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August 29, 1985

Director, Office of Nuclear Reactor Regulation
Attention: J. A. Zwolinski, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Control of Heavy Loads
San Onofre Nuclear Generating Station
Unit 1

References:

1. Letter, D. M. Crutchfield, NRC, to K. P. Baskin, SCE, Control of Heavy Loads Phase I, February 22, 1984
2. Letter, J. L. Rainsberry, SCE, to D. M. Crutchfield, NRC, Control of Heavy Loads, April 11, 1984
3. Letter, K. P. Baskin, SCE, to D. M. Crutchfield, NRC, NUREG-0612, Control of Heavy Loads at Nuclear Power Plants, Supplemental Information Report (SIR), October 21, 1982

Reference 1 provided us with a revised draft Technical Evaluation Report (TER) of the control of heavy loads at San Onofre Unit 1. The TER identified three areas for which additional information was needed to complete the evaluation. Reference 2 indicated that we would be able to provide the information after return-to-service from the seismic backfit outage. Accordingly, the following information regarding the control of heavy loads at San Onofre Unit 1 is provided. The information is formatted to document each area and our corresponding response.

Area No. 1

Provide for the establishment of safe load paths/corridors for loads other than the reactor vessel head, upper internals and movement of the turbine gantry crane, which are chosen to avoid the reactor vessel and minimize movement over residual heat removal (RHR) piping.

SCE Response

In order to address the above concern, safe load paths and load zones have been established for the movement of all heavy loads in containment. These safe load paths and load zones are illustrated in the

A033
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figures shown in Enclosure 1. The safe load paths and load zones were chosen to avoid the reactor vessel and minimize movement over the RHR systems if possible. The load paths and load zones that do not avoid the RHR systems do so only out of necessity due to the location of the equipment being lifted or immovable obstructions. The safe load paths and load zones are intended to cover all circumstances of heavy load handling operations in the San Onofre Unit 1 containment. Any revisions to these figures will be reviewed and approved per the technical review and control requirements of Section 6.0 of the technical specifications. Any additional heavy loads not covered by these figures will be evaluated at the time of the lift as a "special" lift and the lifting operation will be reviewed and approved per the technical review and control requirements of Section 6.0 of the technical specifications.

The safe load paths/zones will be marked on a limited basis in those areas where the load path/zone is not easily discernible to the crane operators via physical limitations. This limited use of temporary markings is justified due to the fact that the reactor service crane is pendant operated, thus markings only visible in the plan view are not useful aids to the crane operator. Additionally, the second person assigned to walk down the lift will have the appropriate safe load path/zone figure in his possession and will be guiding the crane operator during the lift. The temporary markings will be of a nature suitable for guidance of a pendant operated crane (i.e. cones).

Several points of clarification should be made with respect to the figures in Enclosure 1.

(1) The inservice inspection (ISI) tool mentioned in previous submittals was specifically left out because further review indicated that this tool is used infrequently (i.e., 5 and 10 year intervals) and is not the property of SCE. Due to this infrequent use and the fact that different vendors may be contracted to supply the tool, the safe load paths/zones are most appropriately developed and reviewed per the technical review and control requirements of Section 6.0 of the technical specifications.

(2) The CRDM ventilation ducts have an aggregate weight of greater than 1500 lbs, but each piece, when dismantled for removal prior to refueling, weighs on the order of 300 to 400 lbs. However, the load zone for the CRDM duct placement on top of the steam generator doghouse was included since it involves a lifting operation of significant height (i.e., approximately 30 feet) over the refueling deck.

(3) The elevation -10 ft. access and the RCP motor access plugs were referred to as equipment hatches in our previous submittals.

(4) The new heavy loads identified in the figures (the guide studs, the seal ring supports and the pressurizer relief valves) are all small, approximately 2000 to 3000 lb. loads, and are handled with normal rigging, using standard procedures.

Based upon the above discussion and the figures in Enclosure 1, this item is considered resolved for San Onofre Unit 1.

Area No. 2

Provide documentation of performance of initial or periodic load tests for the reactor vessel head and upper guide structure lifting rigs.

SCE Response

We have contacted Westinghouse, the original vendor of the reactor vessel head and upper internals lift rigs, who informed us that prior to approximately eight to ten years ago, no shop proof load testing was performed on these types of lift rigs. They stated that the only test that may have been performed was a field 100% load test prior to the initial lift. This usually consisted of a lift of the design load for approximately 15 minutes and then a visual examination. Our review of past lifting practices at San Onofre Unit 1 indicate that this type of test (i.e., 100% by lifting the reactor vessel head or the upper internals) was the only type that was ever performed on a periodic basis. Based upon this information, we have concluded that no load test as described in ANSI N14.6-1978 was initially or periodically performed on these lift rigs at San Onofre Unit 1.

As stated in our Supplemental Information Report provided to you by Reference 3, the special lift rig inspection program at San Onofre Unit 1 provides for inspections of the reactor vessel head and upper internals lift rigs, in accordance with Section 5 of ANSI N14.6-1978. These inspections will be performed during the next refueling outage that is scheduled to begin November 30, 1985 and on a periodic basis of once per five years. A description of the scope of these inspections and a justification for this scope and the inspection interval are provided below.

Reactor Vessel Head Lift Rig

The reactor vessel head lift rig is required to lift the reactor vessel head which is a load of approximately 65 tons. Our detailed review has shown that during the next refueling outage it is impossible to safely perform a proof load test of this lift rig prior to a lift of the head off the reactor vessel to its storage stand. This is due to the virtually impossible task of transporting the required 97.5 ton (150%) test load into containment for the load test and the reactor vessel head lift rig is not able to be removed from containment for testing. Additionally, the reactor vessel head lift rig consists of two pieces, one of which is virtually integrated into the instrument and control rod drive mechanism packages that rest on top of the reactor vessel head. In lieu of a proof load test, considering both the alternate acceptable approaches discussed in Enclosure 1 to Reference 1 and the fact that the reactor vessel head lift rig has been used to lift the head on 8 prior occasions (initial fuel load and 7 refuelings), the following inspections and testing will be performed during the next refueling outage.

