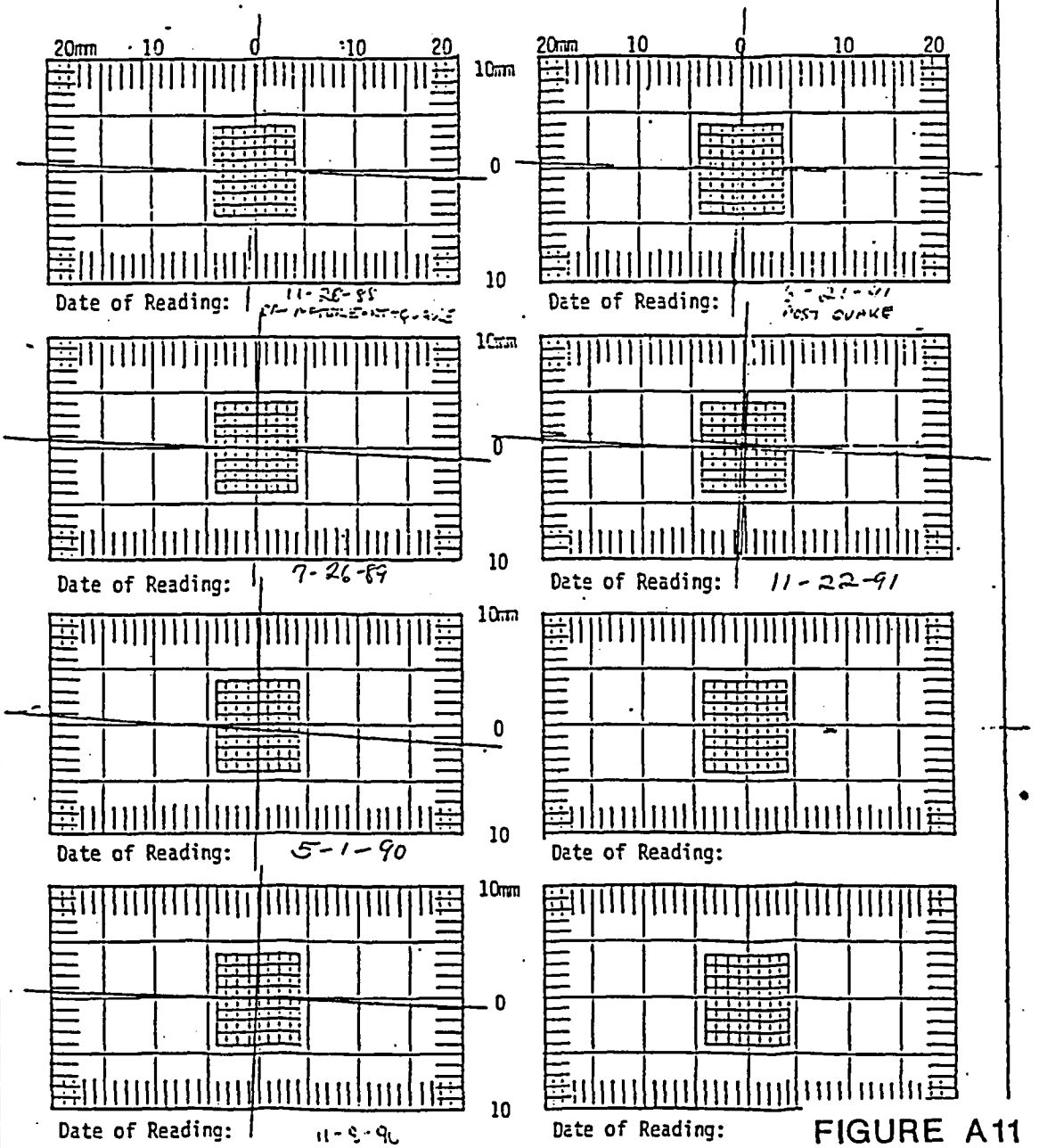

FIGURE A11

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen. Room North Wall - #7 Bottom

Indicate on the diagrams below the "Monitor" movement at each reading:

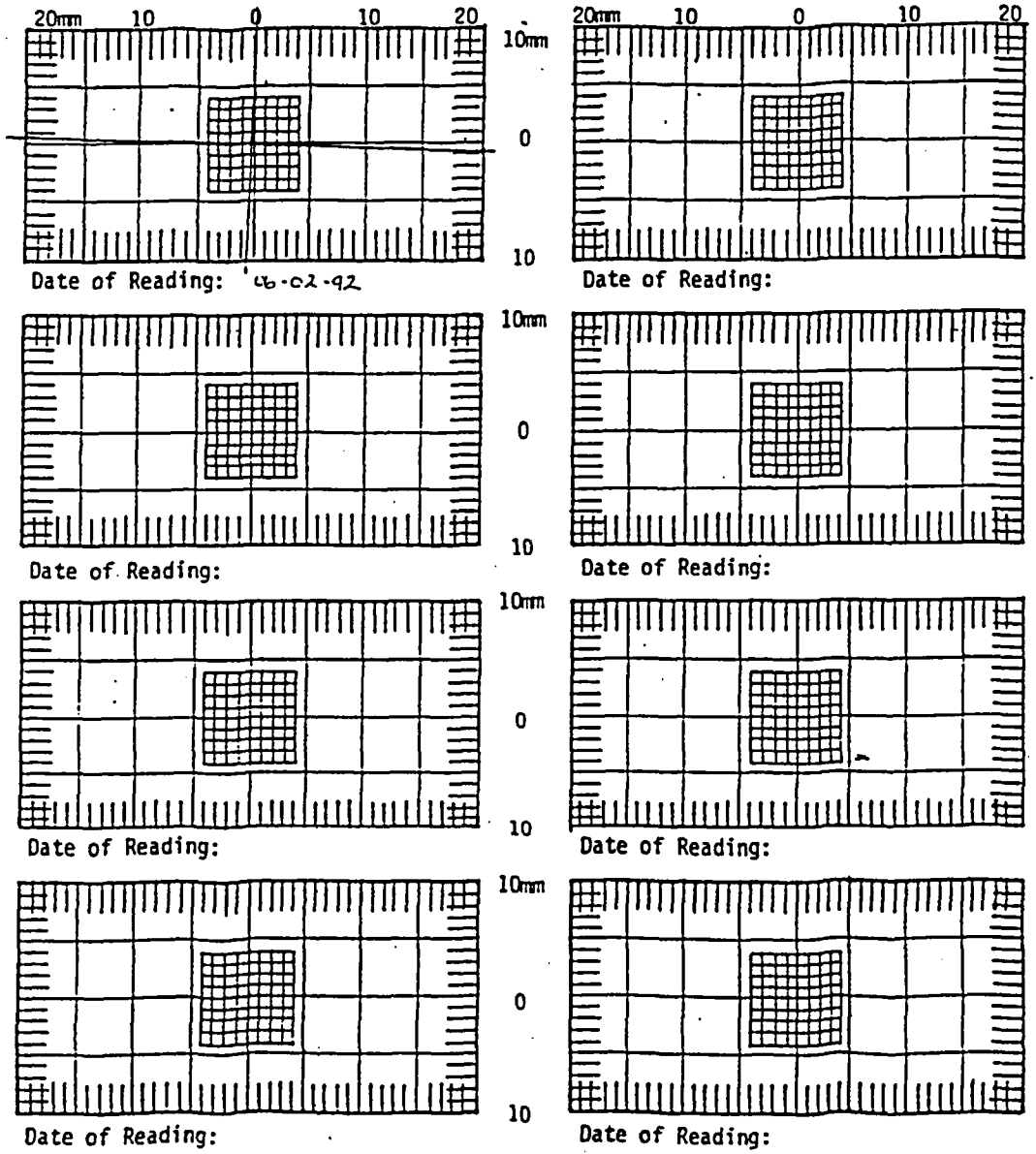

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FIGURE A12

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: __________

Location of Monitor __________ #2

Indicate on the diagrams below the "Monitor" movement at each reading:

