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SUBJECT: Responds to NRC 871125 request for addl info re proposed license amend. Proposed amend to permit replacement of spent fuel pool racks at Unit 1 to ensure that sufficient future capacity exists for storage of spent fuel. Figures encl.

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DECEMBER 22 1987

L-87-538

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Re: St. Lucie Unit I
Docket No. 50-335
Spent Fuel Rerack

By letter L-87-245, dated June 12, 1987, Florida Power & Light Company (FPL) submitted a proposed license amendment to permit replacement of the spent fuel pool racks at St. Lucie Unit I to ensure that sufficient future capacity exists for storage of spent fuel.

By letter dated November 25, 1987 (E. G. Tourigny to C. O. Woody) the NRC Staff requested additional information in the area of plant systems it needed to continue its review of this proposed license amendment.

Attached is FPL's response to this request.

If additional information is required, please contact us.

Very truly yours,

C. O. Woody
Executive Vice President

COW/EJW/gp

Attachment

cc: Dr. J. Nelson Grace, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

A001 1/1

EJW4/054/I

QUESTION NO. 1: Provide additional discussion on the temporary crane that will be used to handle the spent fuel storage racks within the fuel building, specifically, the load path that the fuel building crane will take to carry the temporary crane. Demonstrate that the appropriate safety factors have been applied to the crane.

RESPONSE: Figures 1 through 9 depict the installation sequence for the temporary crane. The numbers listed below correspond to the figure numbers.

1. The auxiliary hook of the fuel cask handling crane will be used to bring the east end truck into the fuel handling building. Using a tag line, the truck will be set onto the east rail and secured in place. Temporary support plates will be provided for this purpose.

2,3,4,5. A temporary jib crane will be installed near the northwest corner of the spent fuel pool and used in conjunction with the cask crane auxiliary hook to maneuver the west end truck into place. It will then be secured to the west rail.

6,7,8. The south bridge girder will be brought into the building using the cask crane auxiliary hook, and with the jib crane will be maneuvered into a horizontal position. The girder will be transported to its proper location at the south end of the crane and bolted to both end trucks. A similar operation will be performed with the north girder.

9. Any miscellaneous small items will be installed at this time. The trolley will then be lowered directly onto the bridge rails.

During the aforementioned operations, the spent fuel handling machine will be parked over the nearest spent fuel rack modules containing stored fuel to ensure that none of the temporary crane components are placed on the rails in that area. No loads will be carried over spent fuel at any time.

QUESTION No. 1 (continued)

RESPONSE: (continued)

The following safety factors, which meet or exceed the requirements of NUREG 0612, have been provided in the design of the load bearing components of the temporary crane:

Component	Factor of safety**	Criterion**
Bridge girders	2.93	Yield strength
End trucks	>20	Ultimate strength
Wheels	2.50	Rated capacity*
Wheel bearings	3.34	Rated capacity*
Drum	5	Ultimate strength
Hoist rope	5.34	Breaking strength
Hook	5	Ultimate strength

* Rated capacity has a margin of 5 over ultimate strength.

** Factor of safety equals criterion stress over design stress.

The following steps are taken in the inspection and testing of the temporary crane to achieve compliance with the spirit of NUREG 0612.

a. The crane structural members are purchased to ASTM specification and certified as such.

b. The crane hoist is proof tested to 150% of the rated load in the hoist manufacturer's shop.

c. The crane is erected in the crane manufacturer's shop and the workings of the trolley drives and alignment of the trolly is confirmed.

d. All welds in the manufacturing of the crane are liquid penetrant or magnetic particle tested.

QUESTION NO. 2: Provide the results of the failure of the temporary crane's hook, assuming that it is lifting the heaviest rack at the maximum carrying height.

RESPONSE: The spent fuel pool structure has been previously analyzed for the drop of a 25 ton cask (dimensions 33 inches in diameter by 195 inches long) from a height of 58 feet (elevation 79.50') above the pool floor. (The cask must attain an elevation of 77.00' for entry into the fuel handling building.) The details of this analysis have been presented in Subsection 9.1.4.3 of the St Lucie Unit 1 FSAR. The concern evaluated there was structural damage to the spent fuel pool concrete. Damage to the steel pool liner was not a limiting factor because a leak in the liner will cause fluid to either (1) enter the space between the liner and the concrete wall where it will eventually be arrested since there is no flow path through the concrete, or (2) enter the monitor channel system where it will eventually be detected at one of the 19 collection points at the base of the pool. The affected pool zone can then be valved off to prevent further leakage.

The cask drop analysis examined various free fall trajectories. It was determined that the vertical drop is critical because it results in the maximum energy at impact. For the purpose of determining the impact velocity, the pool was assumed to be full of water up to elevation 60.00'. As to the assumed location of the drop, the critical target area is the cask storage pit since the concrete slab thickness at this location is 6'-0 as compared to 9'-6 throughout the rest of the pool. Also, it is only in this location that the cask can be lifted as high as elevation 79.50' since the cask handling crane has no access anywhere else in the pool.

The results of the analysis determined that the maximum local penetration in the area of impact was 2". Stresses in the concrete slab are within the appropriate limits using the ultimate strength design method of ACI 318-63. Thus it was concluded that cracking throughout the slab's thickness will not occur under the impact of a cask drop.

The heaviest rack module which will be lifted over the spent fuel pool is an existing 7 x 10 module weighing approximately 42,000 lbs which is somewhat less than a spent fuel cask. The rack will be lifted over the cask storage pit to the same height assumed for a cask, as it must use the same path to leave the building. Whereas the spent fuel cask is a solid cylindrical structure with a circular base, the rack module is a rectangular structure having sharp corners. It is not a solid structure, but is composed of tubular and bar shaped structural members welded together into an assembly.

