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IN 86-06

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

February 3, 1986

IE INFORMATION NOTICE NO. 86-06: FAILURE OF LIFTING RIG ATTACHMENT WHILE LIFTING THE UPPER GUIDE STRUCTURE AT ST. LUCIE UNIT 1

Addressees:

All nuclear power facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This notice is provided to advise licensees of a potentially significant problem that occurred during the movement of a heavy load over the reactor core. It is expected that recipients will review this information for applicability to their facilities and consider actions, if appropriate, to preclude similar problems at their facilities. However, the suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On November 6, 1985, while lifting the upper guide structure from the St. Lucie Unit 1 reactor vessel, licensee personnel noticed the lifting rig tilt. The lift was immediately stopped, with the lifting rig canted upward about 6 inches and the guide structure canted downward about 6 inches at one of the three attachment points. An attempt was promptly made to lower the load back to its installed position, but the load cells indicated binding, so the attempt was terminated after lowering the load a few inches. The 50-ton load was left suspended about 8 feet above the reactor core.

The licensee declared an Unusual Event. Core alteration containment integrity was enhanced by resuming full use of the airlocks. Temporary primary manway covers were installed on both hot and cold legs to enhance the nozzle dams. Survey transits were set up and procedures implemented to monitor the rig and load for any shifts in their positions.

The licensee and the nuclear steam system supplier, Combustion Engineering, designed and tested a supplementary lifting rig to support the upper guide structure from the upper portion of the normal rig, using a cable and J-hook system. On November 9 with the supplementary rig installed, the load was jacked to a level orientation and moved to its normal parking position in the refueling pool.

Damage caused during the incident included bending the lifting rig and one of the two guide pins that align the rig with the reactor vessel.

Discussion:

The upper guide structure is shown in Figure 1. It is supported in the reactor vessel by its upper flange. It is aligned by eight alignment keys, four at the top and four at the bottom. The structure fits down inside the core support barrel, just above the fuel assemblies (see Figure 2). The fuel assembly alignment plate is the bottom component of the upper guide structure.

The lifting rig is attached to the upper guide structure by three vertically oriented bolts. These bolts are attached from above the water line by torque tools that run down the hollow columns of the rig (see Figure 3). Combustion Engineering's procedure for attaching the rig calls for checking for thread engagement and torquing each bolt to 50 ft-lbs. The licensee's procedure omitted the step concerning the check for thread engagement. Subsequent inspection of the bolt that had pulled loose indicated that part of the last thread was stripped. It is assumed that this bolt cross-threaded or bound due to rig to guide structure misalignment during attachment and reached the 50 ft-lb torque requirement with only part of one thread engaged. During the lift, the few inches of unengaged bolt shaft were pulled through the lifting rig until the bolt head rested on the rig's surface at the bottom of the column, resulting in an imperceptible tilt. The resulting lateral load was initially supported by the guide pins. When the rig and guide structure were lifted about 8 feet, where the guide bushings on the lifting rig reached the tapered portion of the guide pins, it is surmised that sufficient lateral motion was permitted to allow the thread of the improperly engaged bolt to slip free. This caused the observed motion and tilt.

After the guide structure was supported by the supplemental lifting rig and leveled, it was moved to its normal parking position in the refueling pool. The short attachment bolts and torque tools were then replaced with full-length bolts. The long bolts are designed with heads that rest on surfaces at the top of the three hollow columns of the lifting rig. This has the advantage of making any lack of full thread engagement more apparent to the personnel attaching the rig. The guide structure was subsequently returned to its installed position using the long attachment bolts.

The licensee has not yet decided whether to permanently modify the attachment bolts. The licensee plans to review all reactor-related lifts for adequacy of the procedures to ensure proper lift rig attachment, including provisions for measuring thread engagement.