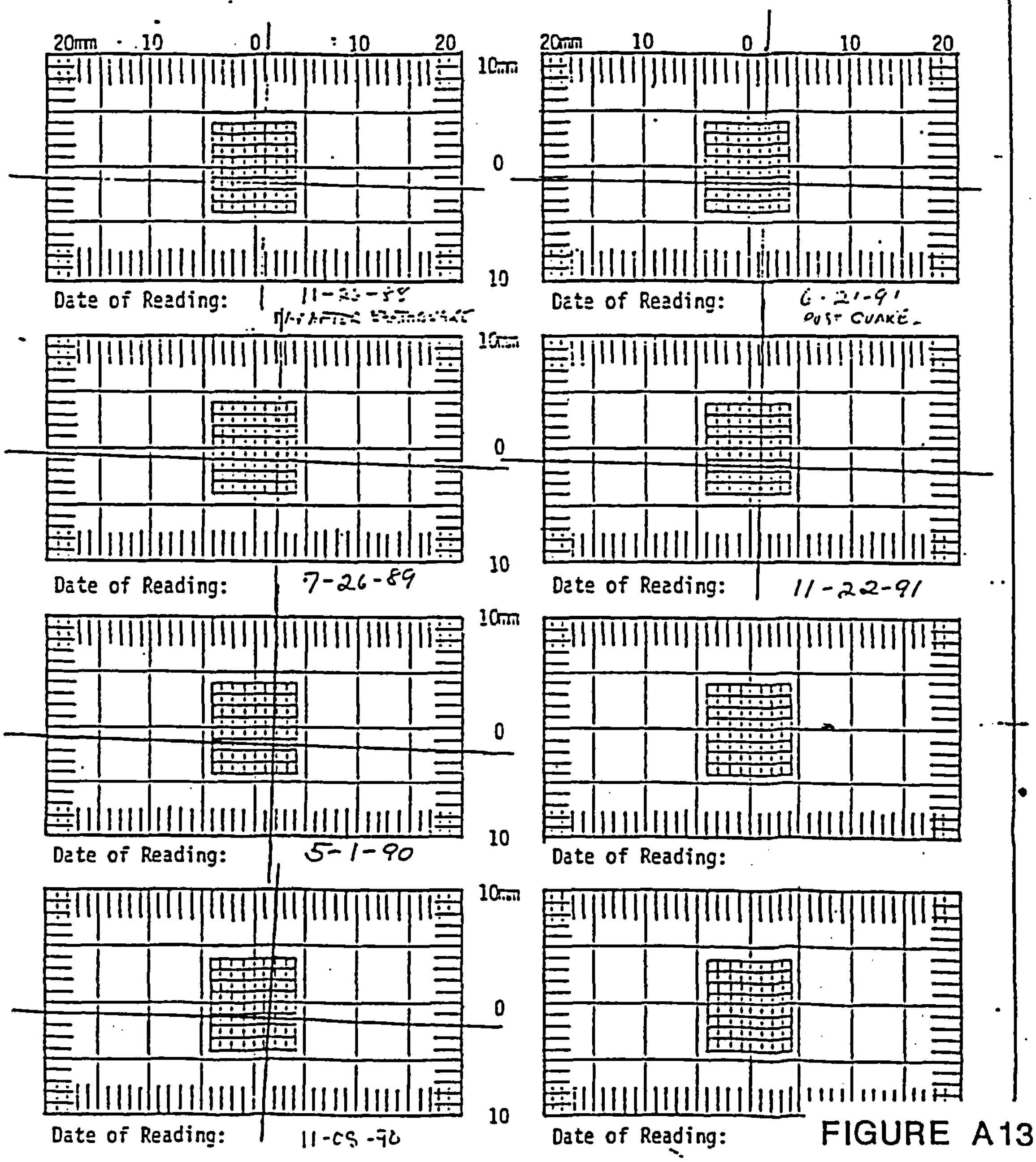


FIGURE A13

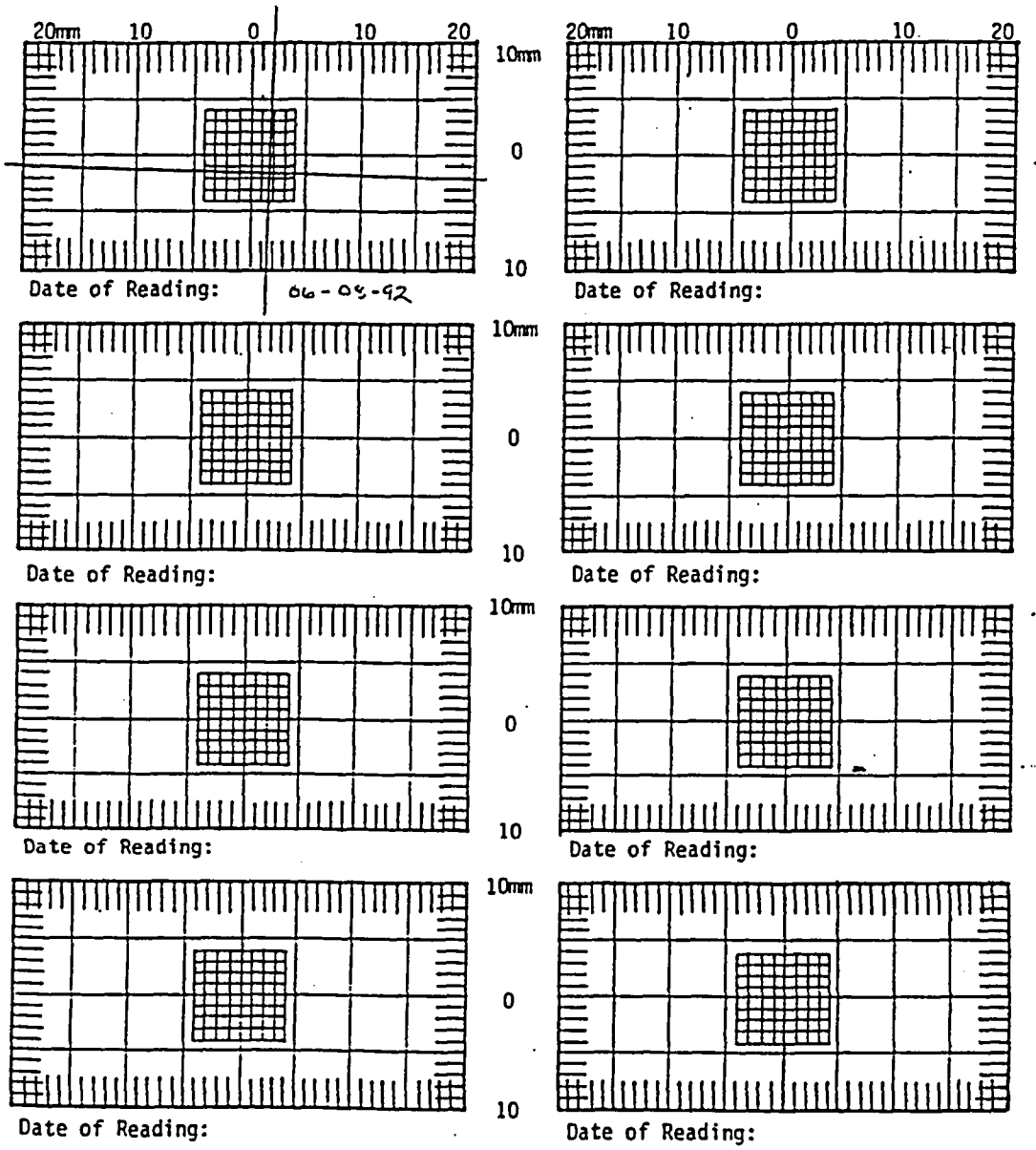
Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor: Split between old & New BLDG. #8 South wall abox Tailrace (outdoors)

Indicate on the diagrams below the "Monitor" movement at each reading:



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Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VERNON

Location of Monitor: FLOOD GATE ALLEY-WALL ACROSS FROM #9 #3 E #4 BUBBLER PIPE FEEDS.

Indicate on the diagrams below the "Monitor" movement at each reading:

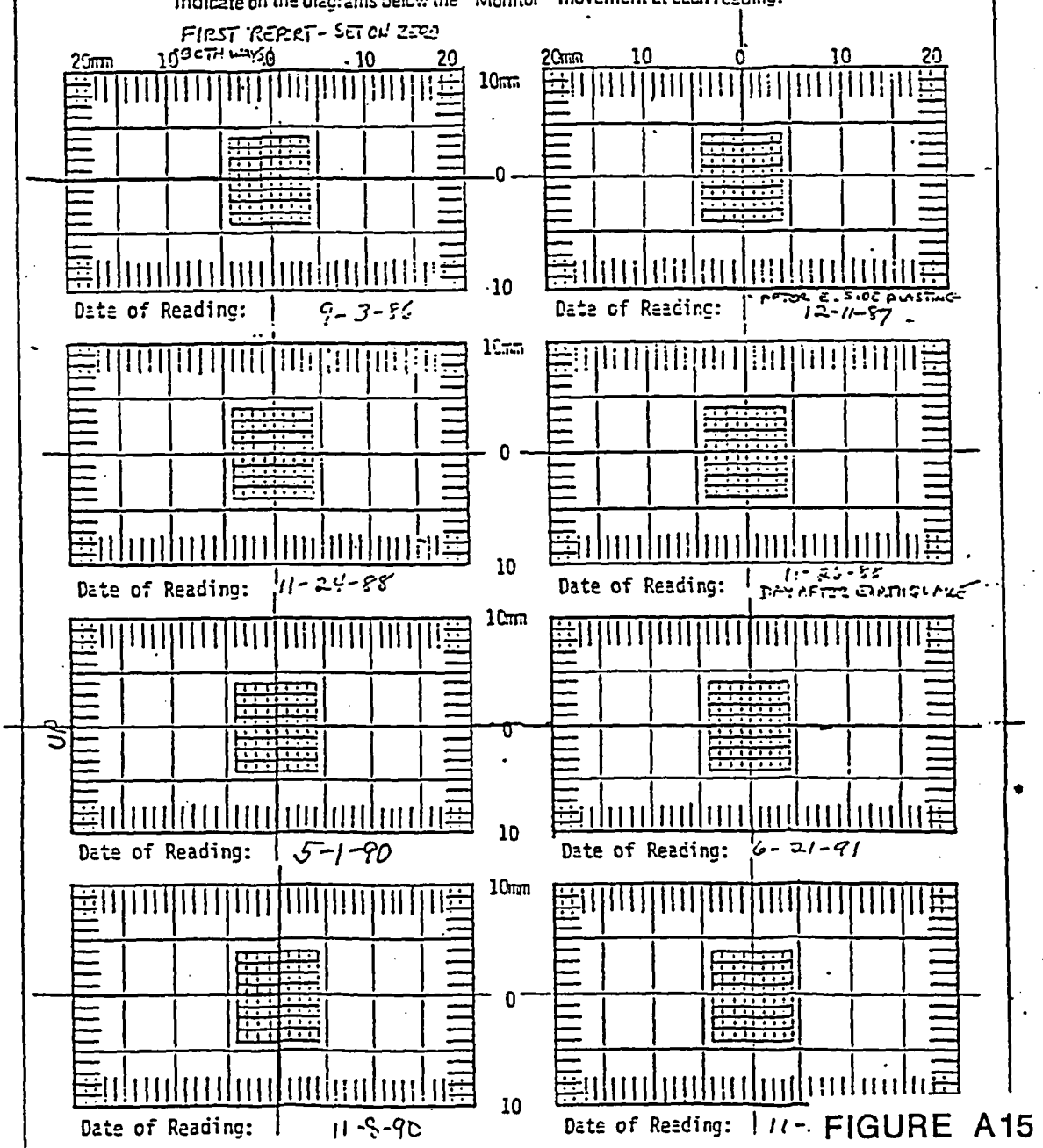


FIGURE A15

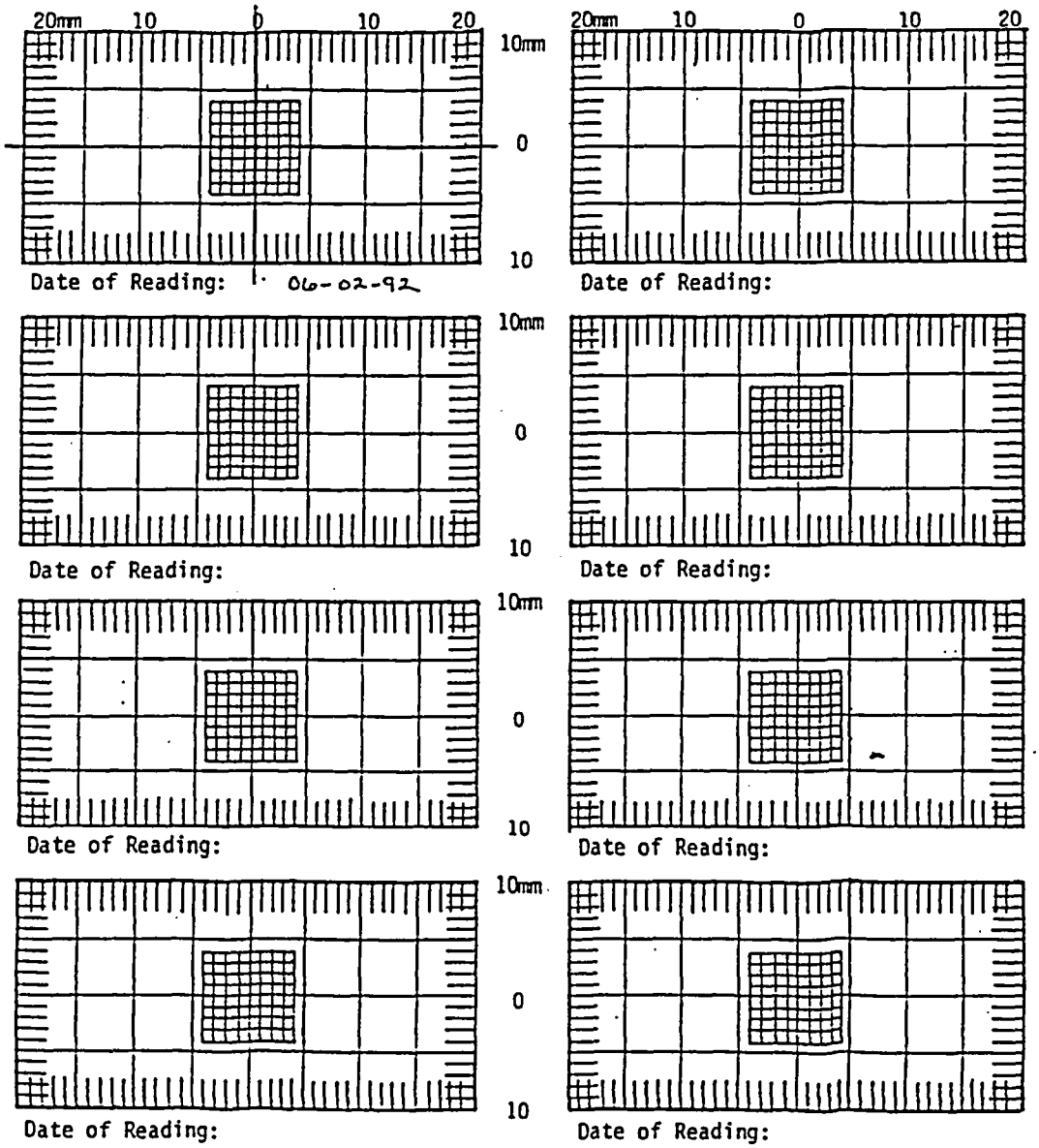
Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor: Flood Gate Alley - Wall across from #9 #3 - #4 bubbler Pipe Feeds