Prior to the reactor vessel head lift a complete visual inspection of the lift rig will be performed. The scope of the inspection will include evaluation of excessive wear or deformation of components. However, the pins in the pinned connections on the reactor vessel head will not be removed, due to the potential hazards to maintenance personnel during reinsertion and realignment. The reactor vessel head will be lifted and sustained at a low height (i.e., less than 6 inches above the flange) for a period of not less than 15 minutes and a visual inspection of the lift rig will again be performed. The head will then be lifted to its storage stand on the refueling deck, via its safe load path. Then at some time during the outage, prior to replacement of the head on the reactor vessel, a proof load test of approximately 125% will be performed. This test will be accomplished by placing the studs and nuts back in the head while it is on the stand and lifting the resultant load. Based upon the approaches discussed in Enclosure 1 to Reference 1 and considering the evaluated design margins in the reactor vessel head lift rig, the testing and inspection of the reactor vessel head lift rig that will be performed during this outage are adequate.

The future periodic inspections may be performed in a manner similar to that described above. However, based upon an evaluation to be performed during this outage, we may elect to defer to the NDE option of ANSI N14.6-1978, Section 5.3.1. To this end we have performed an evaluation of critical components of the reactor vessel lift rig and will determine if NDE is feasible on these components. Therefore, in the future it is our plan to perform either the approximately 125% load test with a visual examination or the NDE as allowed by Section 5.3.1 of ANSI N14.6-1978.

Upper Internals Lift Rig

For the reasons stated above, the upper internals lift rig also does not have documentation of initial or periodic load tests. Therefore, the testing performed during the next refueling outage will be the baseline of future tests.

The upper internals lift rig has been evaluated and its critical components and welds determined. At this time it is not known if the radiation exposure during any testing will allow for an NDE or a load test, but whatever testing is performed will be completed prior to the lift of the upper internals. If a load test is performed, it will be performed at 125% of rated load and may require a removal of part or all of the lift rig from containment, if that is determined to be possible. If the NDE option is chosen, the components will be examined in accordance with Section 5.3.1 of ANSI N14.6-1978. Therefore, in the future it is our plan to perform either the 125% load test with a visual examination or the NDE as allowed by Section 5.3.1 of ANSI N14.6-1978.

Interval and Testing Exceptions

The following justifications are provided for the exceptions taken from ANSI N14.6-1978 in the reactor vessel head and upper internals lift rig test programs described above:

Exception 1: Plant procedures will specify a visual inspection by maintenance or other nonoperating personnel at intervals of eighteen months or prior to next use (i.e., refueling outage), not three months or less as required by Section 5.3.7 of ANSI N14.6-1978. Between periods of use, these devices are stored in a specific location under mild environmental conditions and are not subjected to any other use except the dedicated and specific use mentioned in the description of the devices. Procedures will be revised so that the devices are visually inspected by qualified personnel prior to each use unless the device has been inspected within the last eighteen months. Based on the mild storage environment, dedicated single use, and the complete inspection schedule, described in Exception 2 below, the equivalency of Section 5.3.7 is demonstrated.

Exception 2: The lifting devices will be subjected to NDE and dimensional inspections on intervals longer than those required by Section 5.3(2) of ANSI N14.6-1978. They will be inspected on a 5-year interval based on the very limited and dedicated use of these devices.

The inspection frequencies that have been established for these devices are judged to be equivalent to the intent of ANSI N14.6-1978 in that this standard was intended for cask lifting rigs that are used on a frequent basis (potentially 50 to 100 times in a year), and such lifting rigs would be subjected to potential abuse in transportation between sites as well as harsh environments during transportation.

Since the lifting devices identified above for San Onofre Unit 1 are typically used on approximately an eighteen month basis to support refueling operations, the frequency of use is considerably less than that of the lifting rigs for which ANSI N14.6-1978 was intended. Additionally, these San Onofre Unit 1 special lifting devices are stored and used in an area where they will not be subjected to harsh environments.

Accordingly, while the visual inspections of the lifting rigs will be performed on an eighteen month (i.e., refueling outage) basis, the more difficult and time consuming nondestructive examinations and dimensional examinations will be performed at a five year interval, corresponding to a regularly scheduled refueling outage.

Exception 3: Section 5.3.3 of ANSI N14.6-1978 requires that special lifting devices be load tested according to Section 5.2.1 to 150% of maximum load following any incident in which any load-bearing component may have been subjected to stresses substantially in excess of those for which it was qualified by previous testing, or following an incident that may have already developed due to the overstressed conditions. It is prudent and practical to perform the dimensional examinations for deformation and the nondestructive examinations for defects to determine whether the device is still acceptable for use rather than to subject the device to 150% load testing. If defects or deformation are detected, then the device shall be repaired or modified and then tested to 125% load (consistent with typical initial proof load tests) followed by examination for defects or deformation. This alternative achieves the same objective as Section 5.3.3 of the standard.

Based upon the above discussed testing and justifications, this item is considered resolved for San Onofre Unit 1.

Area No. 3

Provide documentation that the design of the crane bumper and stops is consistent with CMAA-70 or demonstration that adequate precautions exist in administrative procedures to limit travel near the end of bridge or trolley movement.

SCE Response

The San Onofre Unit 1 reactor service and turbine gantry cranes were designed and fabricated by P&H Harnischfeger in Norwalk, California in accordance with the criteria of Bechtel Corporation Specification BSO-254 of April 17, 1964. The cranes were built prior to the issuance of CMAA-70-1975 and were designed to the governing criteria in EOCI #61, "Specifications for Electric Overhead Traveling Cranes," predecessor to CMAA-70. Numerous criteria in CMAA-70 differ in detail from the corresponding criteria in EOCI #61; in some cases, criteria have been added to CMAA-70 which were entirely absent in EOCI #61. Nevertheless, the bridge and trolley bumpers and stops for these cranes have been evaluated against the criteria in Section 4.12 of CMAA-70, "Bumpers and Stops." The results of this evaluation are provided in Tables 1 and 2 of Enclosure 2 to this letter.

The bridge and trolley bumpers and stops for the reactor service and turbine gantry cranes comply with the criteria of Section 4.12 of CMAA-70 with one exception. CMAA-70-1975 specifies deceleration and stopping criteria for bridge and trolley bumpers and stops. Such rigid quantitative criteria had not been developed at the time the reactor service and turbine gantry cranes were designed and fabricated. Therefore, it was not possible to explicitly demonstrate compliance with the criteria of Sections 4.12.1 and 4.12.3 of CMAA-70.