QUESTION NO. 2: (continued)

RESPONSE: An analysis of the impact of a rack module with the pool floor has not been performed, however some comparisons may be drawn between this event and the cask drop case previously analyzed. The structures are roughly of the same weight and are handled at the same height above the pool; the base area of the rack module is much greater than that of the cask. From this it may be assumed that the rack module will attain an impact velocity not greater than that of the cask. A drop resulting in a vertical orientation at impact, therefore, will be enveloped by the cask drop analysis. An inclined drop, or one resulting in a point or edge impact, may reasonably be expected to produce localized damage exceeding that of the cask drop; however, considering that a rack impacting the floor in this orientation will be especially capable of absorbing energy through its own deformation, the overall effect on the pool floor slab is expected to be less severe than that of the cask drop. Localized tearing of the pool liner does not present a problem, as explained above; and based on the results of the cask drop analysis, the through-cracking of the floor slab which would be required to exceed the makeup capability to the spent fuel pool is not expected to occur.

Possible rack drops from the temporary crane in other areas of the pool will be from a lesser height onto a thicker slab, and hence will be enveloped by the case evaluated above.

At no time will the temporary crane carry a load over a rack containing spent fuel; however, with respect to the potential radiological consequences of a dropped rack upon the stored fuel assemblies, a comparison may be drawn with the cask drop accident. The results of that analysis, updated to reflect the increased spent fuel storage, are presented in Subsection 5.3.1.2 of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via letter L-87-245 dated June 12, 1987 and indicate that the 10 CFR 100 limits for offsite doses will not be exceeded provided the stored fuel assemblies have been allowed to decay for 1490 hours before a spent fuel cask is brought into the fuel handling building. Rack movement will not commence until this condition has been satisfied. The cask drop analysis assumes the failure of all the fuel rods in all the stored fuel assemblies. The consequences of the cask drop accident thus envelope those of any postulated rack drop.

QUESTION NO. 3: Provide the stress levels in the temporary crane when the heaviest rack is dropped onto it from the maximum carrying height associated with the cask handling crane. (If the cask handling crane is single failure proof, then dropped means the maximum possible lowering velocity associated with the cask handling crane.)

RESPONSE: The cask handling crane is not single-failure proof. The movement of the existing spent fuel racks in the vicinity of the temporary crane will be limited such that the rack will be lifted a maximum of 6 inches above the temporary crane bridge girders. An analysis of the temporary crane bridge girders has been performed assuming a drop of the heaviest rack from a height of 1'-0 above the top of the girders. The entire impact energy is assumed to be absorbed in the elasto-plastic deformation of one bridge girder. The resulting deflection of the girder is approximately 6 inches. From this analysis, it is concluded that in the event of a rack drop on the temporary crane, the crane will remain on the rails. Should this condition actually occur, the temporary crane will be removed from the fuel handling building and subjected to a load test before being placed back into service.

In any event, there will be no stored spent fuel in the area of the pool where the load transfer between the fuel cask crane and the temporary crane will take place. Even if a rack drop should result in the dropping of crane components or the rack into the pool, the consequences would be enveloped by those of the cask drop accident as discussed in the Response to Question No. 2 of this report.

QUESTION NO. 4: Does Figure 1 (September 8, 1987 submittal) represent the locations occupied by the spent fuel before the temporary crane is installed?

RESPONSE: Figure 1 in the September 8, 1987 submittal shows the locations occupied by the spent fuel before the temporary crane is installed.

QUESTION NO. 5: Provide the results of a light load drop analysis which includes a list of the objects considered, their weight and their maximum carrying height as well as the same information related to the referenced load. As an alternative, provide a discussion of the effects of having the new racks on a previously approved light load analysis.

RESPONSE: A light load analysis has not been performed for St Lucie Unit 1; however, such an analysis has been previously performed for St Lucie Unit 2, and has been reviewed and approved in Subsection 9.1.4 of The Safety Evaluation Report Related To The Operation of St Lucie Plant Unit No. 2, Supplement 3, NUREG-0843, circa April, 1983. The analysis, presented in Subsection 9.1.2.3 of the St Lucie Unit 2 FSAR, has been reviewed with respect to application to St Lucie Unit 1. The maximum attainable lift height for objects handled by the spent fuel handling machine is the same for both units. The spectrum of dropped objects considered for the St Lucie Unit 2 spent fuel pool analysis is applicable to St Lucie Unit 1, and it has been determined that there are no additional objects lighter than a fuel assembly to consider for St Lucie Unit 1. The analysis gives reasonable assurance that fuel damage will not occur due to a dropped light load. Although an indepth analysis has not been performed for light loads in relation to their impact forces per unit area, the drop of a light load will be no more limiting than the fuel handling accident, presented in Table 15.4.1-5 of the St Lucie Unit 1 FSAR. As stipulated in the St Lucie Unit 2 light load analysis, each assembly in the spent fuel pool is stored in a separate storage cell of the spent fuel rack, and it is considered inconceivable that more than one fuel assembly could be damaged by the drop of a light load. This conclusion is also applicable to St Lucie Unit 1. The St Lucie Unit 1 analysis of the fuel handling accident assumes that all the pins in one fuel assembly are damaged, and that all the activity in the pin gas gap is released; therefore, the drop of a light load will be no more limiting than the fuel handling accident.

The new spent fuel racks have been analyzed for the drop of a fuel assembly on top of the racks. The results are presented in Subsection 4.6.6 of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via letter L-87-245 dated June 12, 1987 and conclude that the permanent deformation of the rack does not extend below the tops of the stored fuel assemblies; hence the fuel assemblies will sustain no damage as a result of the drop.

QUESTION NO. 5: (continued)

RESPONSE: (continued)

An analysis of a dropped fuel assembly on a stored fuel assembly is presented in Subsection 15.4.3.1 of the St Lucie Unit 1 FSAR. This analysis concludes that there would be no fuel damage as a result of dropped fuel assembly on a stored fuel assembly since the "end on" energy absorption capability of a fuel assembly is greater than the kinetic energy of the drop.

Table 15.4.1-5 of the St Lucie Unit 1 FSAR presents the doses for the fuel handling accident, and they are well below the 10 CFR 100 limits; This conclusion remains applicable for the new spent fuel racks.