Indicate on the diagrams below the "Monitor" movement at each reading:



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Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: VERNA

Location of Monitor GEN. RICH - OVER STAIRWELL TO SHOP #10

Indicate on the diagrams below: the "Monitor" movement at each reading:

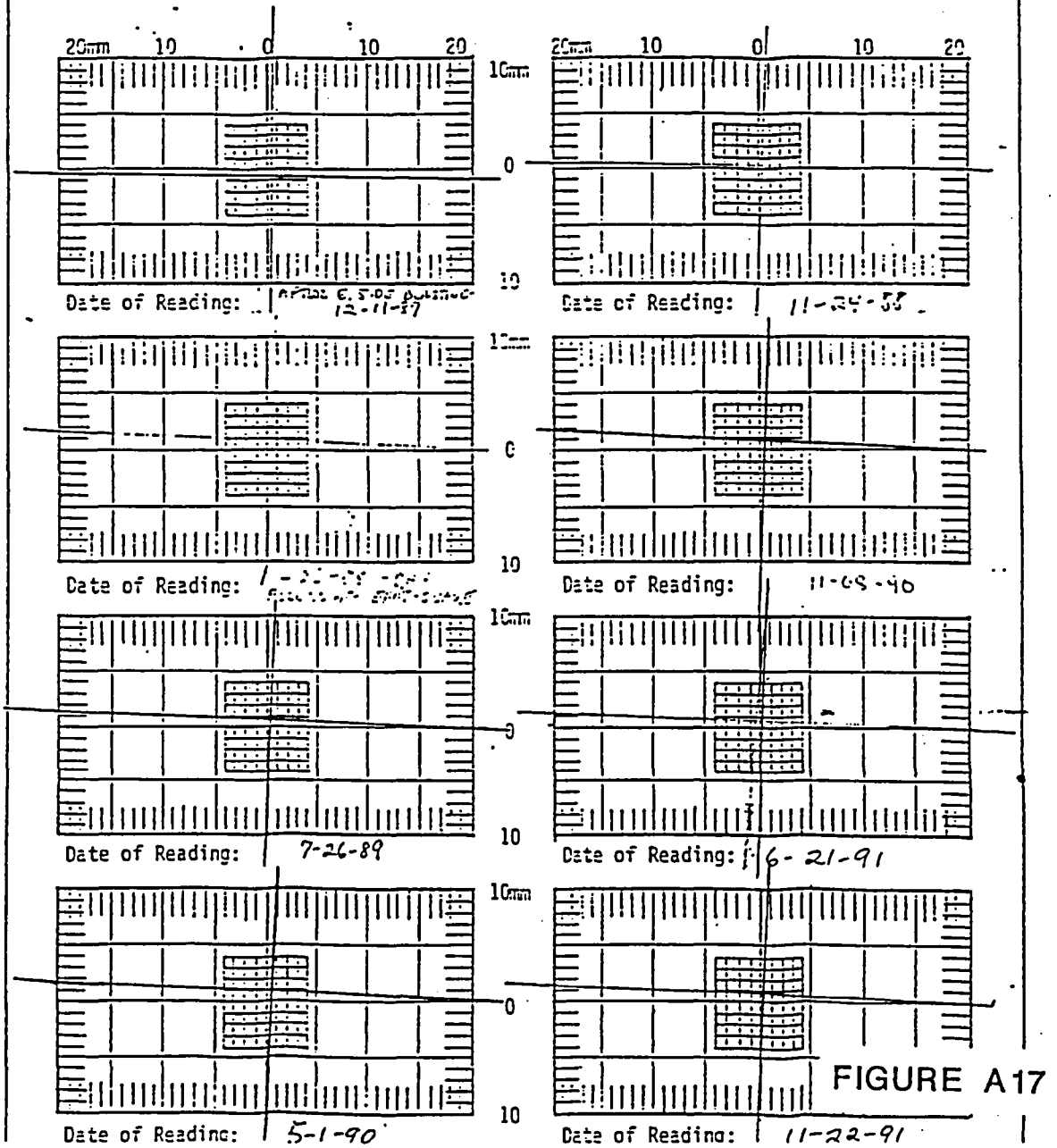


FIGURE A17

Avongard

AVONGARD CALIBRATED CRACK MONITOR CRACK PROGRESS SHEET

Project: Vernon

Location of Monitor Gen. Room - Over Stairwell to Shop #10

Indicate on the diagrams below the "Monitor" movement at each reading:

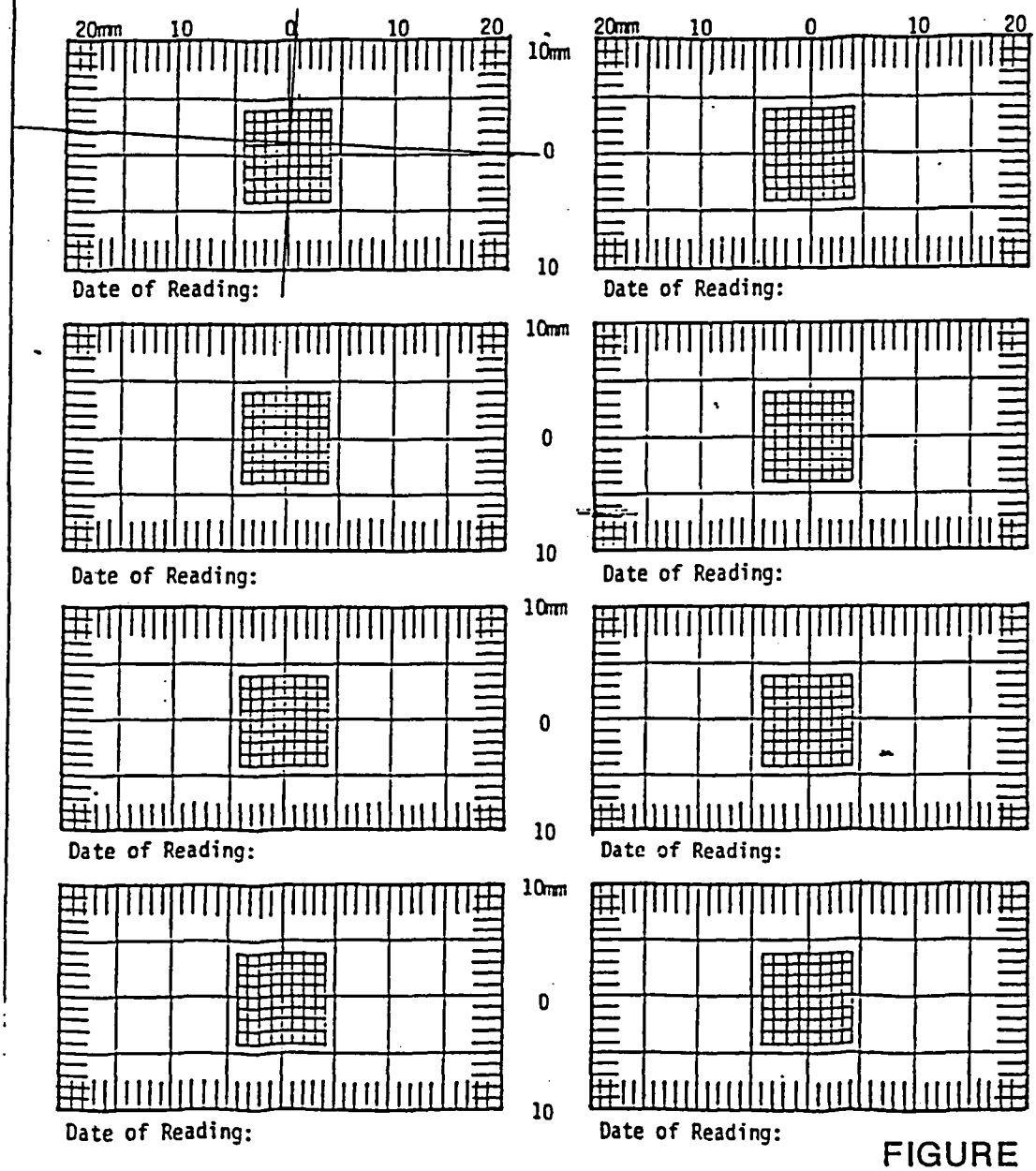


FIGURE A18

MEMORANDUM

To _____ COMPANY OR LOCATION _____ 06-01-92 DATE

From _____ COMPANY OR LOCATION _____ File _____

Subject _____

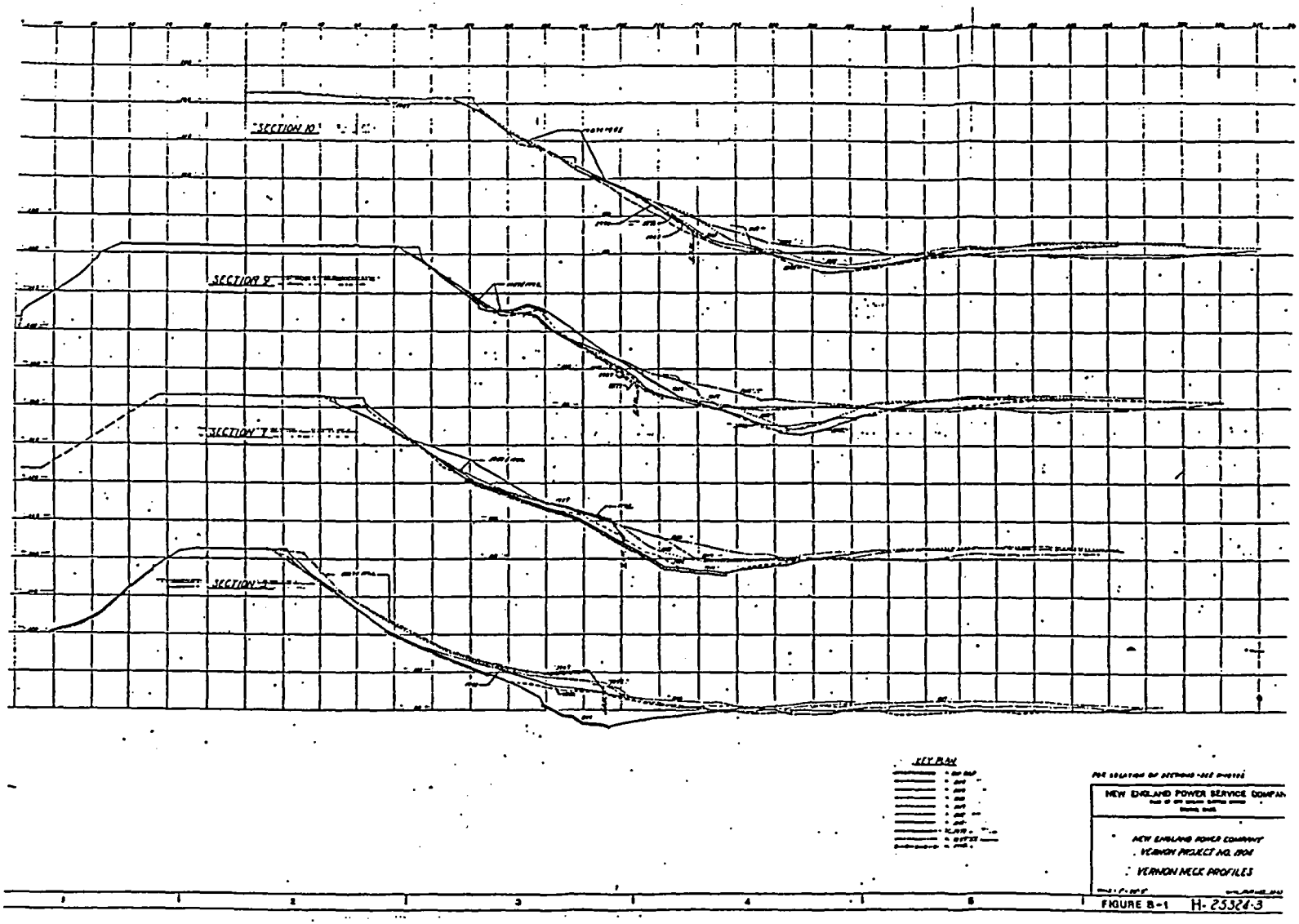
VERNON STATION CRACKS

OCATION	METHOD OF CHECKING	CONDITION FOUND, EXPANSION ON CE
'1 - 189 Gallery Elevation :05.5, East side entrance	Tram	NO CHANGE, EXPANDED TO 0.162 X
:2 - 189 Gallery Elevation .89.0, near #7 discharge in :ailrace.	Tram	~~Expanded to .0242~~ EXPANDED TO 0.095 2
:3 - 205 Gallery on South wall :etween#1 and #2 units	Tram	NO CHANGE, EXPANDED 0.197" 2
:4 - Bus Room South wall between :ld and new buildings (gauge in :ffice closet)	Level & feelers Tram & " mike "	EXPANDED TO 0.092" NEW PLATE 0.125" LOW 2
:5 - Generator room #1 Trans bay Southern wall - East of window	Vanguard Tell-Tale Gauge	2
:6 - Generator Room, East wall :elow window	Vanguard Tell-Tale Gauge	2
:7 - Generator room, North wall :ear East window	Vanguard Tell-Tale Gauge	2
:8 - Split between old and new :uilding, South wall above tail :ace	Vanguard Tell-Tale Gauge	2
#10 - UNDER WINDOW OVER MAIN STAIRWELL TO SHOP INSTALLED: 6/15/57	VANGUARD TELL-TALE GAUGE	27

FIGURE A19

APPENDIX B

Vernon Neck Cross-Section Surveys



APPENDIX C

Inspection Checklist
May 12, 1992

Inventory No. FERC 904

Sheet 1 of 4

VISUAL INSPECTION CHECKLIST

1. Name of Dam: Vernon Project
2. Inventory No.: FERC LP 904
3. Hazard Category: High
4. Size Classification: Large
5. Owner: New England Power Company
   25 Research Drive
   Westborough, MA 01582
6. Date Inspected: May 12, 1992
7. Pool Elevation: 219.6
8. Tailwater Elevation: 185.6
9. Purpose of Dam: Hydropower
10. Weather: Sunny, 60° F

Directions: Mark an "X" in the "YES" or "NO" column.
If item does not apply, write "N/A" in "REMARKS" column.
Use "Other Comments" space to amplify "REMARKS".

ITEM	YES	NO	REMARKS
RESERVOIR			
			Nuclear Power Pla
1. Any Upstream Development?	X		VT Inventory No.: Yankee
2. Any Upstream Impoundments?	X		Ballow Falls Project FERC 1855
3. Shoreline Slide Potential?		X	
4. Significant Sedimentation?		X	
5. Any Trash Boom?	X		Combined Structure
6. Any Ice Boom?	X		
7. Operating Procedure Changes?	X		Stanchion Spillway - 3 bays
			Valve then Pin Flashboard
DOWNSTREAM CHANNEL			
1. CHANNEL			
a. Eroding or Backcutting?	X		Left Abutment. Not a threat
b. Sloughing?	X		See 1.a. to do
c. Obstructions?		X	
d. Bridging?		X	
2. DOWNSTREAM FLOODPLAIN			
a. Occupied Housing?		X	
b. Farming?	X		
c. Recreation Areas?	X		
d. Changed Hazard Potential?		X	
e. New Development?		X	
INSTRUMENTATION			
1. Are there			
a. Piezometers?		X	
b. Weirs?		X	
c. Settlement Pins?		X	
d. Observation Wells?		X	
e. Other? Crack Monitoring Gauges	X		
2. Are readings			
a. Available?	X		
b. Plotted?		X	
c. Taken Periodically?	X		

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Inventory No. FERC No. 1904
Sheet 2 of 4

VERNON PROJECT

ITEM	YES	NO	REMARKS
INTAKES			
1. EQUIPMENT			
a. Trash Racks?	X		
b. Trash Rake?	X		
c. Mechanical Equipment Operable?	X		
d. Intake Gates?	X		
e. Are Racks and Gates Maintained?	X		
f. Are Gate Operators Operable?	X		
2. CONCRETE SURFACES			
a. Any Cracking?		X	
b. Any Deterioration?		X	
c. Erosion?	X		Draft Tube Area at Waterline
d. Exposed Reinforcement?		X	
e. Are Joints Displaced?		X	
f. Are Joints Leaking?		X	
3. CONCRETE CONDUITS			
a. Any Cracking?			Not Accessible
b. Any Deterioration?			" "
c. Erosion?			" "
d. Exposed Reinforcement?			" "
e. Are Joints Displaced?			" "
f. Are Joints Leaking?			" "
4. METAL CONDUITS			Fish Migrant Conduit Only
a. Is Metal Corroded?		X	
b. Is Conduit Cracked?		X	
c. Are Joints Displaced?		X	
d. Are Joints Leaking?		X	
5. METAL APPURTENANCES			
a. Corrosion?		X	
b. Breakage?		X	
c. Secure Anchorages?	X		
6. PENSTOCKS			TYPE MATERIAL:
a. Material Deteriorated?			N/A
b. Joints Leaking?			
c. Supports Adequate?			
d. Anchor Blocks Stable?			
7 Fishladder	X		
9 Powerhouse	X		9 operating Turbine/Generator Unit 8 not Operational

Other Comments:

Inventory No. FERC 1904

Sheet 3 of 4

VERNON PROJECT

ITEM	YES	NO	REMARKS
SPILLWAYS			TYPE: 4 Bays 10'x50' Tainter
			2 Bays 8' Hydraulic Flashboards
			3 Bays 9' Stoplogs
1. CREST			TYPE: 2 Bays 20'x30' Tainter
a. Any Settlements?		X	1 15'x 7' Trash Log Sluice
b. Any Misalignments?		X	
c. Any Cracking?		X	
d. Any Deterioration?		X	Minor at toe of 4 Tainter Gate chute
e. Exposed Reinforcement?		X	
f. Erosion?		X	See 1.d.
g. Silt Deposits Upstream?		X	
2. CONTROL STRUCTURES			TYPE: See NO. Above
a. Mechanical Equipment Operable?	X		
b. Are Gates Maintained?	X		
c. Will Flashboards Trip Automatically?	X		
d. Are Stanchions Trippable?	X		
e. Are Gates Remotely Controlled?	X		Tainter & hydraulic flashboards
3. CHUTE			TYPE:
a. Any Cracking?		X	
b. Any Deterioration?	X		Minor @ Toe of 4 Tainter Gate Chute
c. Erosion?	X		" " " " " "
d. Exposed Reinforcement?		X	
e. Seepage at Lift Lines or Joints?		X	
4. ENERGY DISSIPATORS			TYPE: N/A (Not Applicable)
a. Any Deterioration?			
b. Erosion?			
c. Exposed Reinforcement?			
5. METAL APPURTENANCES			
a. Corrosion?		X	
b. Breakage?		X	
c. Secure Anchorages?	X		
6. EMERGENCY SPILLWAY			TYPE: N/A
a. Adequate Grass Cover?			
b. Clear Approach Channel?			
c. Erodible Downstream Channel?			
d. Erodible Fuse Plug?			
e. Stable Side Slopes?			
7. Inspection Gallery			
a. accessible	X		
b. Seepage	X		along lift joints

Other Comments:

GEOTECHNICAL ENGINEERS INC.
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Inventory No. FERC 1904

Sheet 4 of 4

VERNON PROJECT

ITEM	YES	NO	REMARKS
LOW LEVEL OUTLET			TYPE: 8 - 7'x9' Sluice Gates
			All accessible from Powerhouse
			to Spillway Inspection Gallery
1. GATES			
a. Mechanical Equipment Operable?	X		
b. Are Gates Remotely Controlled?	X		
c. Are Gates Maintained?	X		
2. CONCRETE CONDUITS			
a. Any Cracking?		X	Not Accessible
b. Any Deterioration?		X	↓
c. Erosion?		X	
d. Exposed Reinforcing?		X	
e. Are Joints Displaced?		X	
f. Are Joints Leaking?		X	
3. METAL CONDUITS			
a. Is Metal Corroded?		X	N/A (Not Applicable)
b. Is Conduit Cracked?		X	
c. Are Joints Displaced?		X	↓
d. Are Joints Leaking?		X	
4. ENERGY DISSIPATORS			
a. Any Deterioration?		X	N/A
b. Erosion?		X	
c. Exposed Reinforcement?		X	↓
5. METAL APPURTENANCES			
a. Corrosion?		X	
b. Breakage?		X	
c. Secure Anchorages?	X		

Other Comments:

GEOTECHNICAL ENGINEERS INC.
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APPENDIX D

Inspection Photographs
May 12, 1992

Photo No. 1

Vernon Project

Powerhouse Generator Hall

Photo No. 2

Vernon Project

Concrete Spalling in Tailrace Gallery

Photo No. 3

Vernon Project

El. 189.13 Powerhouse Tailrace Gallery - Note: Migrant Conduit

Photo No. 4

Vernon Project

Operational Trash Sluice Flow Downstream

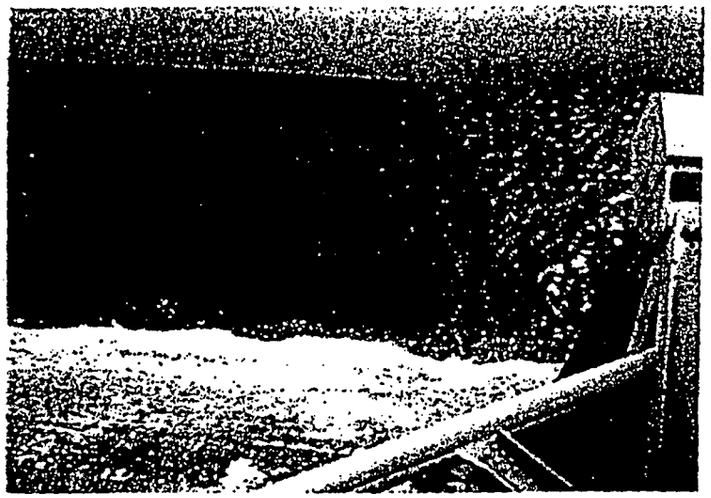


Photo No. 5

Vernon Project

Typical Concrete Erosion at Bottom of Ogee (Nos. 3 to 6)