The potential consequences of dropping heavy loads into the open reactor vessel were addressed by Unresolved Safety Issue (USI) A-36, "Control of Heavy Loads Near Spent Fuel." The concern for a UGS drop is that fuel assemblies might be sufficiently damaged to release the radioactive gases and iodines held within the fuel-clad gap. Under the reduced containment integrity requirements for the refueling mode, damage to several fuel assemblies might cause the radiation dose limits of 10 CFR 100 to be exceeded.

Plant specific calculations were not made for a UGS drop at St. Lucie because the NRC determined that further calculations were not required after reviewing initial calculations previously submitted by other reactor facilities in response to Phase II of USI A-36. Some indication of the consequences of a UGS drop at St. Lucie can be gained from calculations performed by Combustion Engineering for a reactor vessel head drop at Waterford 3. The head drop calculations assumed the reactor vessel head was sufficiently tilted at impact to directly strike the UGS with the UGS at rest in its normal installed position. The calculated response velocity of the Waterford UGS was 28 feet per second, and the resulting vertical stresses imposed on the fuel were not sufficient to rupture the cladding.

If the St. Lucie UGS had dropped from an 8 foot elevation, its striking velocity would have been substantially less than the UGS response velocity calculated for the Waterford head drop. However, the potential for misalignment of the recesses in the bottom of the UGS (i.e., the fuel assembly alignment plate) with the fuel assembly upper end fitting posts was not addressed by the Waterford scenario. If substantial misalignment occurred, the fuel could be subjected to additional axial loading. Significant misalignment could not occur without substantial impact damage to the eight keys and keyways, which would also result in a reduced striking velocity of the UGS as it reached the fuel. On this basis, significant radioactive gas release is considered to be unlikely, although it has not been shown to be impossible.

No specific action or written response is required by this notice. If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Edward L. Jordan, Director
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and Engineering Response
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Attachments:
1. Figure 1, Upper Guide Structure Assembly
2. Figure 2, Reactor Internals Assembly
3 Figure 3, Upper Guide Structure Lifting Rig
4. List of Recently Issued IE Information Notices

