

Interim Construction Deficiency Report

Damage Resulting From Derrick Failure During Hurricane David

Name of Station: St. Lucie Plant - Unit #2
Owner: Florida Power & Light Company .
Architect/Engineer: Ebasco Services, Incorporated
Date of Deficiency: September 3, 1979
Interim Report Filed: October 4, 1979

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I. SUMMARY

On Monday morning, September 3, 1979, at approximately 10:45 a.m., the Chicago Bridge & Iron guyed derrick buckled, twisted, and collapsed during Hurricane David. The lower portion of the derrick (below elevation +192 feet) did not collapse and was leaning at a slight angle from the vertical, remaining braced to the containment shield wall by virtue of the horizontal strut braces. The upper portion of the derrick became dismembered and four major sections came to rest in or on the Reactor Auxiliary Building. A portion of the boom remained suspended by guy wires from the top of the containment shield wall. The guy wires performed their intended function and did not fail.

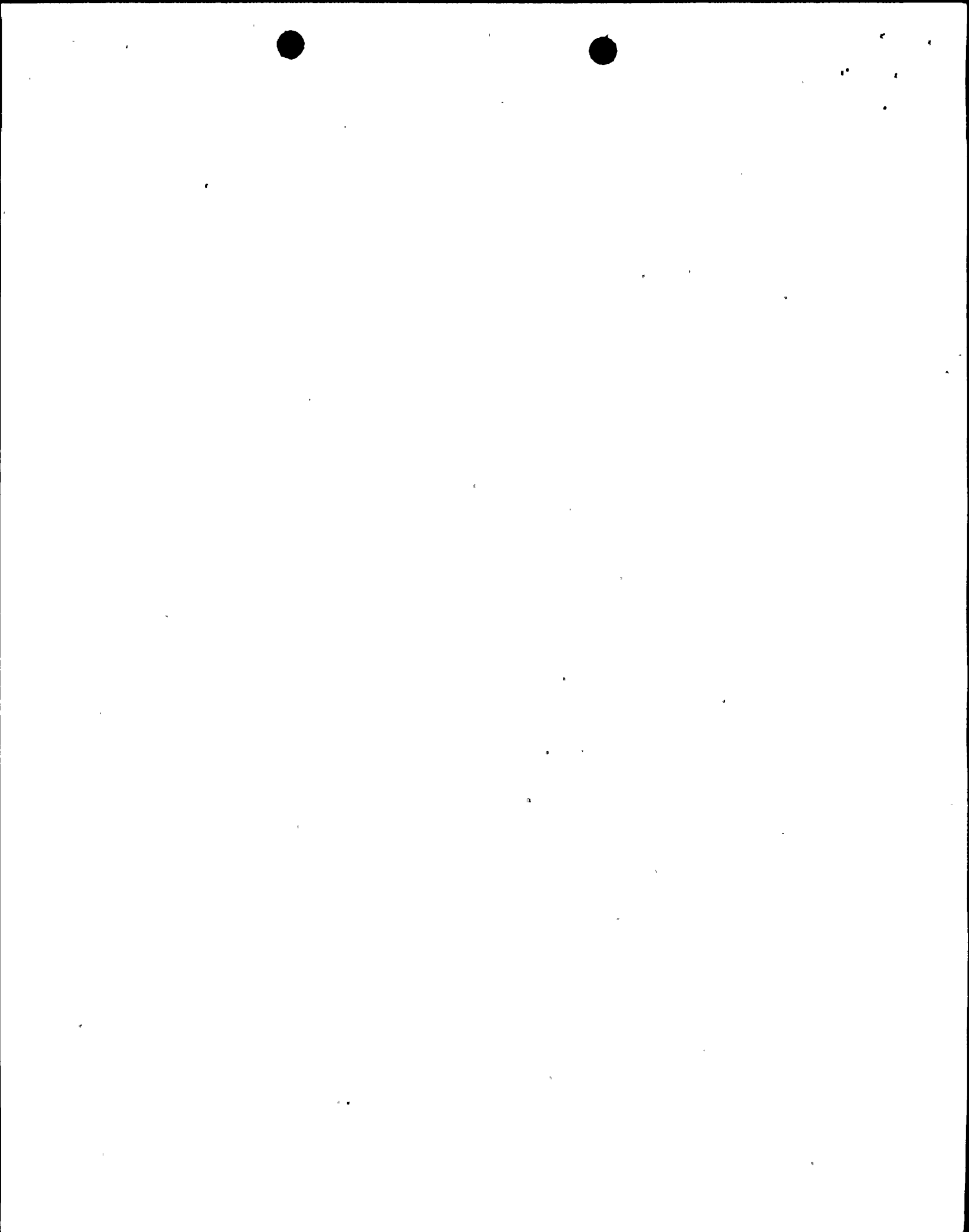
Per the requirements of 10CFR50.55(e), the event is reportable because the derrick failure caused significant damage to safety related structures and, were they to have remained uncorrected, could adversely affect the safety of operations of the plant, and does require extensive evaluation and repair. Notification of the incident was telephoned in to the NRC Inspection and Enforcement Office on September 4, 1979 (approximately 11:45 a.m.) by Mr. N. Weems, Florida Power & Light Company's Assistant Manager, QA Construction.