As stated in Enclosure 3 of the NRC's December 22, 1980 letter regarding control of heavy loads, for instances where specific compliance with CMAA-70 cannot be determined, equivalency must be demonstrated. To that end, a review of plant procedures related to crane checkout and operation was performed to determine if adequate precautions currently exist in these procedures to limit travel near the end of bridge and trolley movements. The results of this review are summarized below.

Plant Maintenance Procedure No. S01-1-7.28, "Reactor Service Crane Checkout and Operation," contains precautions which:

- o Specifically prohibit bypassing, overriding or exceeding any crane limit without specific written authorization (Section 4.7);
- o Require a second person to walk down the lift path and guide the crane operator, as appropriate (Section 4.16); and
- o Require the operator to back away from bridge and trolley limits if the bridge or trolley should activate a limit switch (Section 6.3.4 and 6.3.5).

These requirements provide adequate assurance that travel near the end of bridge and trolley movement is controlled. Therefore, compliance with the criteria of Section 4.12.1 and 4.12.3 of CMAA-70 has been demonstrated via equivalence for the reactor service crane. Table 2 of Enclosure 2 reflects the above review results.

Plant Maintenance Procedure No. S01-1-7.27, "Turbine Gantry Crane Checkout and Operation," contains precautions which:

- o Specifically prohibit bypassing, overriding or exceeding any crane limit without specific written authorization (Section 4.8); and
- o Require a second person to walk down the lift path and guide the crane operator, as appropriate (Section 4.11).

Consistent with the precautions for the reactor service crane, the turbine gantry crane procedure will be revised to:

- o Require the operator to back away from trolley limits if the trolley should activate a limit switch; and

- o Require the crane operator to operate the bridge at the lowest possible speed when operating in the north and south turbine deck extension areas.

The precautions currently in the existing procedure, coupled with the above revisions, will provide adequate assurance that travel near the end of bridge and trolley movements is controlled. Therefore, compliance with the criteria of Section 4.12.1 and 4.12.3 of CMAA-70 will be demonstrated via equivalence for the turbine gantry crane. Table 1 of Enclosure 2 reflects the above review results.

SCE recognizes the need for crane operating personnel to bypass the above discussed limits on both the reactor service and turbine gantry cranes bridges and trolleys. These actions will be accomplished via clear procedural controls.

Based upon the above discussed information this item is considered resolved for San Onofre Unit 1.

Our review of the heavy load handling commitments has indicated another open area regarding the reactor coolant pump lift and equipment hatch rigs. Reference 1 indicated that these lift rigs were in compliance based upon our proposal to procure new rigs by September 1983. Since this backfit has been deferred by its placement on the Integrated Living Schedule for San Onofre Unit 1, an interim evaluation is required. This evaluation is provided below.

The equipment hatch lift rigs mentioned in our previous submittals are completely selected from standard sling and rigging stock. Rigging selection criteria have been established and the inspection and maintenance are covered by our rigging control program. Therefore, further review of these lift rigs is not necessary.

The reactor coolant pump (RCP) motor lift rigs consist of three slings shackled to a trunion. The free ends attach to the RCP motor housing by the use of specially designed hooks. Since the slings and rigging equipment come from standard rigging stock, selection criteria have been developed and the inspection and maintenance of these components are covered in our sling and rigging control program. Therefore, the only "special" components of the RCP motor lift rigs are the hooks. Since no design information is available on these hooks, prior to their use in the next refueling outage they will be tested to a load test of 150% of the maximum load to which they are subjected. After sustaining the load for a period of not less than ten minutes, the hooks will be nondestructively examined in accordance with Section 5.5 of ANSI N14.6-1978, which states that:

- o Inspections utilizing liquid penetrant or magnetic particle examination shall be performed by written procedures and by personnel, both qualified in accordance with the rules in the current edition of ASME Boiler and Pressure Vessel Code, Section V, Articles 1, 6, 7, 24 and 25.

- o Liquid penetrant and magnetic particle acceptance standards shall be as indicated in paragraphs NF-5350 and NF-5340 of the current edition of ASME Boiler and Pressure Vessel Code, Section III, Division 1.

The periodic inspection requirements (period not to exceed 14 months or prior to next use, whichever is later) to which the RCP motor lift rigs will be subjected to are either of the following:

- o A load test equal to 150% of the maximum load to which the device is subjected followed by a visual inspection of critical areas, including major load bearing welds; or

- o In cases where surface cleanliness and conditions permit, the load testing may be omitted, and dimensional testing, visual inspection and nondestructive testing of major load bearing welds and critical areas in accordance with Section 5.5 of ANSI N14.6-1978 shall suffice.

Consistent with Section 5.3.1 of ANSI N14.6-1978, recommended inspection and testing requirements will be established for these hooks. These guidelines, when incorporated into appropriate plant procedures, will meet the provisions of Section 5 of ANSI N14.6-1978 except as described in Exceptions 1 and 2 previously stated in our response to Open Area No. 3.

The above discussed information resolves all of the open heavy loads issues for San Onofre Unit 1. If you have any questions, please let me know.

Very truly yours,

M. O. Medford

M. O. Medford
Manager, Nuclear Licensing

LAB:4695F
Enclosures

cc: F. R. Huey, USNRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

bcc: (See attached sheet)