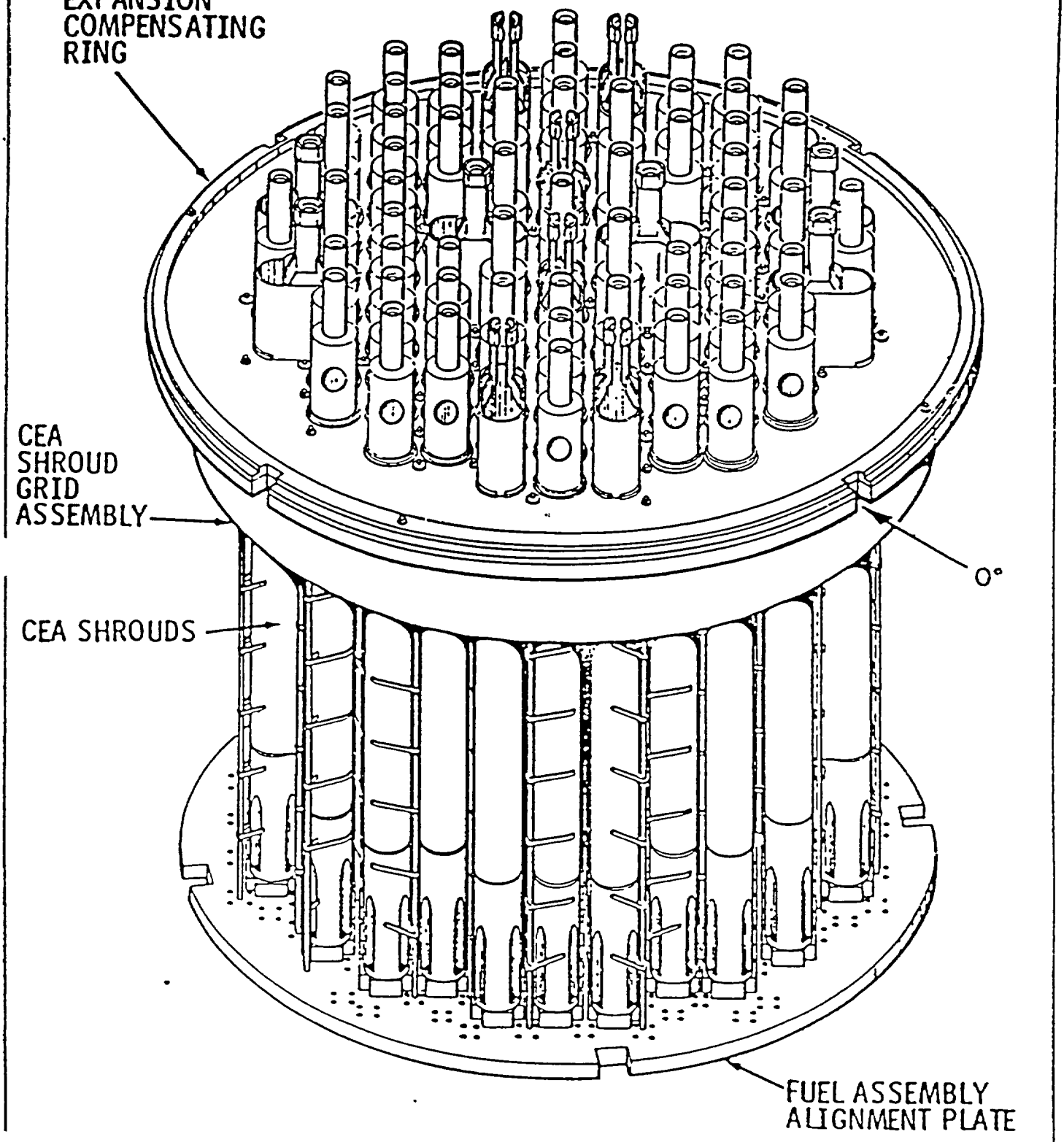

Figure 1: Upper Guide Structure Assembly
(St. Lucie Unit 1 FSAR figure 4.2-10)