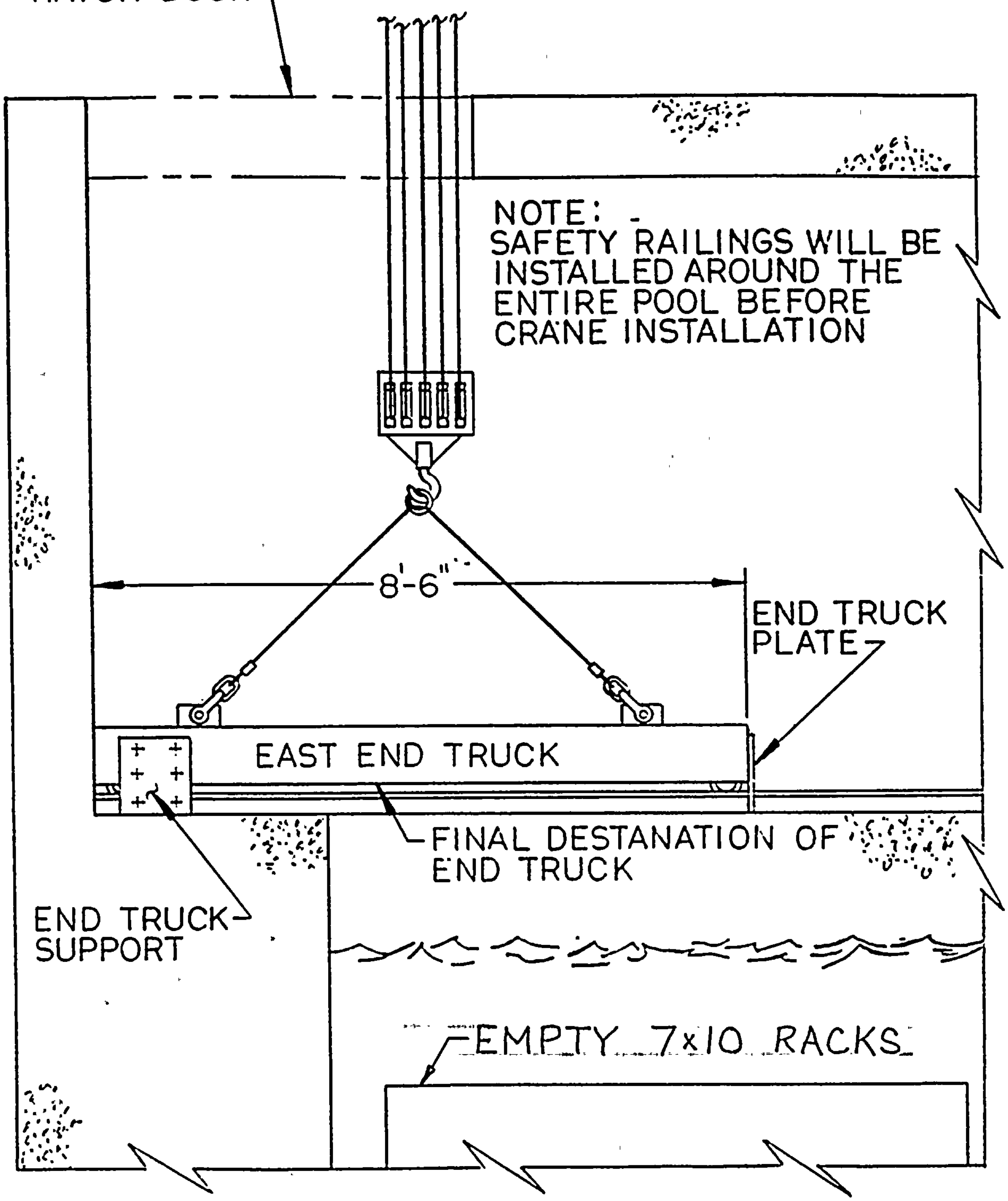

FIGURE I
LOOKING EAST

NORTH

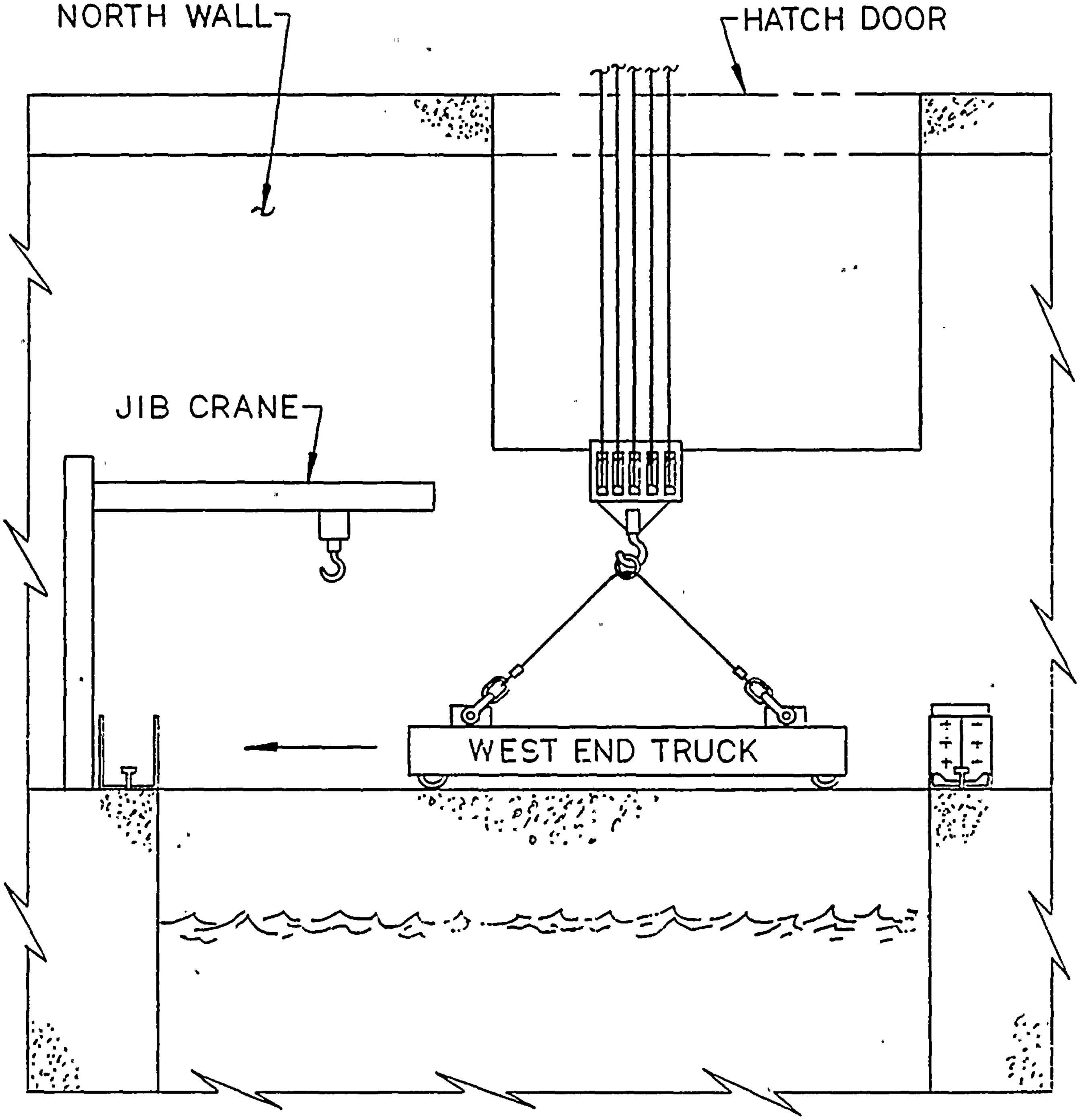

FIGURE 2
LOOKING NORTH

NUC nuclear utility construction