ENCLOSURE 1

SAFE LOAD PATHS

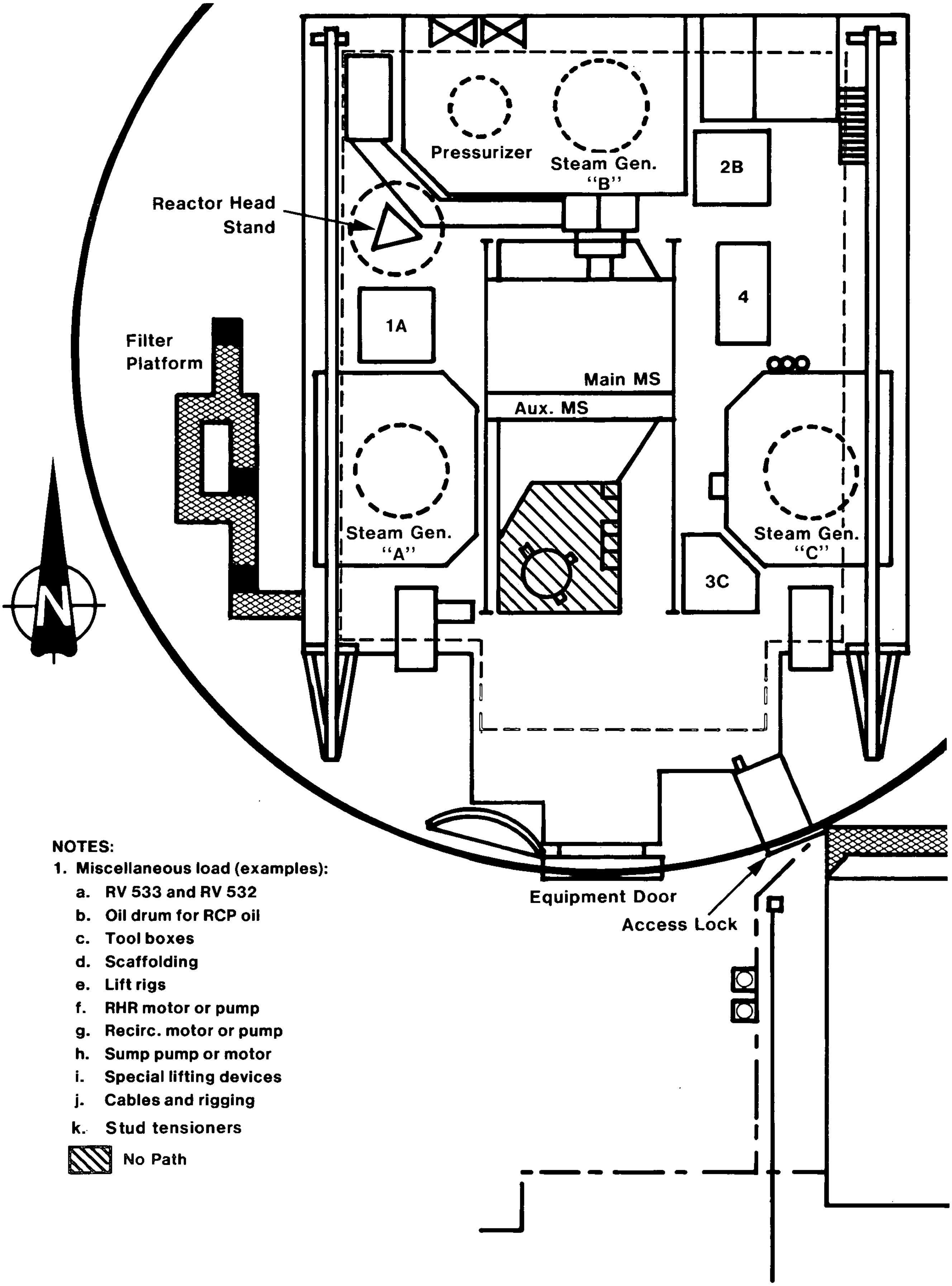
AND

SAFE LOAD ZONES

FOR

SAN ONOFRE UNIT 1

Miscellaneous Load Zone With Missile Shield Installed

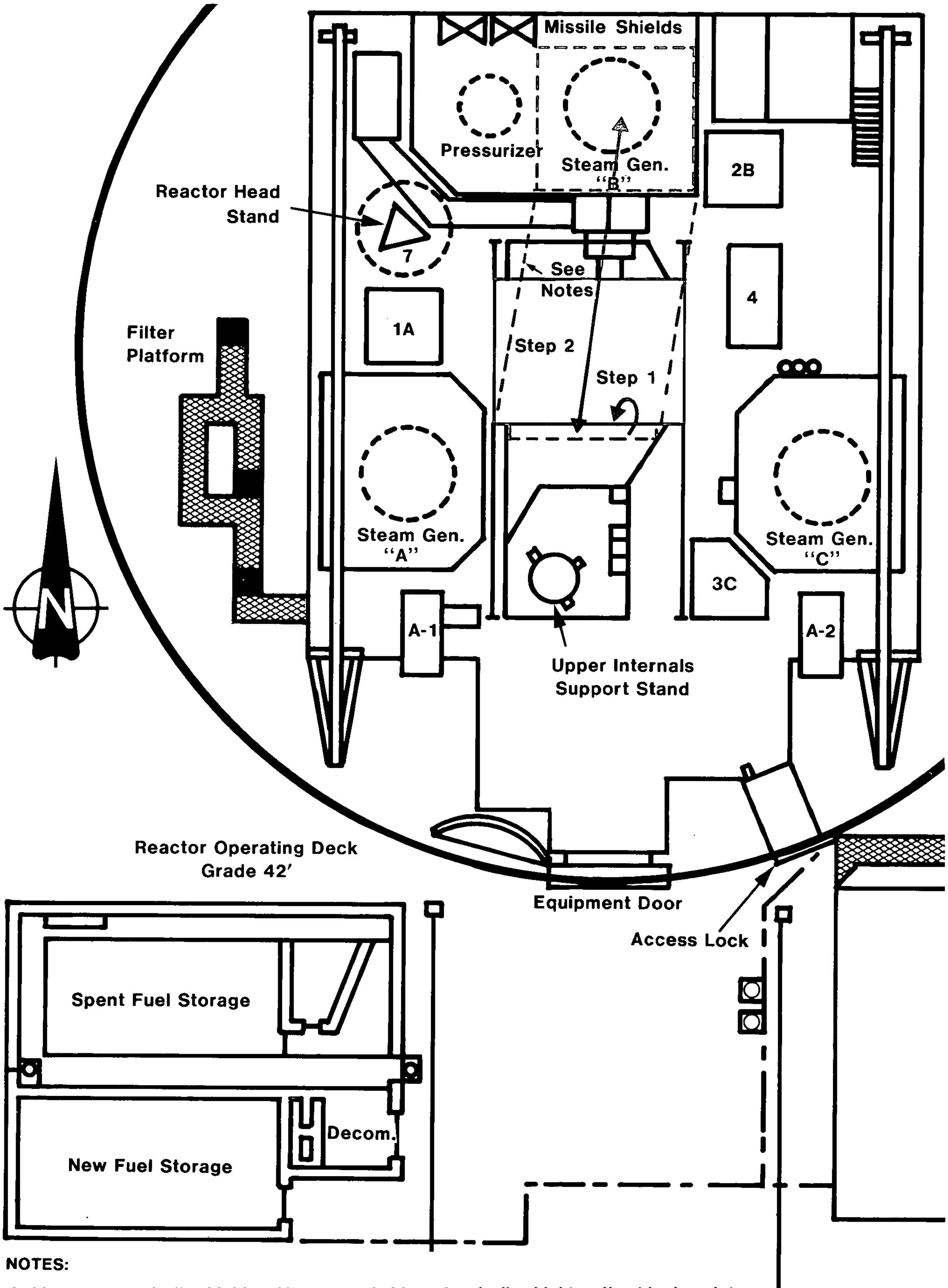


NOTES:

1. Miscellaneous load (examples):
   a. RV 533 and RV 532
   b. Oil drum for RCP oil
   c. Tool boxes
   d. Scaffolding
   e. Lift rigs
   f. RHR motor or pump
   g. Recirc. motor or pump
   h. Sump pump or motor
   i. Special lifting devices
   j. Cables and rigging
   k. Stud tensioners

No Path

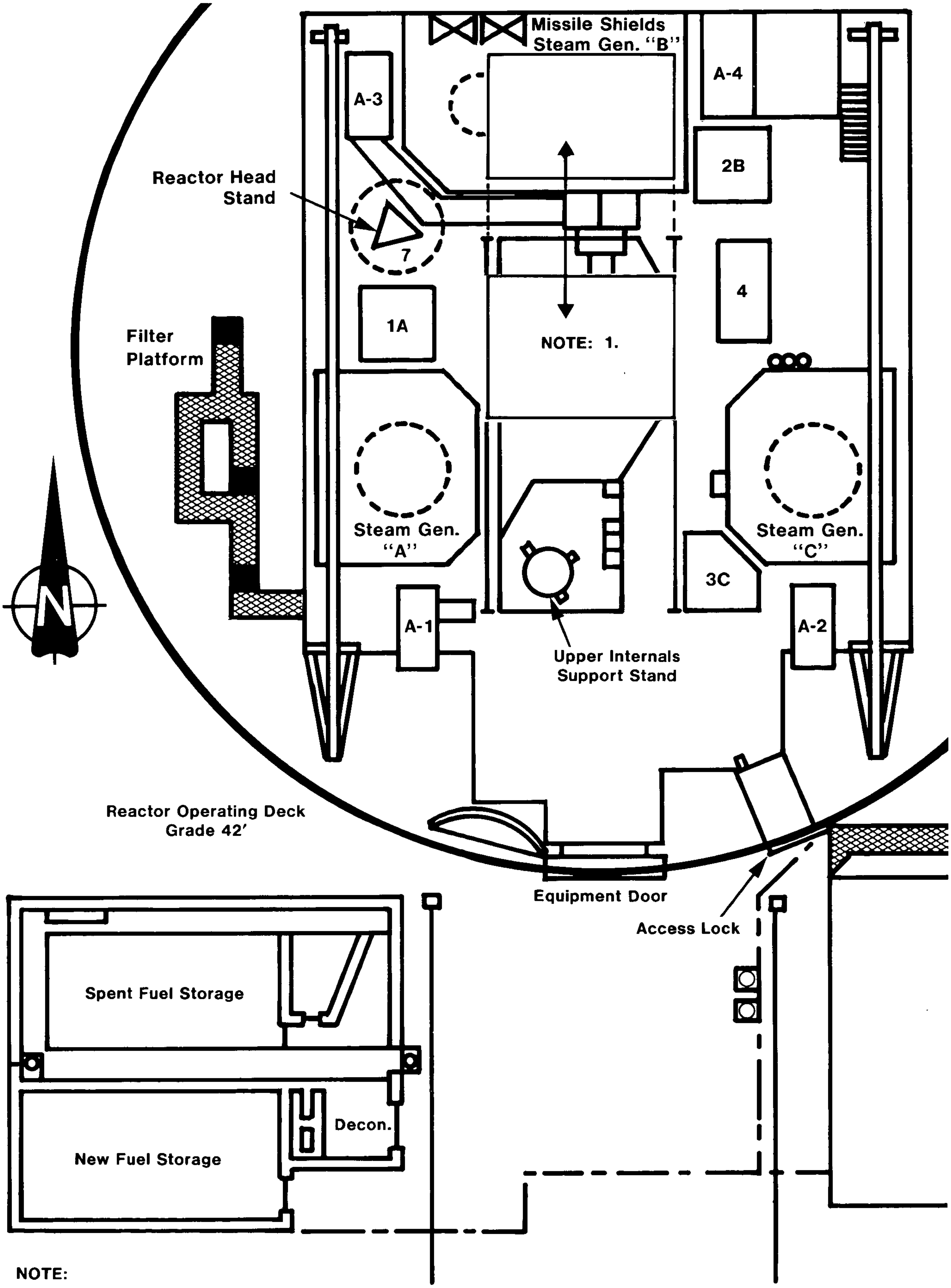
Auxiliary Shield Safe Load Path



NOTES:

1. Lift auxiliary missile shield and lay on west side main missile shield mating hinging plates.
2. Flat rig and lift shield to steam generator dog house.
3. Store in the furthest north position.