After numerous onsite inspections, engineering is in the process of developing and dispositioning corrective actions for the damaged areas. Subsequent to aforementioned inspections, onsite confirmatory destructive and non-destructive testing will be implemented and any additional corrective action will be issued by engineering if required.

An interim report is being submitted while investigation of the damaged areas is still ongoing and repair work is proceeding.

II. DESCRIPTION

The concrete Shield Building and the Reactor Auxiliary Building were at the following stages of construction when the hurricane passed the jobsite: The concrete Shield Building cylinder had been completed to elevation +191.42 feet and the Reactor Auxiliary Building, being constructed in a staggered manner, had walls and columns completed to the underside of floor slabs at elevations +43 feet, +62 feet and +82 feet.



II. DESCRIPTION (continued)

Completed Actions to Identify Damage

A storm damage team was assembled to determine and document the extent of damage resulting from the derrick failure. The team consisted of a construction civil engineer and two assistant civil engineers. In conjunction, the Architect/Engineer has visited the jobsite, both before and after derrick removal and cleanup, to observe the damage, and to confirm the task force findings. Areas completely unaffected by the derrick failure have been released for continued planned construction. Investigations are ongoing to determine if and where destructive and non-destructive testing should be performed before releasing areas adjacent to areas damaged.

The damage to the containment shield wall was limited to bent and sheared dowels projecting from the top of the cylinder wall and a small surface gauge on the exterior wall. The mapping of this damaged area has not yet been completed.

The damage within the Reactor Auxiliary Building was extensive and consisted of penetration of floor slabs, shattered floor beam, spalled concrete, and bent and sheared dowels for columns and walls. There is a possibility of some cracking of some floor beams and girders and one exterior wall section. The location of derrick and boom section resting positions, and details of observed damage to the Reactor Auxiliary Building is presented on the enclosed sketches, SK-2998-FG 75.01 to 75.06. In addition to the noted damage on the attached sketches, cracks were observed on the surface of a few elevation +43 feet floor beams. These cracks were chipped back to determine depth and were observed to be only surface shrinkage cracks.