Photo No. 6

Vernon Project

New Stanchion Stoplog Spillway Bay

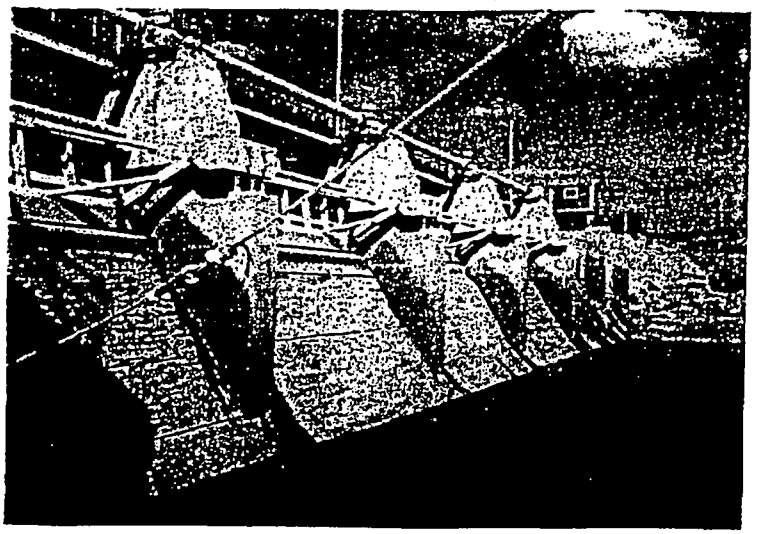


Photo No. 7

Vernon Project

Westerly Tainter
Gate Spillway Bay

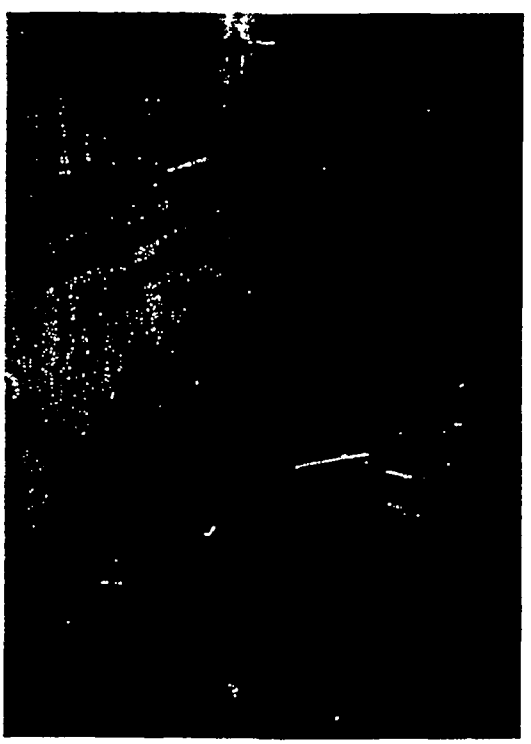


Photo No. 8

Vernon Project

Sluice Gate Operator
in Inspection Gallery
Note: Seepage from
Lift Joint

Photo No. 9

Vernon Project

New Concrete at Left Downstream Spillway Training Wall

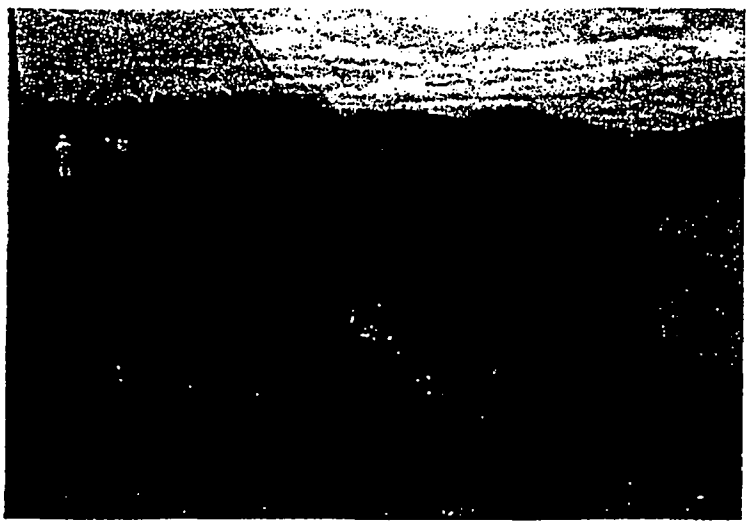


Photo No. 10

Vernon Project

Downstream Slope of "Vernon Neck"

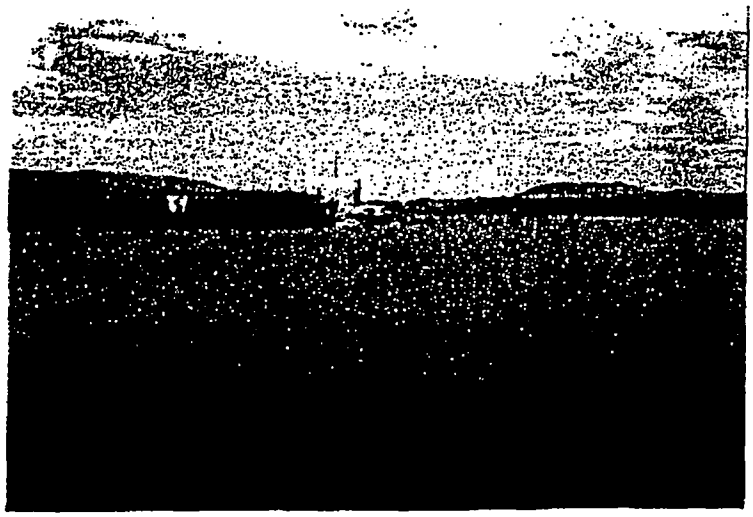


Photo No. 11

Vernon Project

View Upstream of Vermont Yankee Nuclear Power Station

Photo No. 12

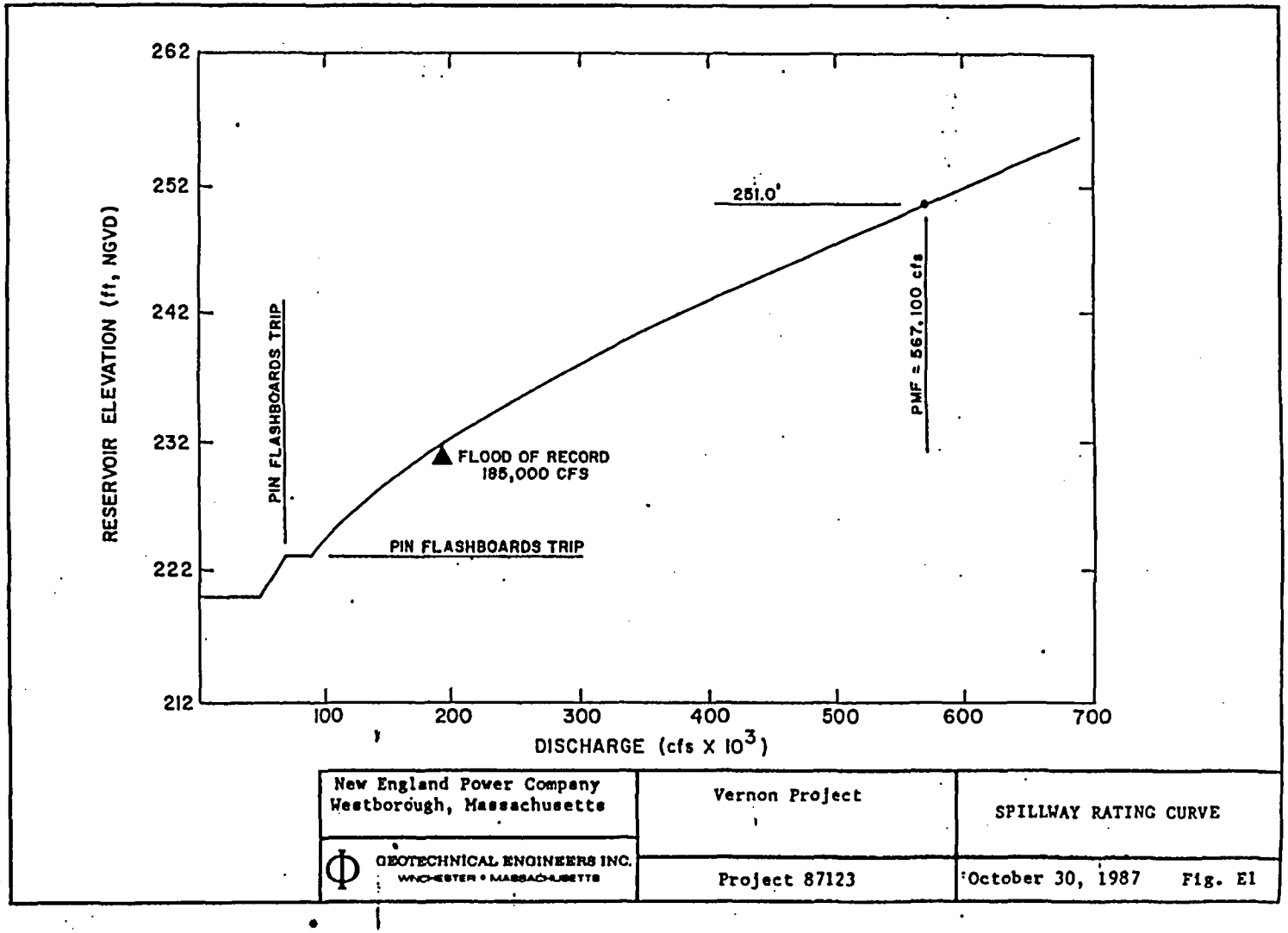
Vernon Project

Spillway Warning Devices and Intake Structure/Forebay

APPENDIX E

Spillway Rating Curve

Source: Chas. T. Main, Inc., "Inspection Report of the New England Power Company Wilder Project," November 1972.



New England Power Company Westborough, Massachusetts	Vernon Project	SPILLWAY RATING CURVE
GEOTECHNICAL ENGINEERS INC. WINCHESTER • MASSACHUSETTS	Project 87123	October 30, 1987 Fig. E1

APPENDIX F

Spillway Gate Operation Report

New England Power

New England Power Company
33 West Lebanon Road
P.O. Box 528
Lebanon, New Hampshire 03766-0528

December 11, 1991

Mr. Anton J. Sidoti
Regional Director
Federal Energy Regulatory Commission
201 Varick Street, Room 664
New York, New York 10014

Re: NEPCo 1991 Spillway Gate Test Reports/Minimum Flows, L.P.'s 1855, 1892, 1904, 2077, 2323, 2669

Dear Mr. Sidoti:

In compliance with FERC Order 122, Section 1244, we submit our annual report on spill gate operation for the year 1991. Attached documentation verifies that each gate has been operated at least once during the preceding 12 month period. Gates that have emergency power available were also operated via emergency power.

In regards to minimum flows at our projects, there have been no instances in the past 12 months where the minimum flow was not maintained through our projects. Records of these flows are part of our daily log records and are available for inspection.