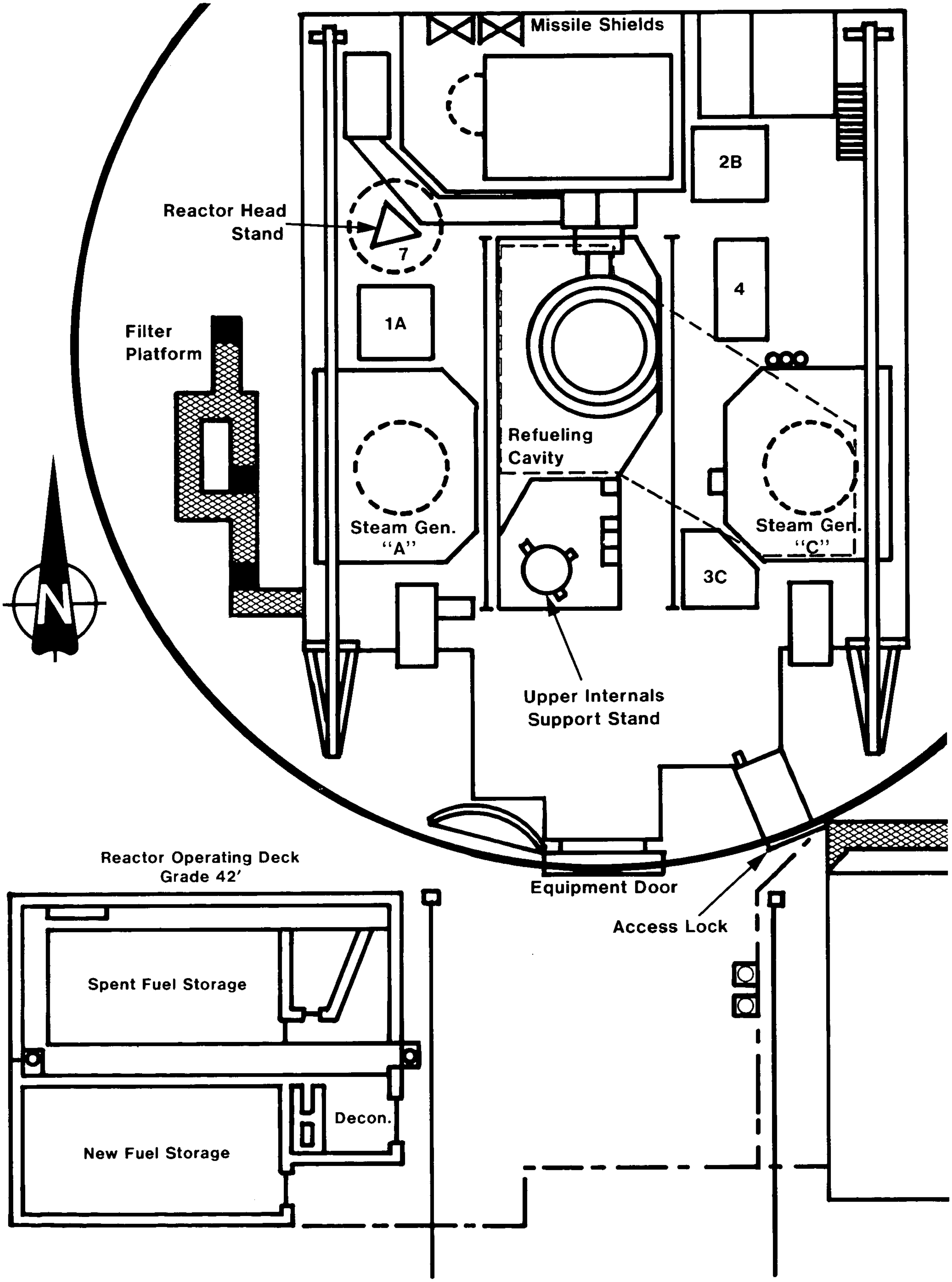
Main Missile Shield Safe Load Path



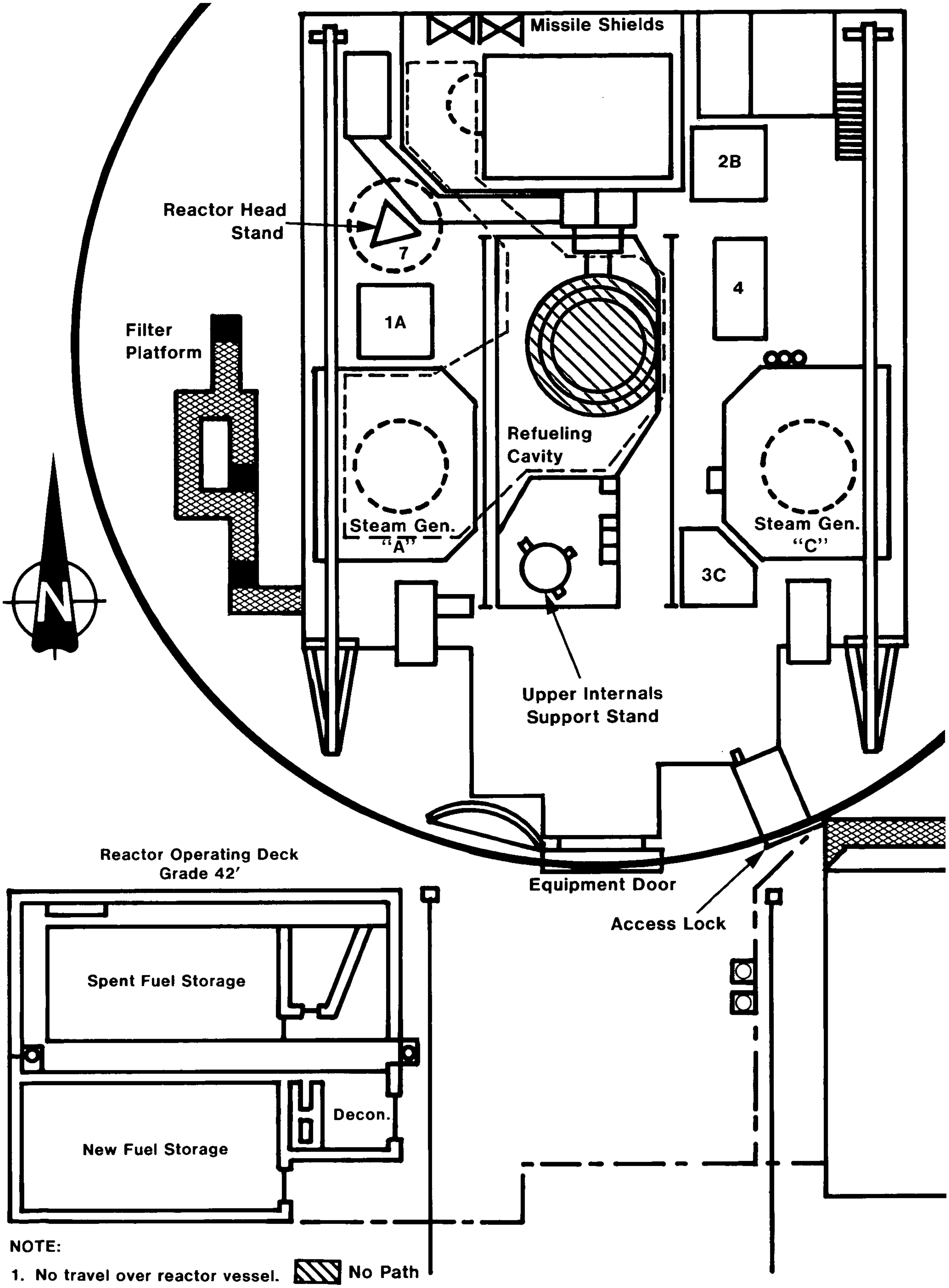
NOTE:

1. Place on top of auxiliary missile shield in furthest north position on top of Steam Generator "B" doghouse.

Load Zone for CRDM Ventilation Ducting With Missile Shield Removed and Head In Place



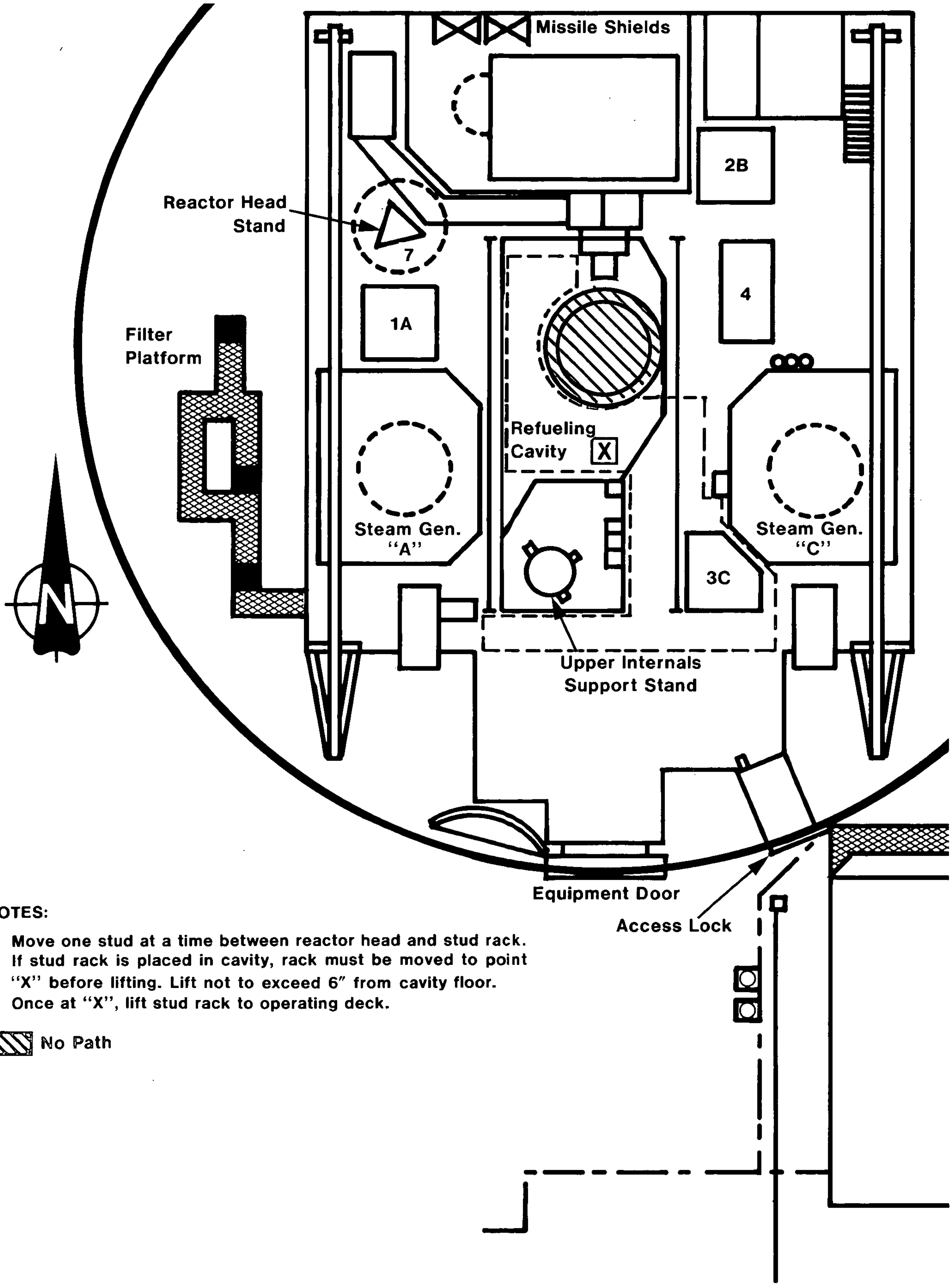
Load Zone for Seal Ring Supports With Head On, Shield Off



NOTE:

1. No travel over reactor vessel.

Load Zone for Reactor Vessel Stud Rack With Missile Shield Removed, Reactor Vessel Head Installed