In addition to the above structural damage in the Reactor Auxiliary Building, the following is a listing of damaged equipment and supports:

- 1 - Conduit on elevation +43 feet
- 2 - Cable tray restraint on elevations +43 feet and +62 feet
- 3 - 4.16 KV Switchgear 2A3-1, 2, 3, 4, 5, 6, 7, 8
- 4 - Station Service Transformer 2A2
- 5 - 480V Switchgear
- 6 - Pressurizer heater buses 2A3 and 2B3

II. DESCRIPTION (continued)

Planned Actions to Further Identify Damage

Architect/Engineer has directed Construction to proceed with two testing programs to confirm the extent of damage within the Reactor Auxiliary Building. The first program requires testing of reinforcing steel samples removed from the damaged floor beams and slabs at elevation +62 feet. Test results will indicate if the reinforcing which extends into the surrounding sound concrete had been overstressed during missile impact. The second program requires non-destructive testing of concrete members, 1) adjacent to damaged floor slab areas at elevations +43 feet and +62 feet, including all the beams at elevation +43 feet which were observed to have only surface cracks, and 2) in an exterior wall along the north side of the building which had only five day concrete strength when a section of the derrick hit the top of the wall. The pulse echo method was selected and will be performed by Muenow and Associates of Charlotte, North Carolina. The attached Figures 1 and 2 show the concrete members to be investigated.

In addition, the damaged areas on the containment shield wall will be mapped and evaluated prior to any repair work being initiated.

III. CORRECTIVE ACTIONS

Completed Corrective Actions

Florida Power & Light Company's Quality Control Department has the responsibility to prepare nonconformance reports (NCR's) where damage has occurred to complete construction activities (i.e., after concrete placement) or equipment. Table 1 is a list of dispositioned NCR's summarizing categories of structural members, types of damage and corrective action to be taken.

Table 2 is a list of currently dispositioned NCR's summarizing the equipment damage and corrective action to be taken; additional NCR's will be issued as required.

Planned Corrective Actions

Three additional NCR's (834C, 842C and 851C) have been issued for the damaged concrete and reinforcing within slabs and beams at elevations +43 feet.

III. CORRECTIVE ACTIONS (continued)

Planned Corrective Actions' (continued)

These NCR's will not be dispositioned until after the rebar and echo testing programs are completed and data has been evaluated for final determination of damaged area. An additional NCR will be issued to cover the damaged rebar in the containment shield wall.

Architect/Engineer will issue a Design Change Notification (DCN) form if resulting NCR dispositions require redetailing of floor beam and slab reinforcing at elevations +43 feet and +62 feet. Mechanical splicing of reinforcing steel will be used where lap splicing is impractical.

QC Involvement

The procedures utilized to identify damage, evaluate and disposition corrective action are the following:

- 1 - Site Quality Procedure SQP-21 "Corrective Actions"
- for the handling of NCR's.
- 2 - Ebasco Company Procedure E-69 "Design Change Notification/
Field Change Report" - for handling DCN's.

The Florida Power & Light Company's Quality Control Department has independently reviewed the damaged areas and issued NCR's to identify damaged areas and equipment. They will then follow-up the corrective action dispositioned by Engineering and apply the normal testing and inspection requirements for final approval.

Any NCR's that require redetailing will be handled by Engineering via DCN's.

In addition to the above normal QC inspection and approval process and documentation, the storm damage team has photographed and mapped the damaged areas to permit additional documentation on the extent of damage.

IV. SAFETY IMPLICATIONS

The Chicago Bridge & Iron derrick failure caused significant damage to the Reactor Auxiliary Building structure which requires extensive evaluation and repair to establish the adequacy of the structure to perform its intended safety function and meet the criteria and bases stated in the Preliminary Safety Analysis Report. If it were to have remained uncorrected, the structural damage could have possibly affected the safety of operations of the plant.

An extensive investigation is being performed to identify the extent of damage. No repair work or new construction will proceed in the affected areas until each area has been specifically evaluated and, where necessary, repair measures approved by the Architect/Engineer. Adequate documentation is being maintained to allow analysis and evaluation of the deficiency and of the corrective action taken and the completed documentation package will be a part of the final report.