Sincerely,

H. W. Sullivan
Director - Hydro Production

HWS:lw

Enc

APPENDIX G

Stability Summary

Source: Chas T. Main Inc., "Fourth Five-Year Safety Inspection of the New England Power Company Bellows Falls Project, FERC Project No. 1855," November 1982.

Spillway and Revised Earthquake Loading Case
Geotechnical Engineers Inc.
"Fifth Quinquennial Safety Inspection, Vernon Project, FERC Project No. 1904," October 30, 1987.

LIST OF FIGURES

APPENDIX G

STABILITY ANALYSIS

1. Values and Assumptions for Stability Analysis of Concrete Sections

A. Nomenclature:

Effective Length = uncracked portion of base

FH = Summation of Horizontal Forces - kips

FV = Summation of Vertical Forces - kips (including uplift)

M_r = Summation of Resisting Moments - kip-ft

M_o = Summation of Overturning Moments - kip-ft

$\frac{M_r}{M_o}$ = Factor of Safety Against Overturning

$\frac{FH}{FV}$ = Coefficient of Sliding

B. Unit Weight of Concrete: 150 lbs/cu ft

C. Unit Weight of Water: 62.4 lbs/cu ft

D. Uplift Pressure:

The base pressure was assumed to vary linearly from full headwater pressure at the upstream side to full tailwater pressure at the downstream side taken over 100 percent of the base area for each case analyzed.

Uplift on any portion of the base or section not in compression is assumed to be 100 percent of the headwater pressure for any case with no foundation drainage systems.

Due to the transient or short-term nature of earthquake loading, the uplift is not changed from the pre-earthquake condition due to further propagation of a tensile crack.

E. Lateral Water Pressure:

Headwater pressures were computed using the full heights of water to headwater elevations over the projected height of the structures. Tailwater pressures are taken at full tailwater elevation for non-overflow structures. For overflow structures, tailwater back pressures are based on Figs. 14 through 18, Ven T. Chow Open Channel Hydraulics, 1959.

Chas. T. Main, Inc.

F. Ice Load: 5 kips per linear foot at normal water level.

G. Earthquake:

Accelerations of 0.10g were applied in a horizontal direction. To obtain the worst case, the resultant force action on the structure due to earthquake is taken in the downstream direction.

The hydrodynamic force was determined using a method presented in Design of Small Dams, USBR, pages 336-337.

H. Resistance to Sliding:

Where the ratio of FH/FV is greater than 0.65, the shearing resistance of the foundation to horizontal movement must be investigated using the Shear Friction Formula.

The factor of safety against sliding is determined by the Shear Friction Formula as:

$$S_{s-f} = \frac{f\,V + c\,A}{H}$$

where: f = coefficient of the angle of internal friction of foundation material (Tan Φ = 0.65)

V = summation of vertical forces

c = unit shearing strength at zero normal load on foundation material (0.192 ksi)

A = area of potential failure plane (area of base in compression)

H = summation of horizontal forces

Typical values of "f" and "c" were taken from "The Sliding Stability of Dams" by Harold Link in Water Power Magazine, March, April and May 1969.

The following factors of safety are generally required for the calculated stress and shear-friction factor of safety within the structure and at the rock-concrete interface, assuming a planar failure surface.

High or Significant Hazard Potential Dams

Usual Loading Combination	3.0
Unusual Loading Combination	2.0
Extreme Loading Combination	1.0

Low Hazard Potential Dams

Usual Loading Combination	2.0
Unusual Loading Combination	1.25
Extreme Loading Combination	1.0

Loading Conditions to be Investigated

a) Usual Loading Combination: Normal Operating Condition
b) Unusual Loading Combination: Flood Discharge Condition
c) Extreme Loading Combination: Normal Operating Condition with earthquake

The applied loads should include the appropriate concrete, water, earth, silt, ice, earthquake, and uplift forces applicable to the loading conditions being investigated.

I. Bearing Pressure:

Maximum bearing stress = 20 tsf on bedrock (278 psi)

J. Factor of Safety Against Overturning:

The minimum factor of safety against overturning is 1.0.

K. Strength of Vertical Connections:

For structures connected to adjacent structures via keyways, the maximum shear strength used across the key = 250 psi.

2. Cases Used in Stability Analysis

CASE I	Normal Operating Water Levels			
	H.W.L.	=	218.0	(123.9)
	T.W.L.	=	184.8	(90.7)
CASE II	Normal Operating Water Level with Earthquake			
	H.W.L.	=	218.0	(123.9)
	T.W.L.	=	184.8	(90.7)
CASE III	Normal Operating Water Level with Ice			
	H.W.L.	=	212.1	(118.0)
	T.W.L.	=	184.8	(90.7)
CASE IV	Normal Flood Conditions (3' over flashboards and prior to flashboard collapse)			
	H.W.L.	=	223.1	(129.0)
	T.W.L.	=	185.1	(91.0)
CASE V	Flood of Record Q = 185,000 cfs			
	H.W.L.	=	231.4	(137.3)
	T.W.L.	=	222.9	(128.8)
CASE VI	Probable Maximum Flood Q = 567,100 cfs			
	H.W.L.	=	251.0	(156.9)
	T.W.L.	=	247.0	(152.9)

STABILITY SUMMARY

CONDITION	BASE TOT LEN.	BASE CR. LEN	BASE EFF LEN	Σ H (kips)	Σ V (kips)	Σ H / Σ V	S s.f	RESULTANT FROM DOWNSTREAM	Σ Mo (k-ft)	Σ Mo (k-ft)	Σ Mo / Σ Vo	BASE STRESS (psi) UPSTREAM	BASE STRESS (psi) DOWNSTREAM
CASE I	87.5	--	87.5	2657	13853	0.19	25.53	39.0	590,493	50,295	11.74	30.88	60.74
~~CASE II~~	~~87.5~~	~~--~~	~~87.5~~	~~2885~~	~~13853~~	~~0.22~~	~~22.65~~	~~38.25~~	~~590,493~~	~~60,566~~	~~9.75~~	~~28.55~~	~~63.07~~
CASE III	87.5	--	87.5	2777	13853	0.20	24.43	38.52	590,493	56,879	10.38	29.38	62.24
CASE IV	87.5	--	87.5	2763	14496	0.19	24.73	39.71	631,198	55,629	11.35	34.65	61.20
CASE V	87.5	--	87.5	516	9933	0.05	125.77	41.03.	421,074	8,591	49.02	27.84	33.85
CASE VI	87.5	--	87.5	96	1828	0.05	607.10	44.12	688,679	608,022	1.13	6.20	5.89

*Tensile crack propagates through full length of base. Loadings, stresses and functions thereof are based on uncracked section.

Powerhouse Unit 5

NEW ENGLAND POWER COMPANY
WESTBOROUGH, MASSACHUSETTS

VERMONT PROJECT L.P. 1984

STABILITY SUMMARY

MAIN

DATE NOVEMBER 190

12 70 - 097 - 1V

Fig. G

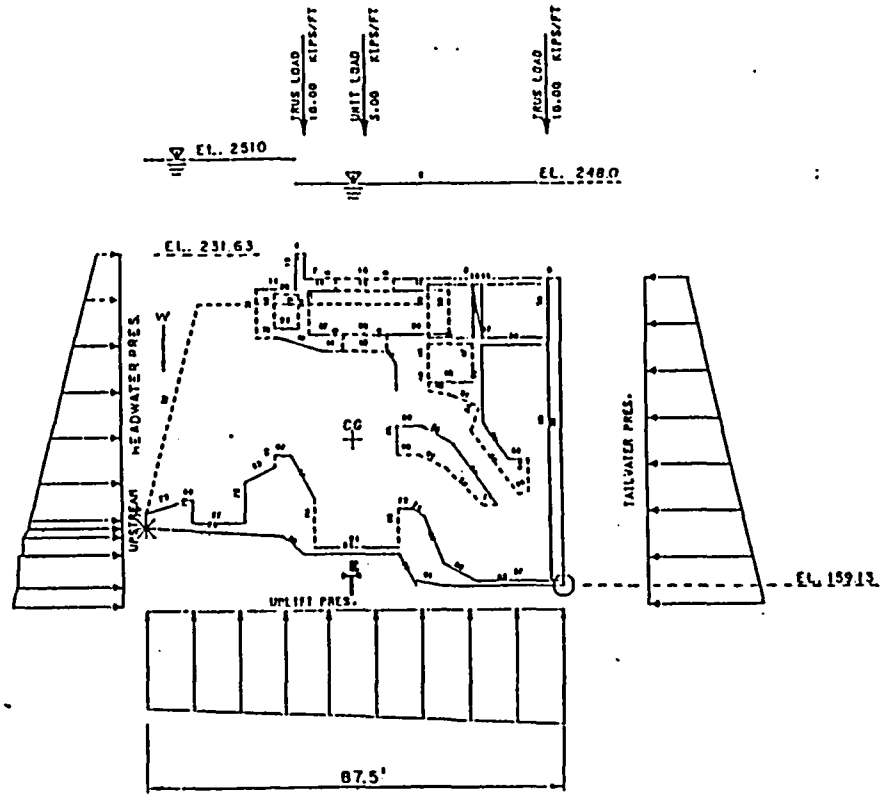
STABILITY SUMMARY

CONDITION	BASE			Σ FH (kips)	Σ FV (kips)	$\frac{\Sigma FH}{\Sigma FV}$	S a-f	RESULTANT FROM DOWNSTREAM	Σ Mr (k-ft)	Σ Mo (k-ft)	$\frac{\Sigma Mr}{\Sigma Mo}$	BASE STRESS (psi)	
	TOT. LENGTH	CR. LEN.	EFF. LEN.									UPSTREAM	DOWNSTREAM
Case II (CEI)	87.5	--	87.5	3333	13,853	0.24	20.4	37.5	590,493	70,837	8.33	26.4	65.6

*Tensile crack propagates through full length of base. Loadings, stresses and functions thereof are based on uncracked section.