TITLE: SEQUENCE OF PORTABLE HOIST INSTALLATION

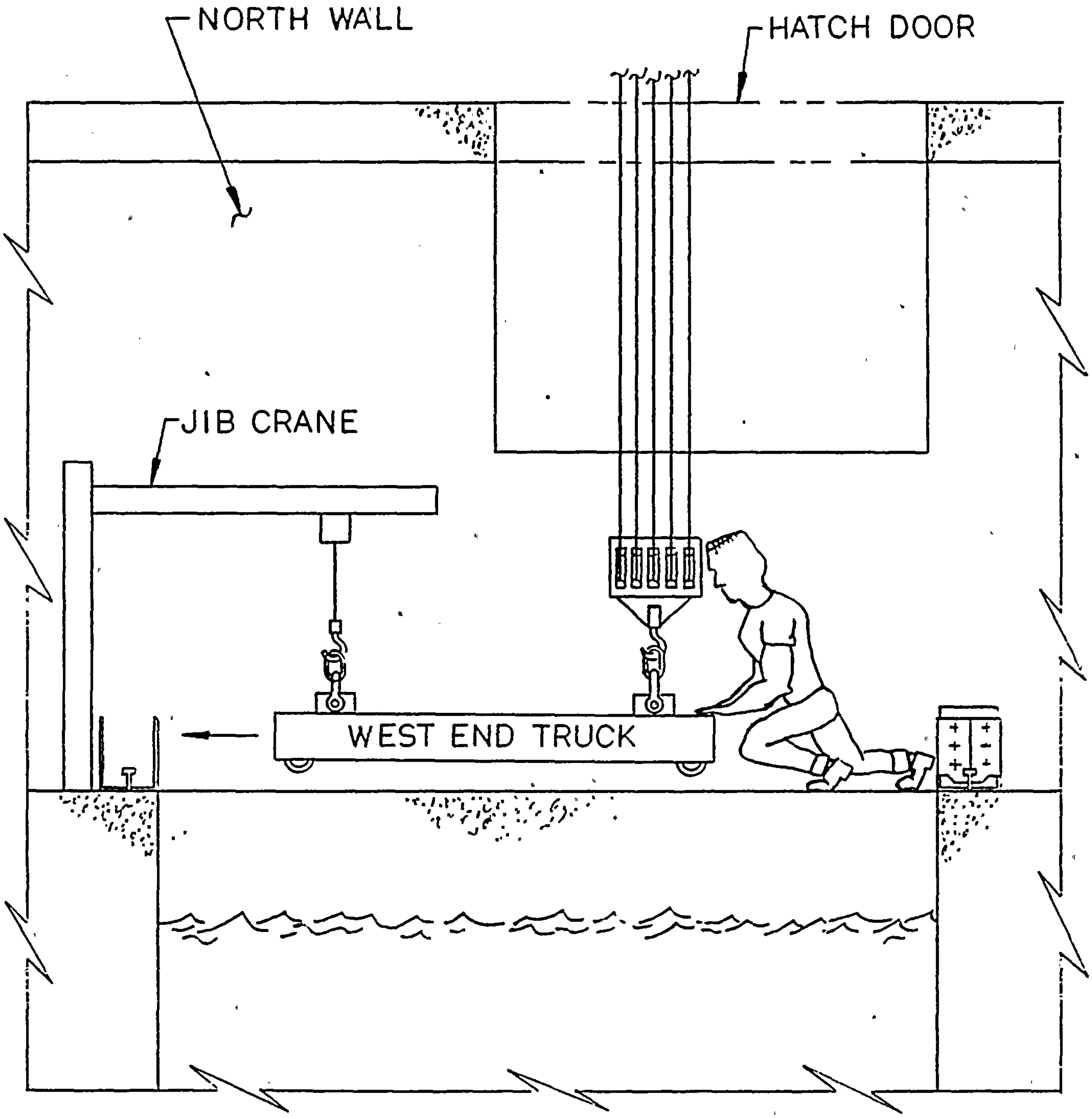

FIGURE 3
LOOKING NORTH

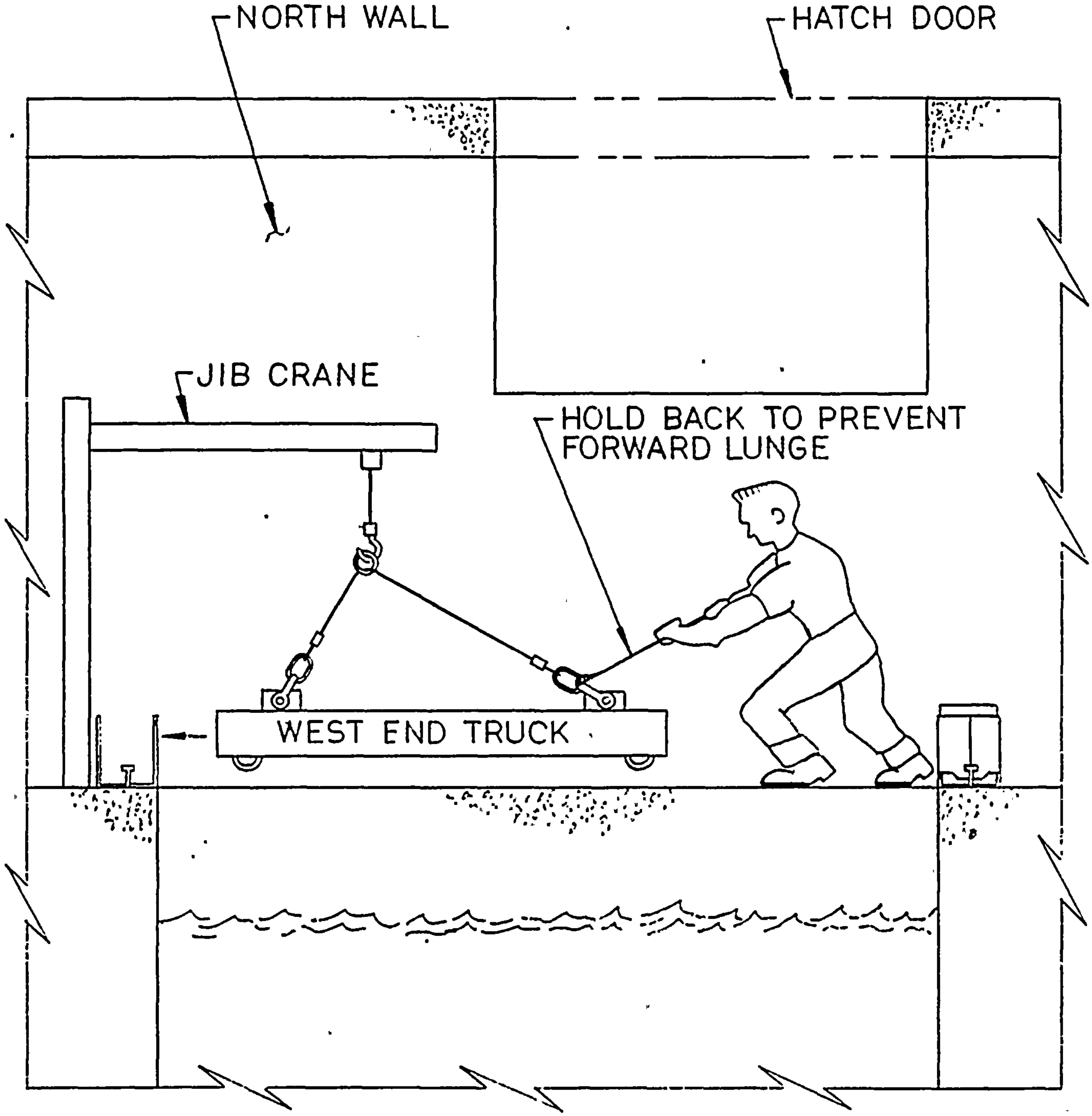