V. CONCLUSION

The Chicago Bridge & Iron derrick failure was determined to be a potentially reportable accident on September 4, 1979 and such notification was made to the NRC Inspection and Enforcement Office the same day. Prior to any repair work or new construction in the affected areas, each area is specially evaluated for structural soundness and repair measures approved. Adequate documentation on the structural evaluation and repair work is maintained.

Subsequent to completing the planned action of identifying damage and the planned corrective actions, a final report will be submitted to the NRC. The report will include a description of the deficiency, an analysis of the safety implications and the corrective actions taken. Sufficient information (e.g., updated drawings, test results, copies of NCR's and DCN's) will be provided to permit analysis and evaluation of the deficiency and of the corrective action. The final report will be submitted by February 1, 1980.

Table 1

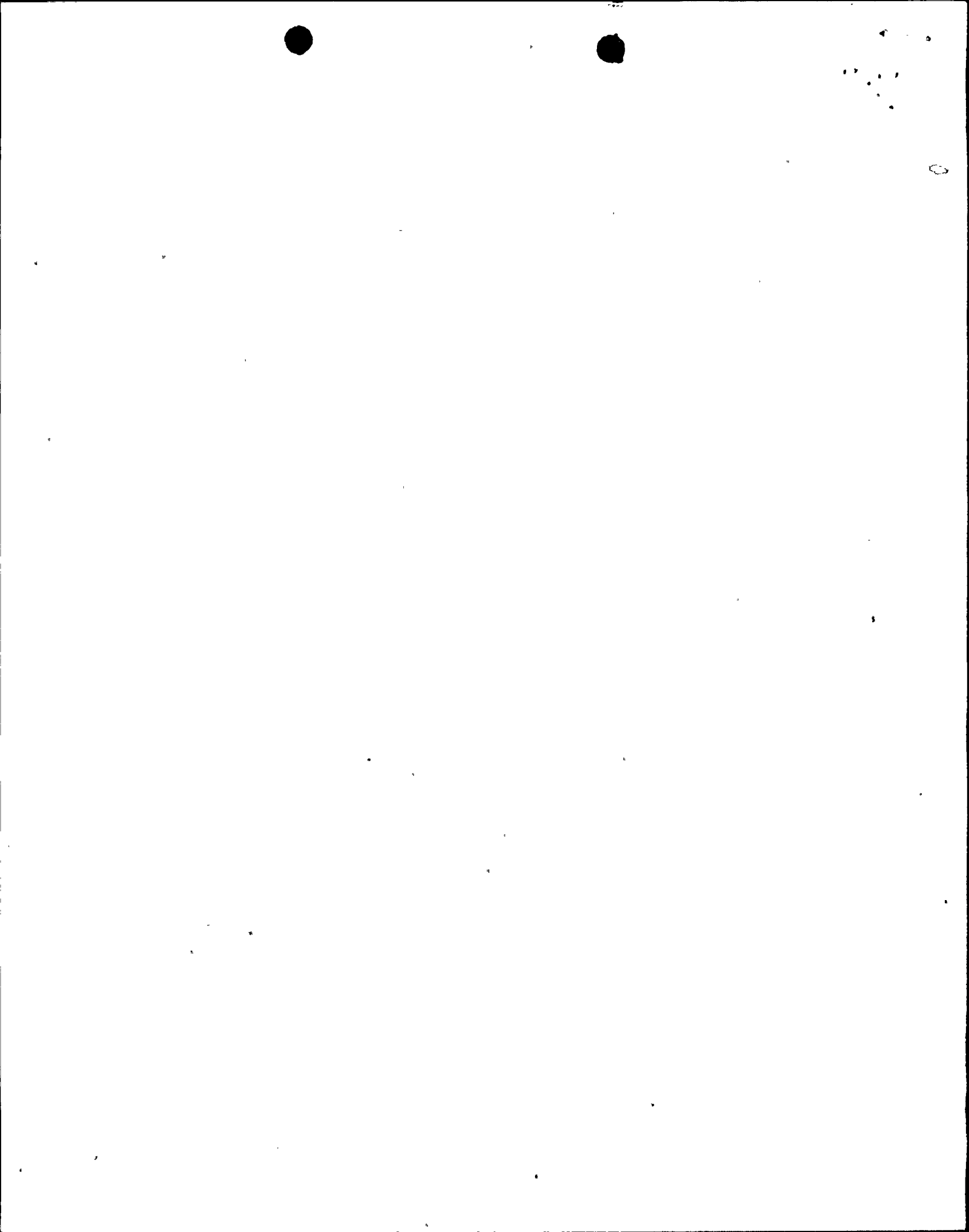
Dispositioned Concrete NCR's

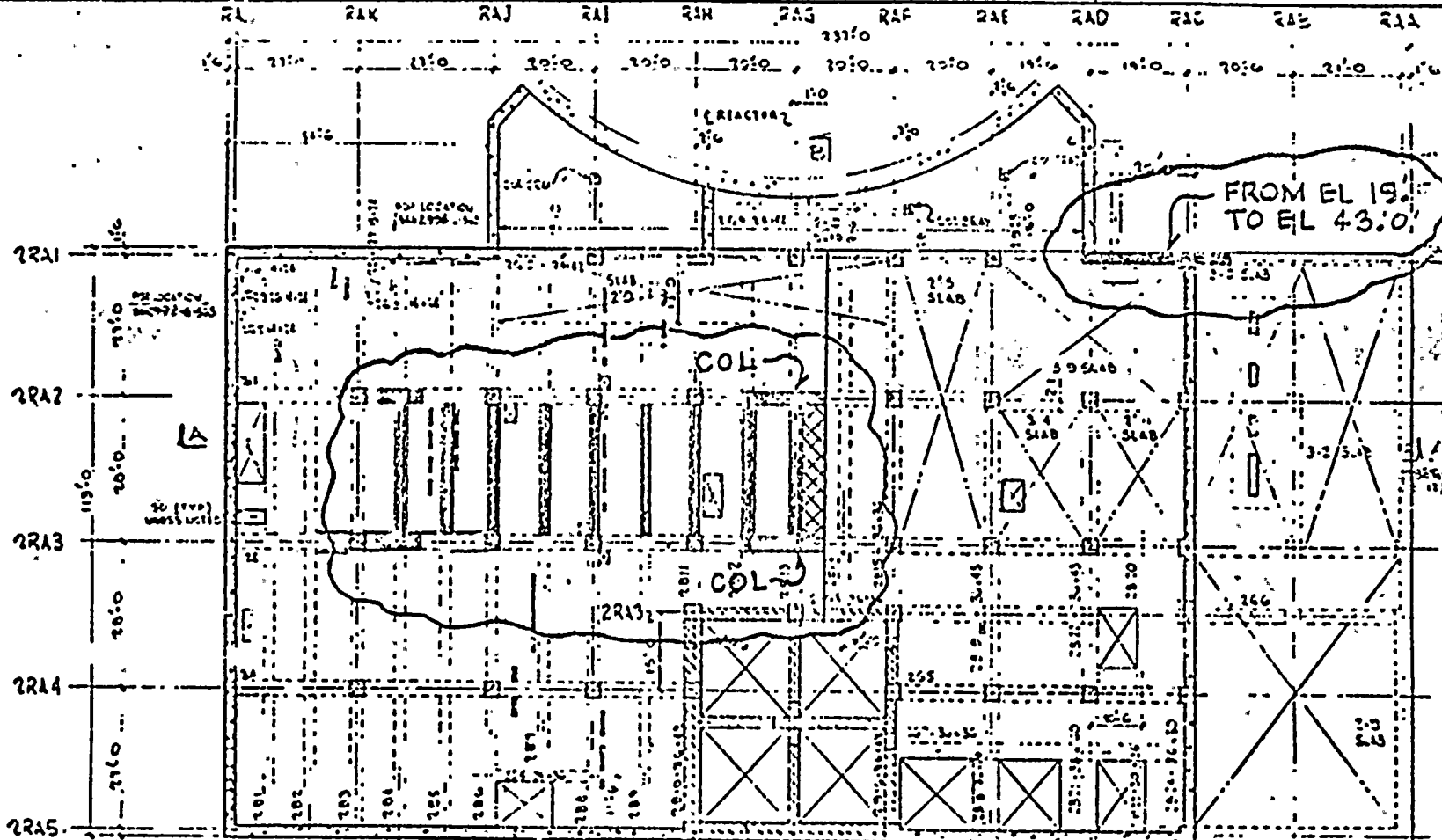
<u>Issued NCR's</u>	<u>Categories Covered by NCR</u>	<u>Type of Damage</u>	<u>Corrective Action</u>
830C	Interior wall and projecting reinforcing	Bent rebars	Rebend rebars to original positions
831C, 841C, 845C, 846C, 848C, 850C	Columns, walls and projecting reinforcing	Spalled concrete and bent rebars in walls and columns	Chip concrete back 1'-6, cut off damaged rebars and mechanically splice rebars
835C	Wall and projecting reinforcing	Cracked concrete and bent rebars	Chip back 1 ft. into sound concrete and mechanically splice rebars
832C	Columns and projecting reinforcing	Bent rebars	Chip concrete back to specified elevation for full rebar lap splice and install new rebar
833C	Columns and projecting reinforcing	Cracked near floor level	Chip concrete column and replace damaged reinforcing