Powerhouse Unit 5

New England Power Company Westborough, MA	Vernon Project	STABILITY SUMMARY
Φ GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 87123	Oct. 30, 1987 Fig. C2



LOADING CONDITION NO. 6
PMF HEADWATER LEVEL = 251.0

ΣFH = -96.90
ΣFV = 1828.32
$\Sigma FH/\Sigma FV$ = 0.05
SSF = 607.10
RESULTANT AT X = 43.38
ΣMR = 688678.75
ΣMO = -608021.75
$\Sigma MR/\Sigma MO$ = 1.13
BASE STRESS (PSI)
6.20 AT X = 0.00
5.89 AT X = 87.50

VERNON STATION POWERHOUSE UNIT 5

0 20 40 60 80
Scale In Feet

[redacted]
[redacted]
VERNON PROJECT L.P. 1995
STABILITY SUMMARY
MAIN [redacted]
[redacted] NOVEMBER, 19
1270-097-[redacted]

Fig. C3

STABILITY SUMMARY

CONDITION	BASE			Σ FH (kips)	Σ FV (kips)	Σ FH / Σ FV	θ e-f	RESULTANT FROM DOWNSTREAM	Σ Mr (k-ft)	Σ Mo (k-ft)	Σ Mr / Σ Mo	BASE STRESS (psf)	
	TOT. LENGTH	CR. LEN.	EFF. LEN.									UPSTREAM	DOWNSTREAM
18-Foot-Wide Section													
Case 1	52.5	--	52.5	1768	2695	0.66	15.8	23.4	194,021	131,000	1.48	13.3	26.2
Case 2	52.5	--	52.5	2365	2695	0.88	11.8	18.9	194,021	143,080	1.36	3.2	36.4
Case 3	52.5	--	52.5	1460	2785	0.52	19.1	25.9	190,124	117,755	1.61	19.6	21.3
Case 4	52.5	--	52.5	2125	2830	0.75	13.2	19.4	203,575	148,640	1.37	4.5	37.0
Case 5	52.5	--	52.5	550	2677	0.20	50.7	32.6	275,882	188,700	1.46	33.9	5.4
Case 6 *	--	--	--	--	--	--	--	--	--	--	--	--	--

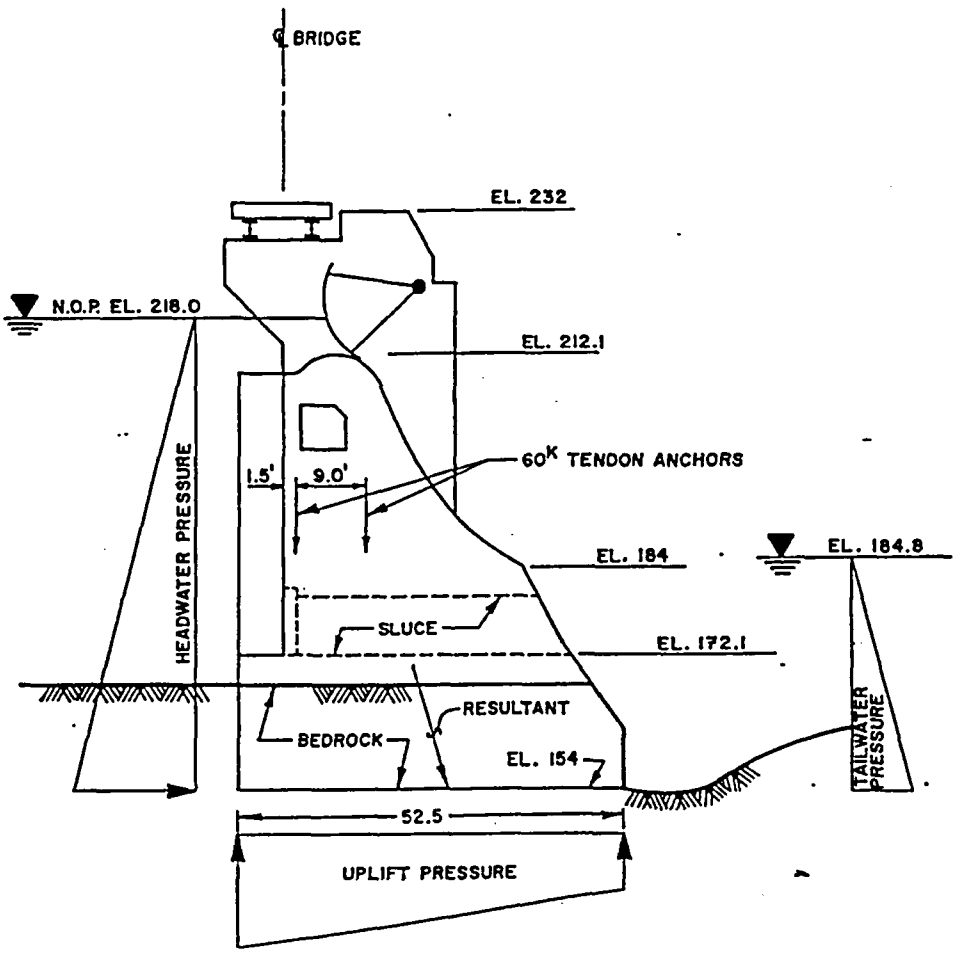
* Headwater is 39 feet above spillway crest. Tailwater is 4 feet lower, 35 feet above spillway crest. Spillway is fully submerged during PMF and stable by inspection.

New England Power Company Westborough, MA	Vernon Project	STABILITY SUMMARY SLUICE GATE SECTION
Φ	Project 87123	Sept. 30, 1987 Fig. C4

NOTES

1) WEIGHT OF BRIDGE, PIER AND GATE = 9.4 K/ft. OF DAM.

2) SLUCE GATE SECTION IS 18 FEET LONG.



CASE 1: NORMAL OPERATING POOL

0 20 40

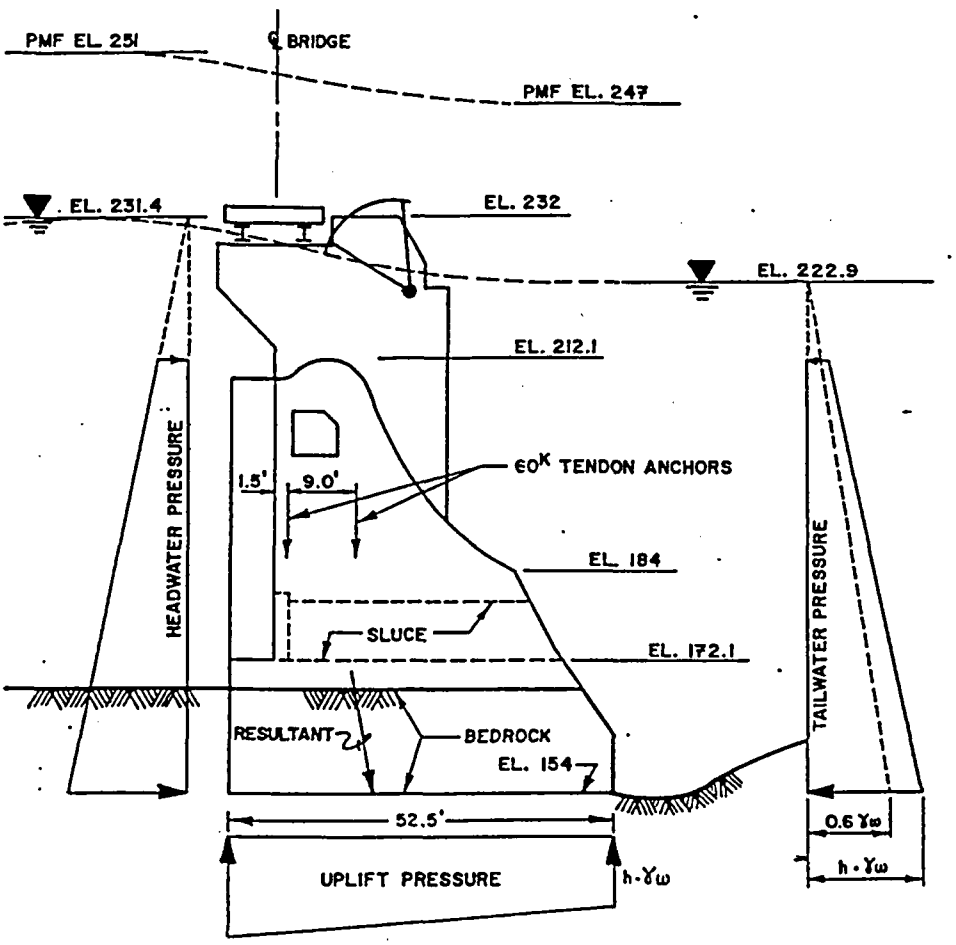
SCALE: 1" = 20'

New England Power Company Westborough, Massachusetts	Vernon Project	LOADING DIAGRAM SLUICE GATE SECTION NORMAL OPERATING POOL
GEOTECHNICAL ENGINEERS INC. WINCHESTER • MASSACHUSETTS	Project 87123	October 30, 1987 Fig. G5

NOTES

1) WEIGHT OF BRIDGE, PIER AND GATE = 9.4 K/ft. OF DAM.

2) SLUICE GATE SECTION IS 18 FEET LONG.



CASE V: FLOOD OF RECORD

0 20' 40'

SCALE: 1" = 20'

New England Power Company Westborough, Massachusetts	Vernon Project	LOADING DIAGRAM SLUICE GATE SECTION FLOOD OF RECORD
GEOTECHNICAL ENGINEERS INC. WINCHESTER • MASSACHUSETTS	Project 87123	October. 30, 1987 Fig. G6

STABILITY SUMMARY

CONDITION	BASE			Σ FH (kips)	Σ FV (kips)	Σ FH / Σ FV	S a-f	RESULTANT FROM DOWNSTREAM	Σ Mr (k-ft)	Σ Mo (k-ft)	Σ Mr / Σ Mo	BASE STRESS (psi)	
	TOT. LENGTH	CR. LEN.	EFF. LEN.									UPSTREAM	DOWNSTREAM
55 Foot Unit Block													
Case 1	53.0	--	53.0	550	994	0.55	14.5	25.7	33,021	7,494	4.41	23.6	28.5
Case 2	53.0	--	53.0	598	984	0.61	13.3	25.6	33,021	7,800	4.23	23.1	28.4
Case 3	53.0	--	53.0	523	1029	0.51	15.3	25.2	33,021	7,111	4.64	22.9	31.0
Case 4	53.0	--	53.0	907	955	0.95	8.7	21.6	33,021	12,400	2.66	11.1	38.9
Case 5	53.0	--	53.0	104	1003	0.10	76.7	29.3	33,390	3,964	8.42	34.6	17.9
Case 6 *	53.0	--	53.0	--	--	--	--	--	--	--	--	--	--

* Headwater is 39 feet above spillway crest. Tailwater is 4 feet lower, 35 feet above spillway crest. Spillway is fully submerged during PMF and stable by inspection.

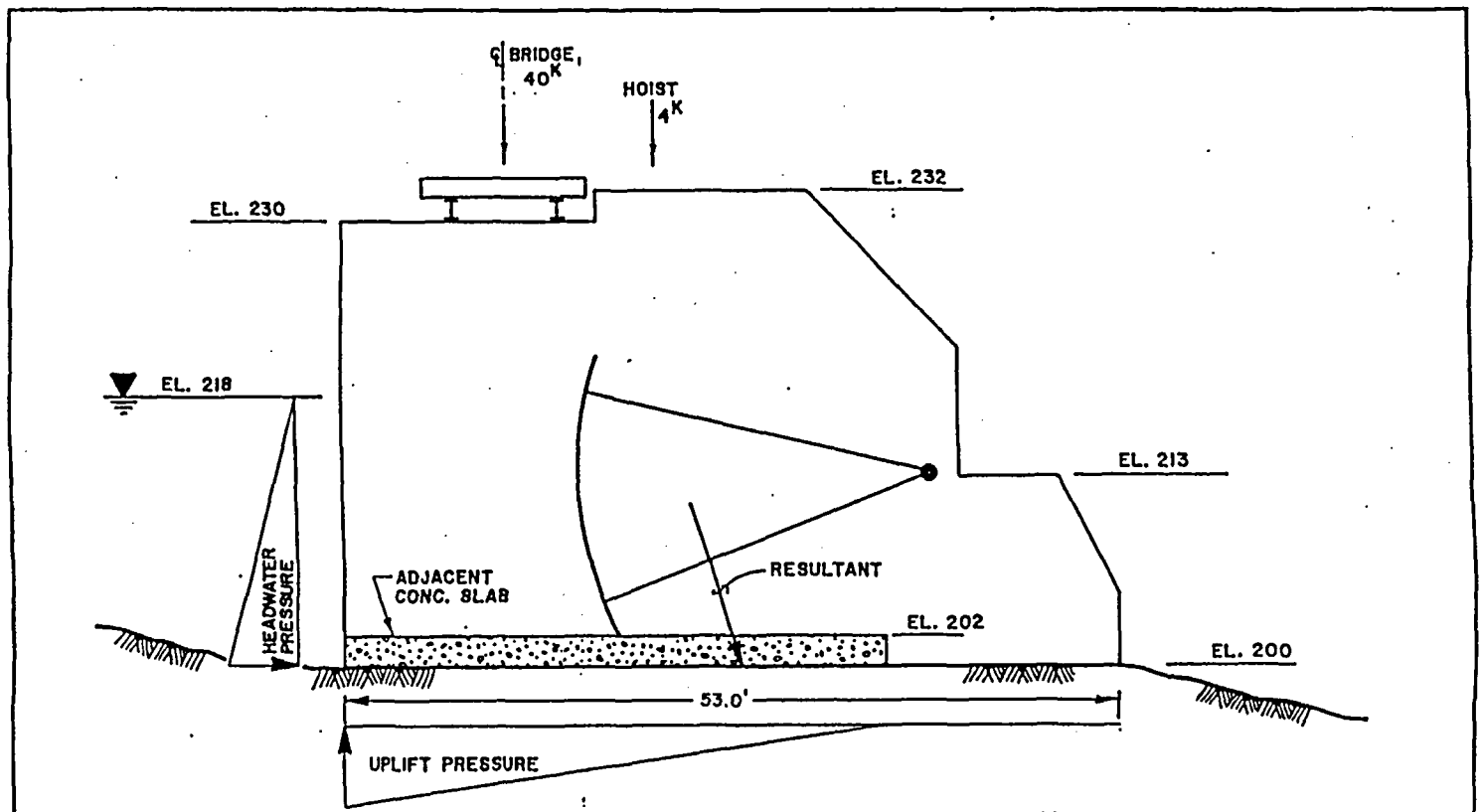
New England Power Company
Westborough, MA