FIGURE 4
LOOKING NORTH

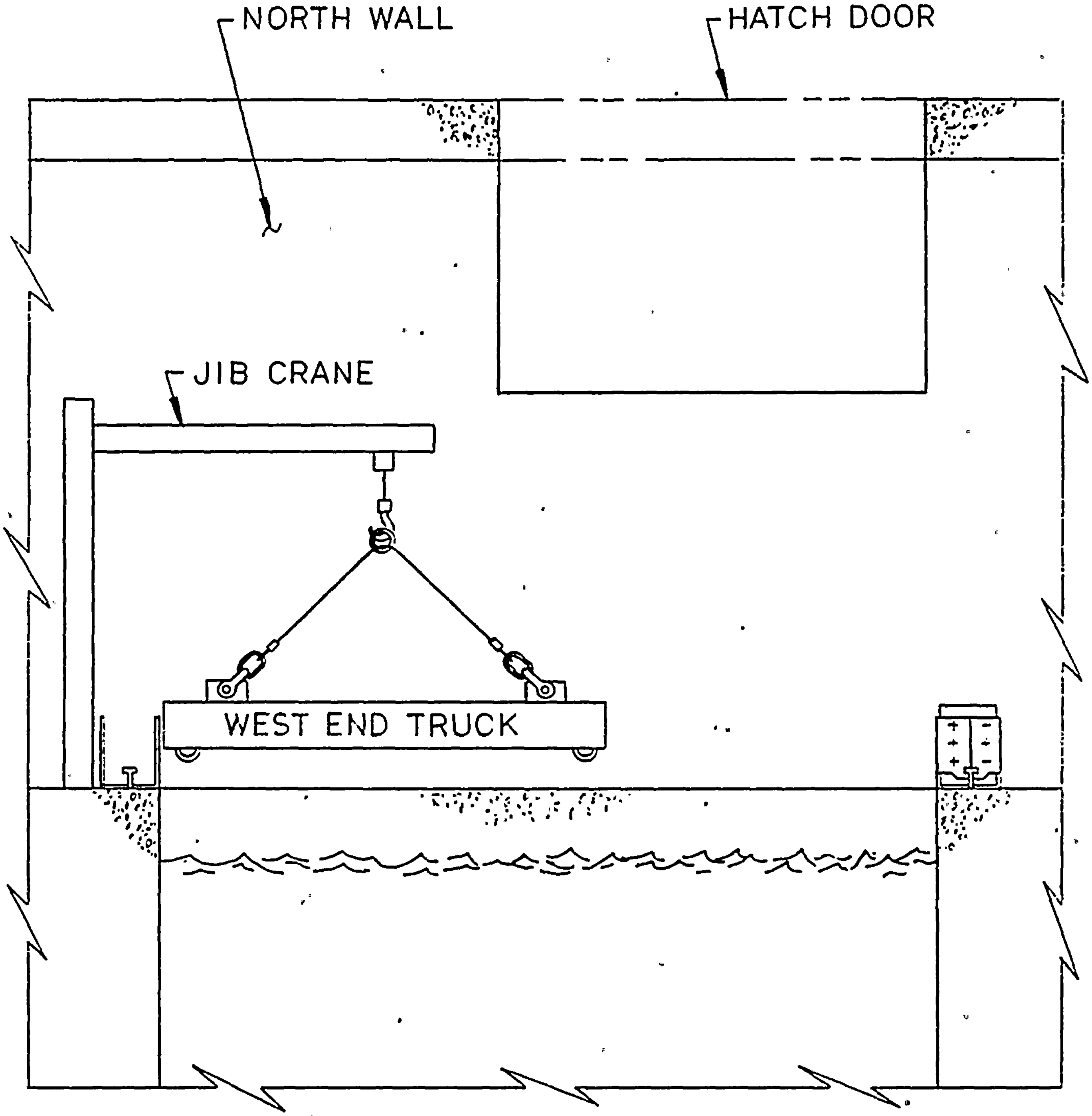

FIGURE 5
LOOKING NORTH

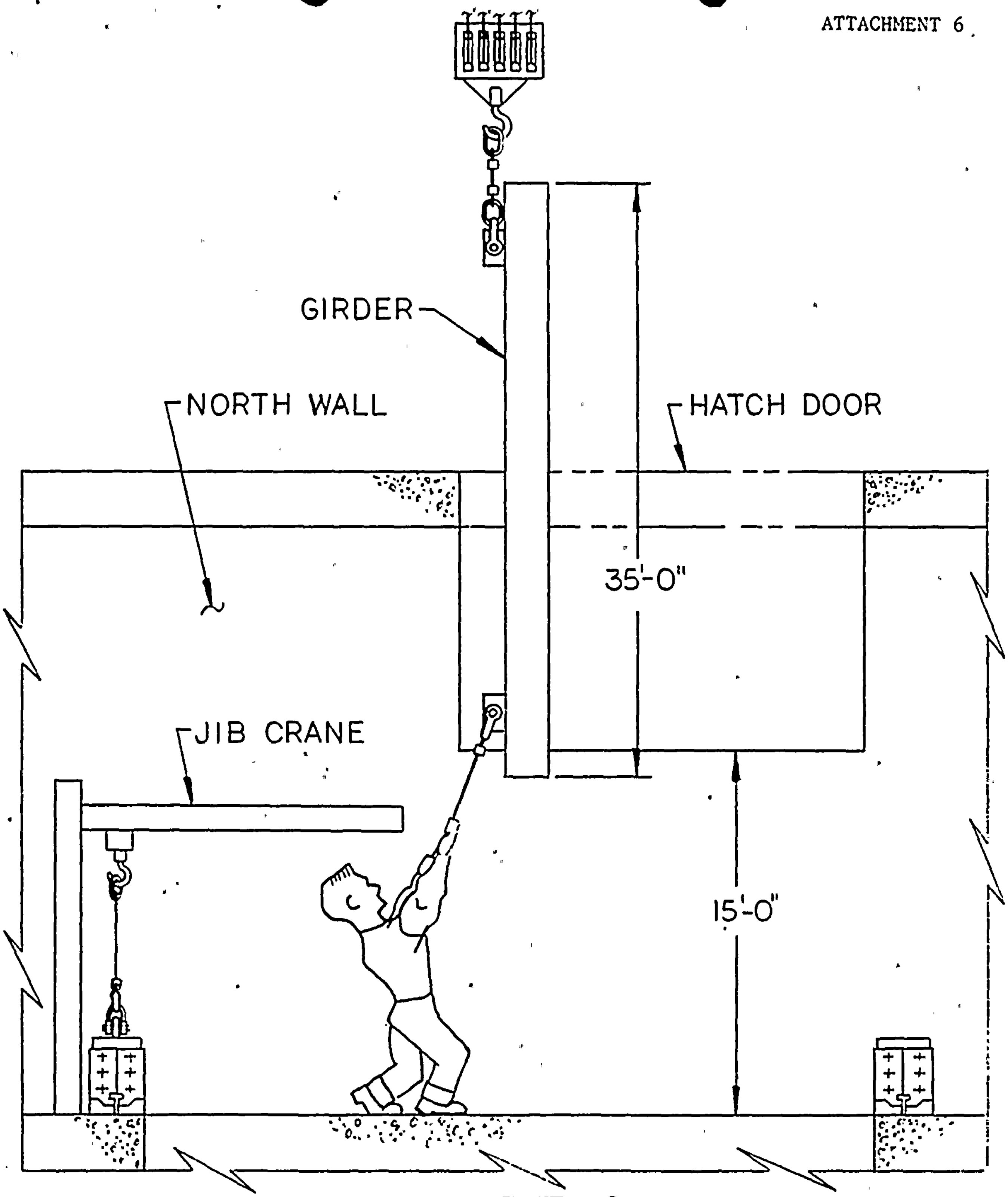

FIGURE 6