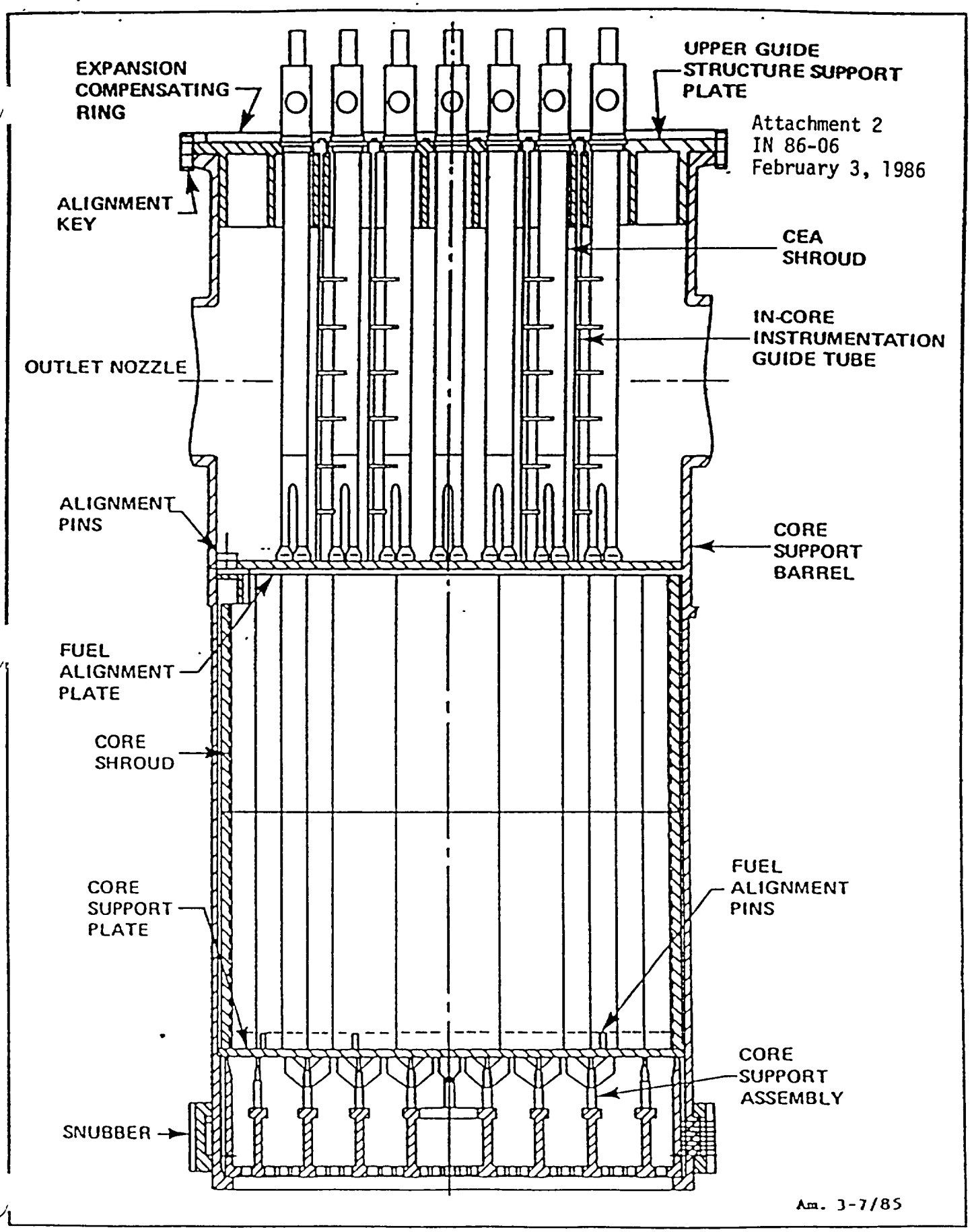

Figure 2: Reactor Internals Assembly
(St. Lucie Unit 1 FSAR figure 4.2-7)