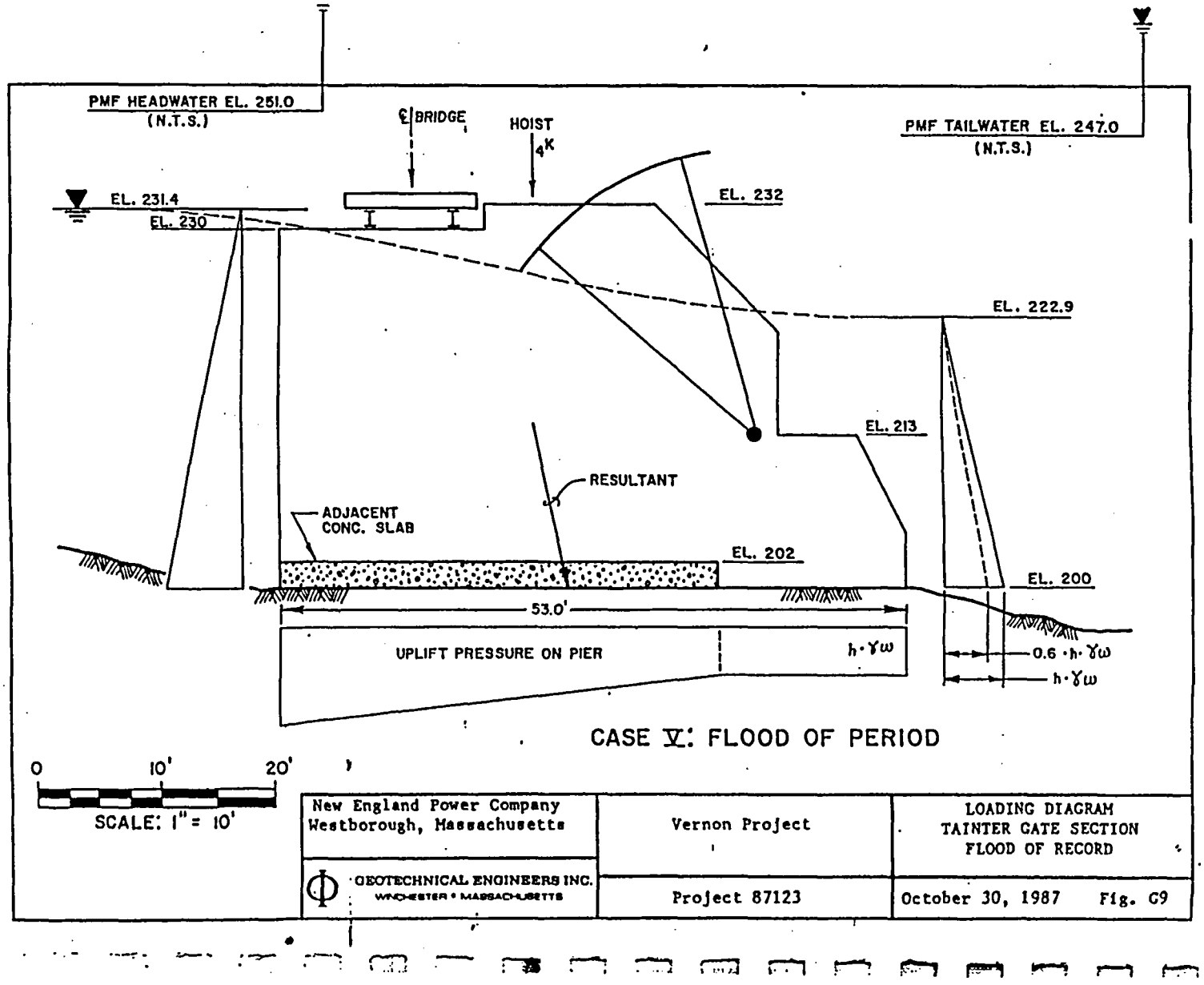
Vernon Project

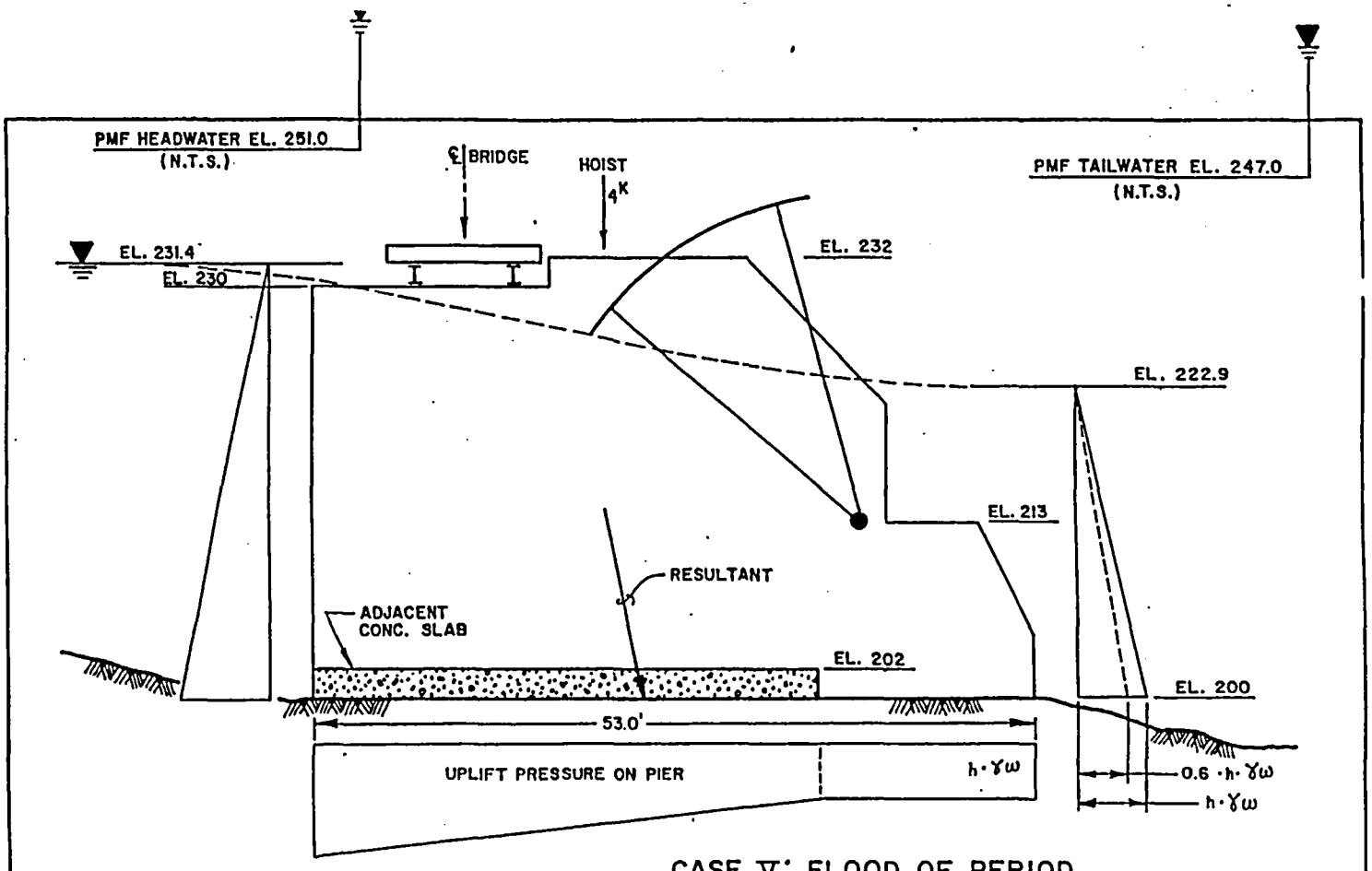
Project 87123

STABILITY SUMMARY
DEEP TAINTER GATE

Sept. 30, 1987 Fig. C7







APPENDIX H

Letter from FERC
Accepting Independent Consultant

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

MAR 18 1992

Project No's. 2077, 1892,
1855, & 1904
Fifteen Mile Falls, Wilder,
Bellows Falls & Vernon
New England Power Service

Mr. Denton E. Nichols
Manager - Civil Engineering
New England Power Service
25 Research Drive
Westborough, Massachusetts 01582-0099

Dear Mr. Nichols:

By letter dated March 4, 1992, you proposed Mr. Alton P. Davis as the independent consultant to be responsible for the sixth Part 12 safety inspections of the Projects listed on Enclosure A. Mr. Davis' resume confirms that he meets the Commission's independent consultant qualifications specified in Section 12.31(a) of the regulations. Mr. Davis is therefore approved as the independent consultant for these inspections. In accordance with Section 12, Subpart D, the approved independent consultant must either personally inspect the projects or be present during the inspections to supervise those individuals that conduct the inspections. You are also reminded to instruct your consultant that should any condition be discovered that requires emergency corrective measures, he must immediately notify you, since you are required to submit a report to the Regional Director in accordance with Section 12.36.

Mr. William Walton may participate as a member of the inspection team.

Three copies of the inspection reports must be filed with the New York Regional Director by the dates listed on Enclosure A. The consultant's reports must be formatted in accordance with the enclosed outline (Enclosure B).

You are reminded that not later than 60 days after each report of the independent consultant is filed with the Regional Director, you must submit to the Regional Director three copies

of a plan and schedule for designing and carrying out any proposed corrective measures for that project.

Sincerely,

Ronald A. Corso

Ronald A. Corso, Director
Division of Dam Safety and
Inspections

Enclosure

Enclosure A

Project No.	Project Name	Date Due
2077	Fifteen Mile Falls	January 2, 1993
1892	Wilder	November 1, 1992
1855	Bellows Falls	November 1, 1992
1904	Vernon	November 1, 1992