LOOKING NORTH

NUC nuclear utility construction

TITLE: SEQUENCE OF PORTABLE HOIST INSTALLATION

ENCLOSURE: 6 OF 9

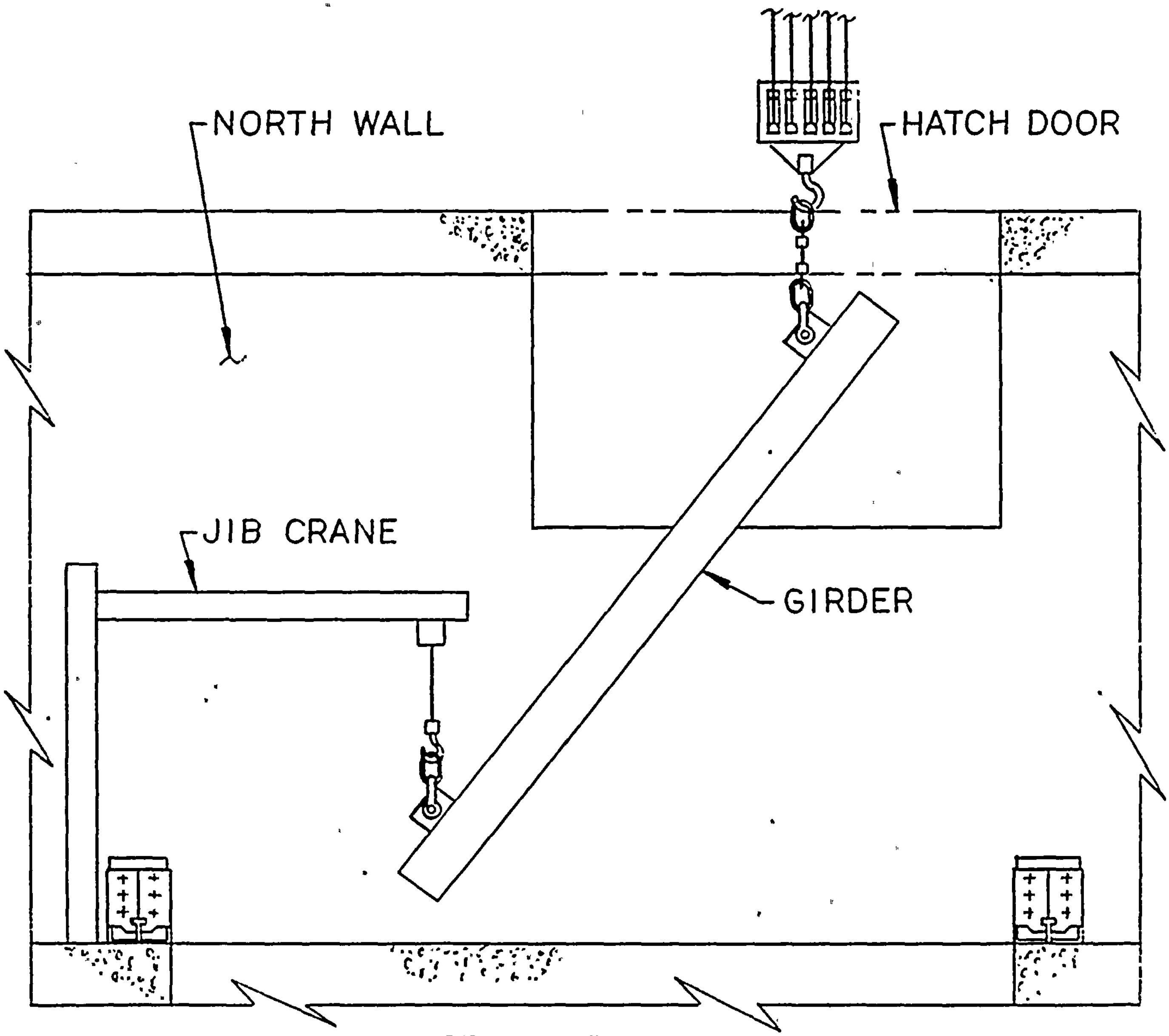