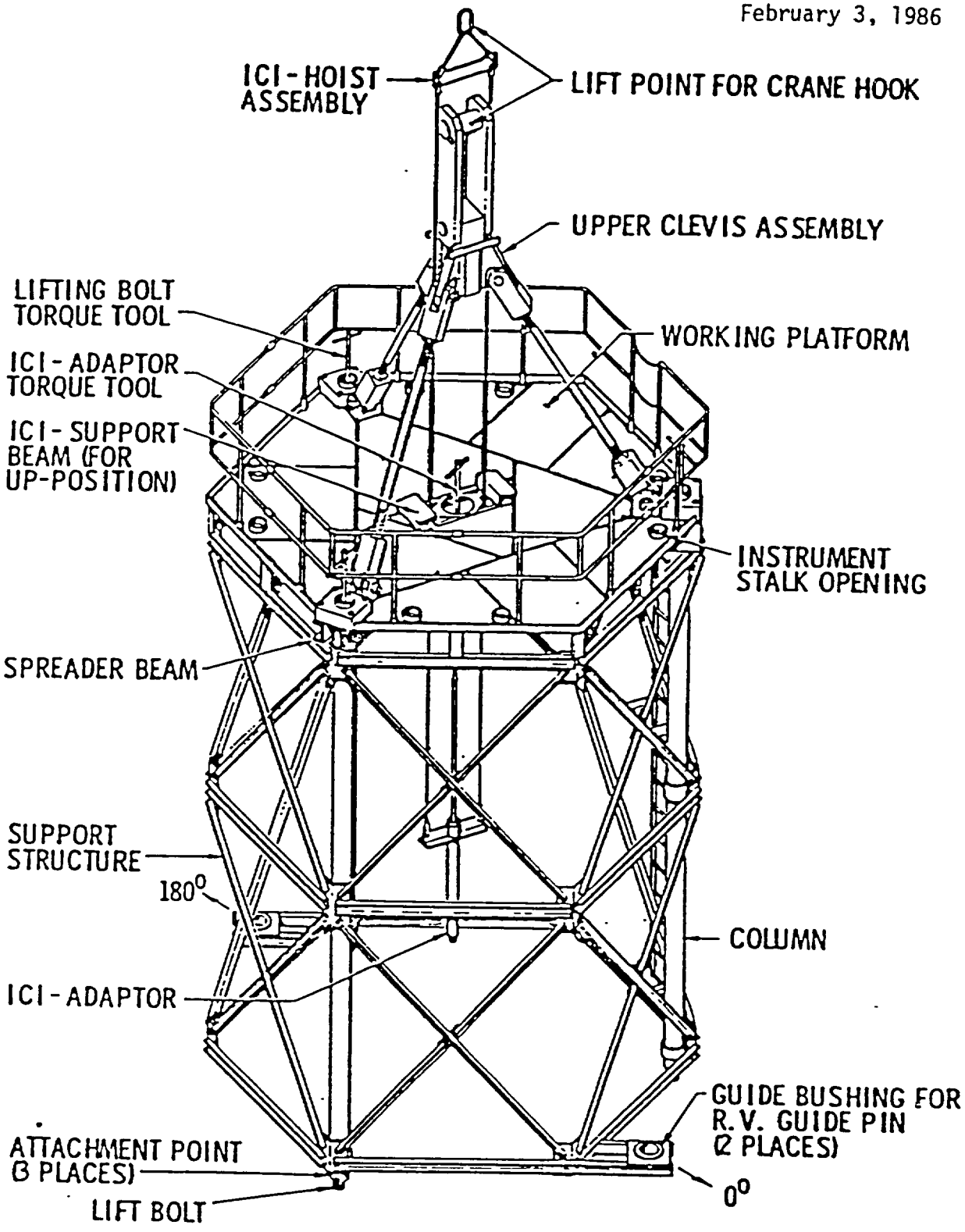

Figure 3: Upper Guide Structure Lifting Rig
(St. Lucie Unit 1 FSAR figure 9.1-8)

Attachment 4
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LIST OF RECENTLY ISSUED IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-05	Main Steam Safety Valve Test Failures And Ring Setting Adjustments	1/31/86	All PWR facilities holding an OL or CP
86-04	Transient Due To Loss Of Power To Integrated Control System At A Pressurized Water Reactor Designed By Babcock & Wilcox	1/31/86	All power reactor facilities holding an OL or CP
86-03	Potential Deficiencies In Environmental Qualification Of Limitorque Motor Valve Operator Wiring	1/14/86	All power reactor facilities holding an OL or CP
86-02	Failure Of Valve Operator Motor During Environmental Qualification Testing	1/6/86	All power reactor facilities holding an OL or CP
86-01	Failure Of Main Feedwater Check Valve Causes Loss Of Feedwater System Integrity And Water-Hammer Damage	1/6/86	All power reactor facilities holding an OL or CP
85-101	Applicability of 10 CFR 21 To Consulting Firms Providing Training	12/31/85	All power reactor facilities holding an OL or CP
85-100	Rosemount Differential Pressure Transmitter Zero Point Shift	12/31/85	All power reactor facilities holding an OL or CP
85-99	Cracking In Boiling-Water-Reactor Mark I And Mark II Containments Caused By Failure Of The Inerting System	12/31/85	All BWR facilities having a Mark I or Mark II containment
85-98	Missing Jumpers From Westinghouse Reactor Protection System Cards For The Over-Power Delta Temperature Trip Function	12/26/85	All Westinghouse designed PWR facilities holding an OL or CP

OL = Operating License
CP = Construction Permit