Table 2

Dispositioned Electrical NCR's

<u>Issued NCR's</u>	<u>Equipment Covered by NCR</u>	<u>Disposition</u>
839E, 840E	Conduits on elevation +62 feet	Remove damaged conduit and replace with new
837E	Cable tray restraints on elevations +43 feet and +62 feet	Two restraints are to be repaired by Construction to within AISC tolerances. Balance to be scrapped.





NOTES

CONSTRUCTION, WHERE A
 CODED SPECIFICATIONS
 OF ACI 318-71 AND ALL
 CONFLICT BETWEEN THIS
 SHALL GOVERN.
 CONCRETE SHALL BE CLASS A
 SEE SPECIFICATION FLO.

ALL REINFORCING, BRASS OR
 ELECTRICAL LEAD BUSTERS TO
 BE IN POSITION BEFORE CASTING.

ALL BEAMS "B" SHALL BE
 ALL GIRDS "G" SHALL BE

FOR COLUMN S 285, 1
 "B" CHAINS BEING 1
 STIFF INDICATES BE
 FOR JOINTS AND DIV
 SEE MASONRY DWGS 2

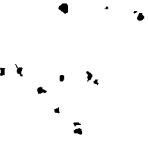
THIS IS A P&T DRAW
 REFERENCE FOR L
 MASONRY DETAILS
 10/27/70 J.A.S. ENR

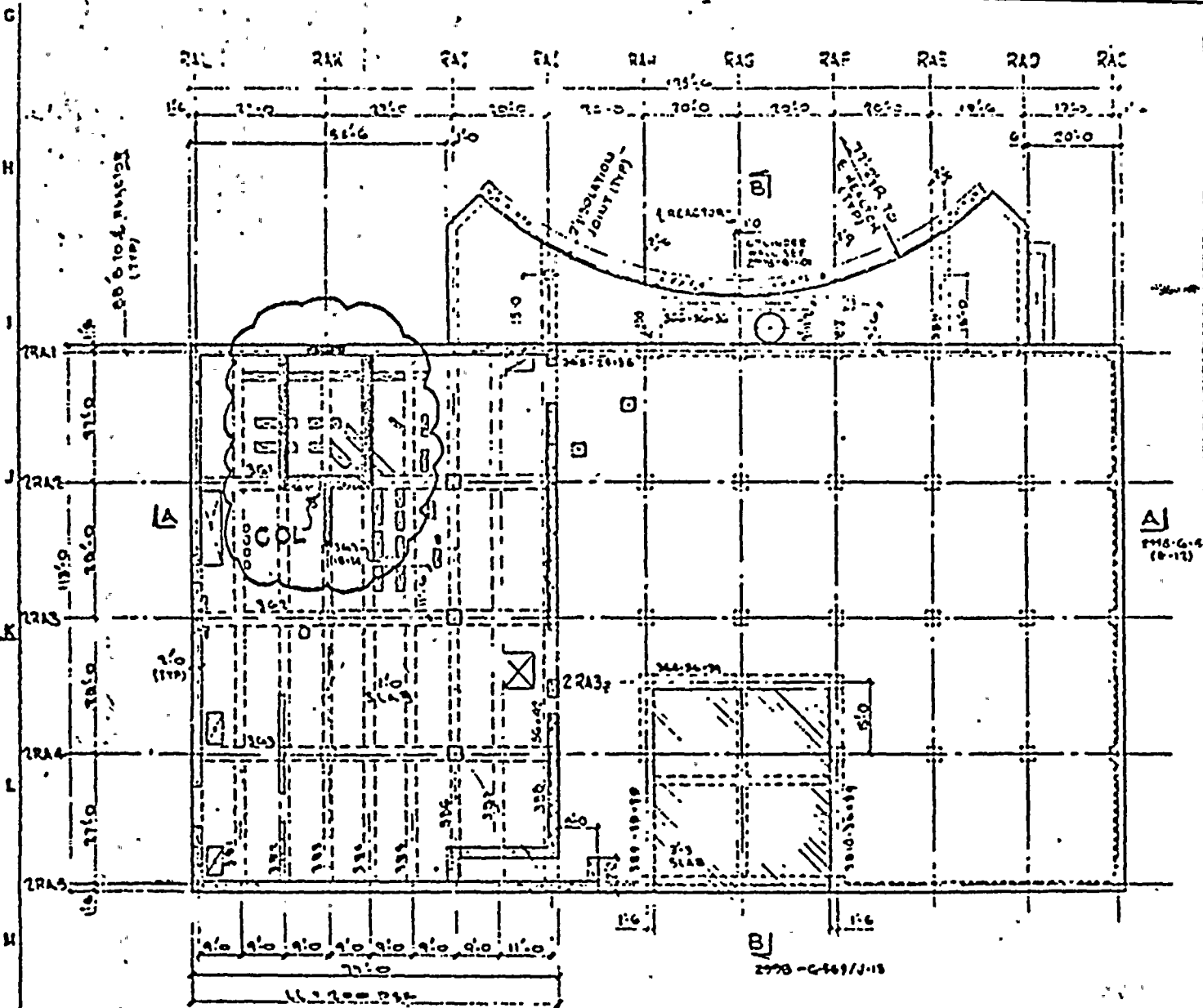
LIVE LOAD: 200 PSF AND 8000 LB CONCENTRATED LOAD

PLAN - EL 43.00 UNLESS NOTED
 160 SLAB (TIP) UNLESS NOTED

E BASCO SERVICES INCORPORATED		FIG. 1	
DV. _____	DR. _____	APPROVED	REACTOR AUXILIARY BUILDING LOCATION OF PULSE ECHO TESTING
DTE _____	CH. _____		
SCALE _____			







LIVE LOAD: 30 PSF (UNLESS NOTED) (AND)
8000 LB CONCENTRATED LOAD

PLAN - EL G2.00
2" O SLAB (TYP) UNLESS NOTED

EBASCO SERVICES INCORPORATED		FIG. 2	
DIV. _____ DR. _____	APPROVED		REACTOR AUXILIARY BUILDING
DATE _____ CH. _____			LOCATION OF PULSE
SCALE _____			ECHO TESTING