FIGURE 7
LOOKING NORTH

NUC -nuclear utility construction

TITLE: SEQUENCE OF PORTABLE HOIST INSTALLATION

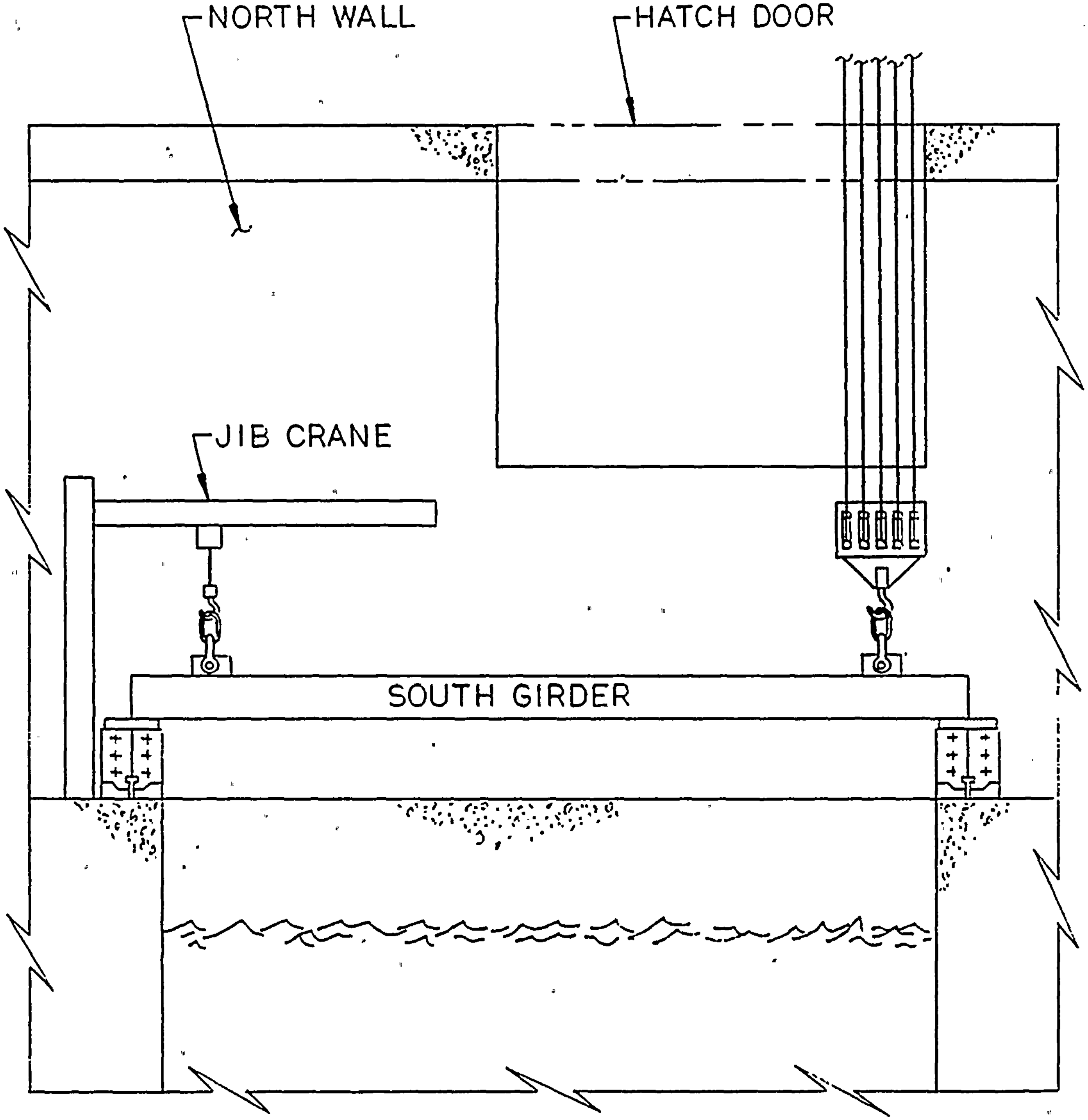

FIGURE 8
LOOKING NORTH

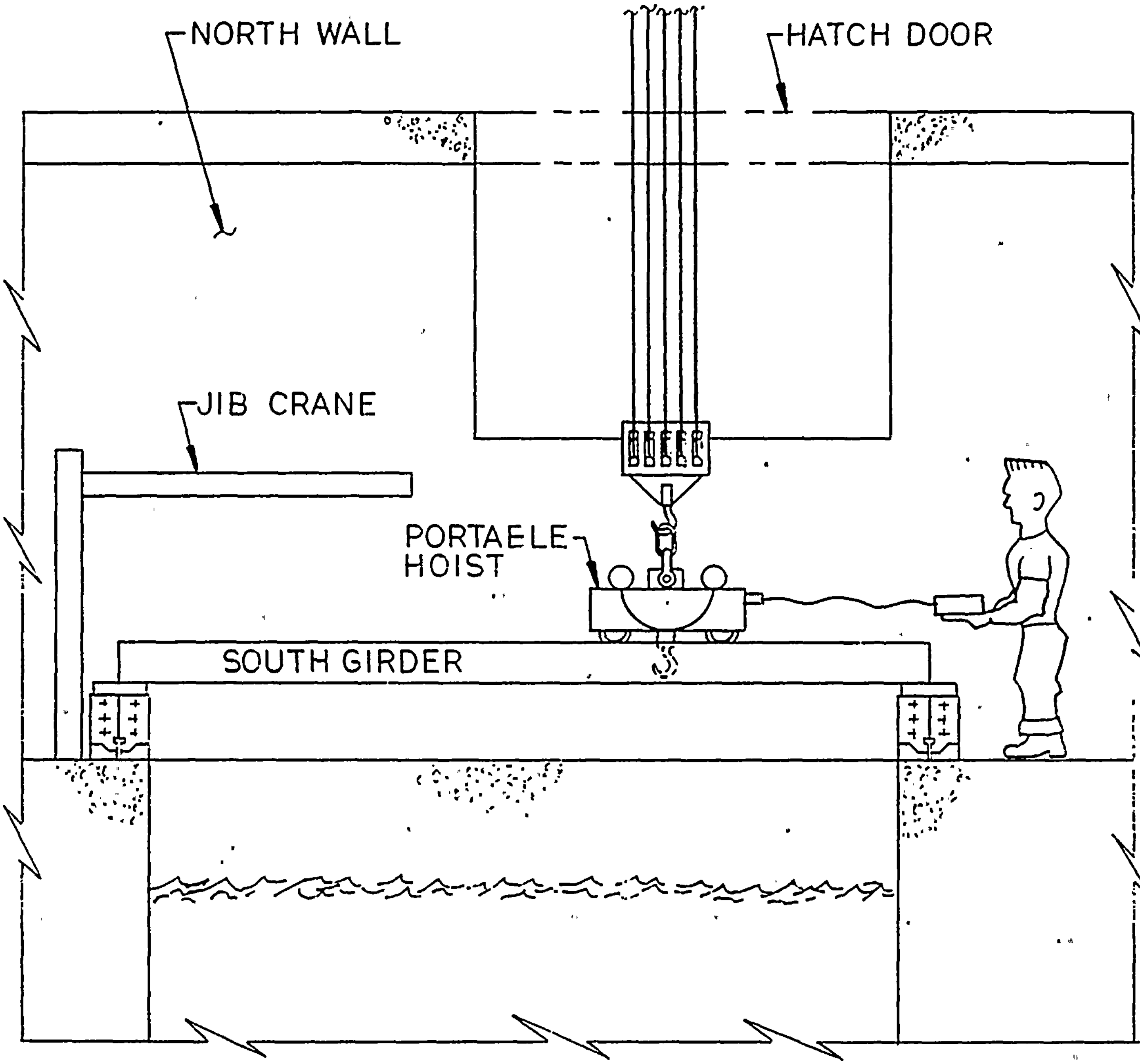

FIGURE 9
LOOKING NORTH

NUC nuclear utility construction

TITLE: SEQUENCE OF PORTABLE HOIST INSTALLATION