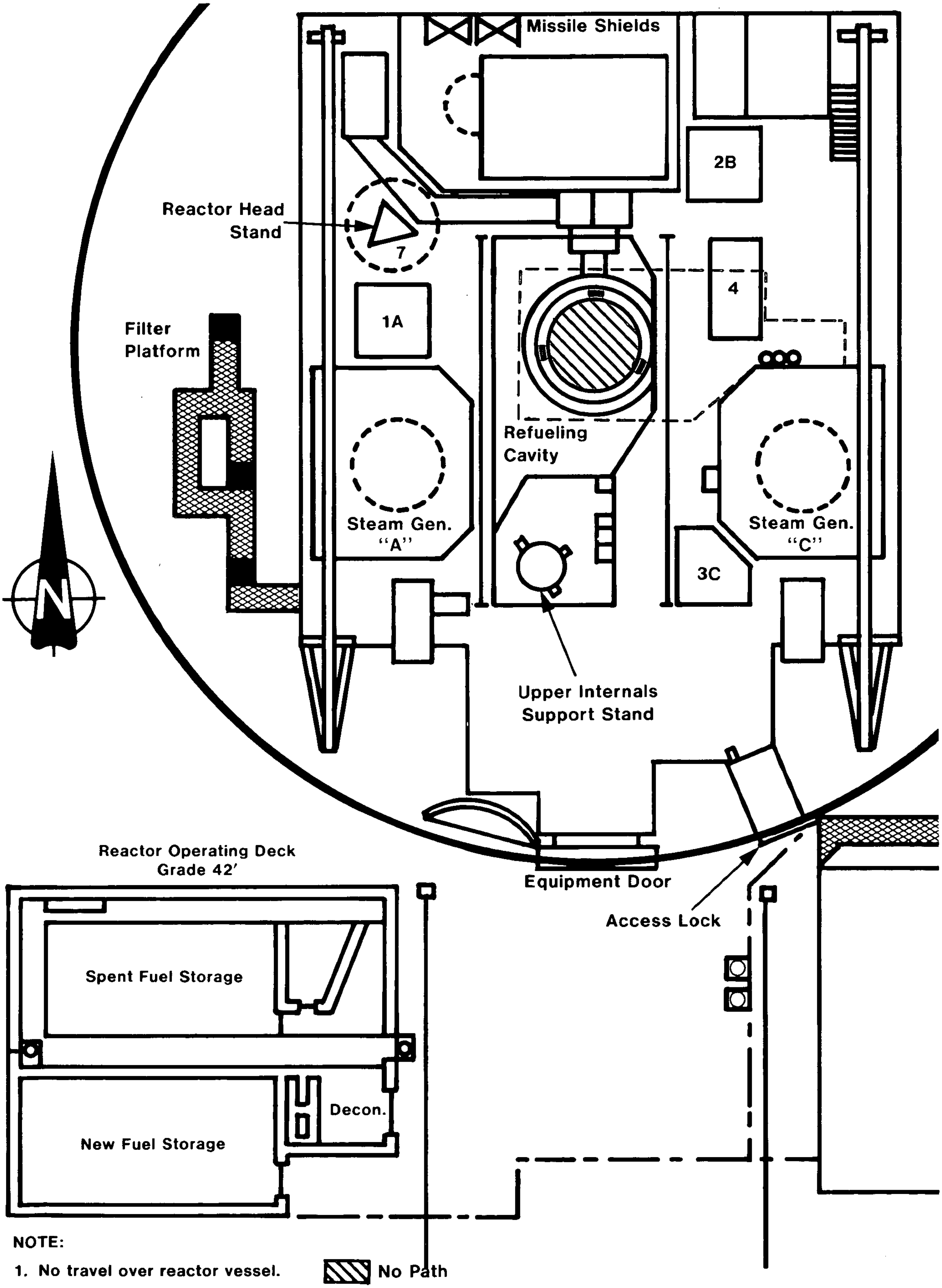


NOTES:

1. Move one stud at a time between reactor head and stud rack.
2. If stud rack is placed in cavity, rack must be moved to point "X" before lifting. Lift not to exceed 6″ from cavity floor. Once at "X", lift stud rack to operating deck.

No Path

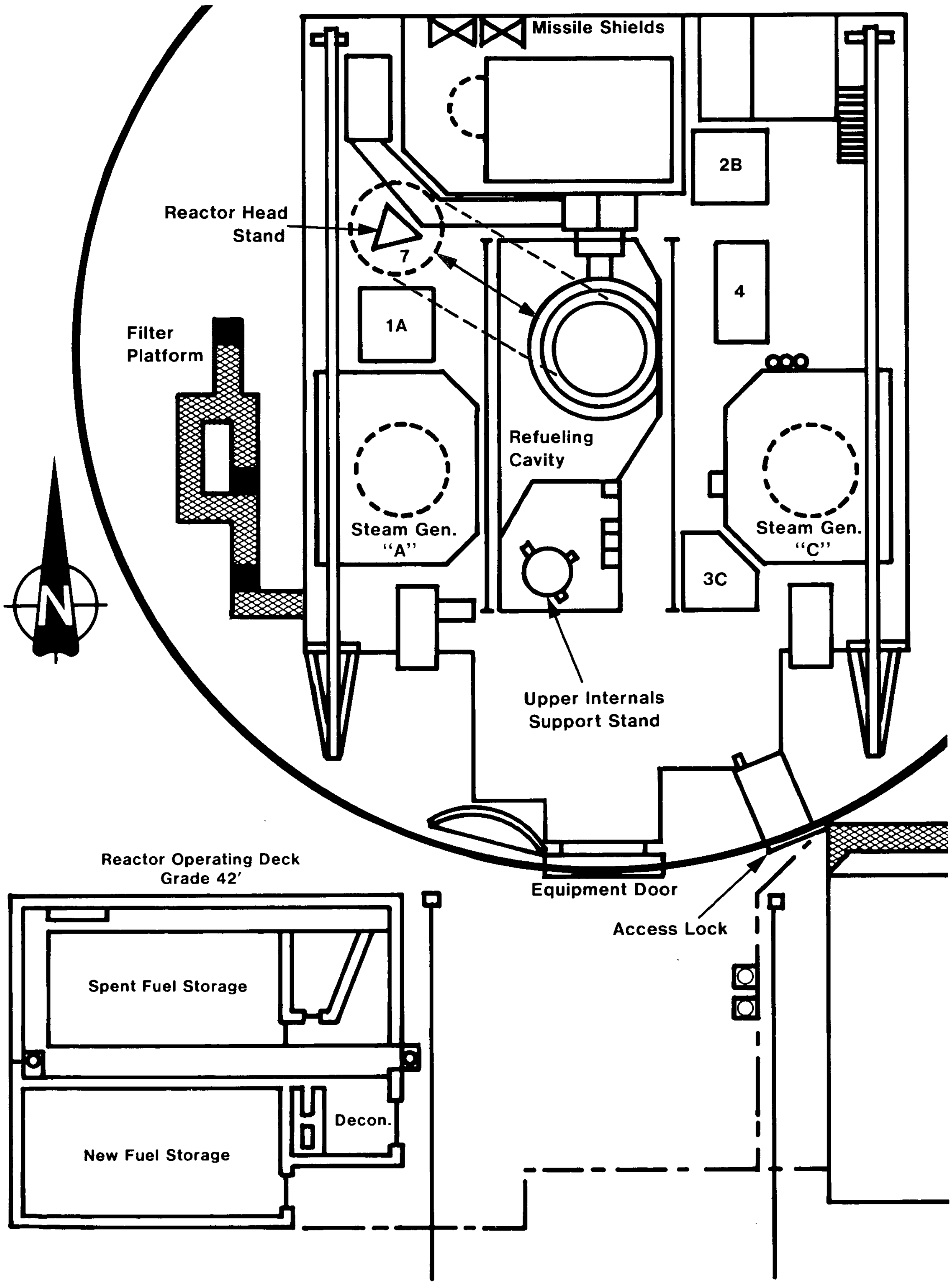
Load Zone for Guide Studs Installation and Removal, With Missile Shield Removed



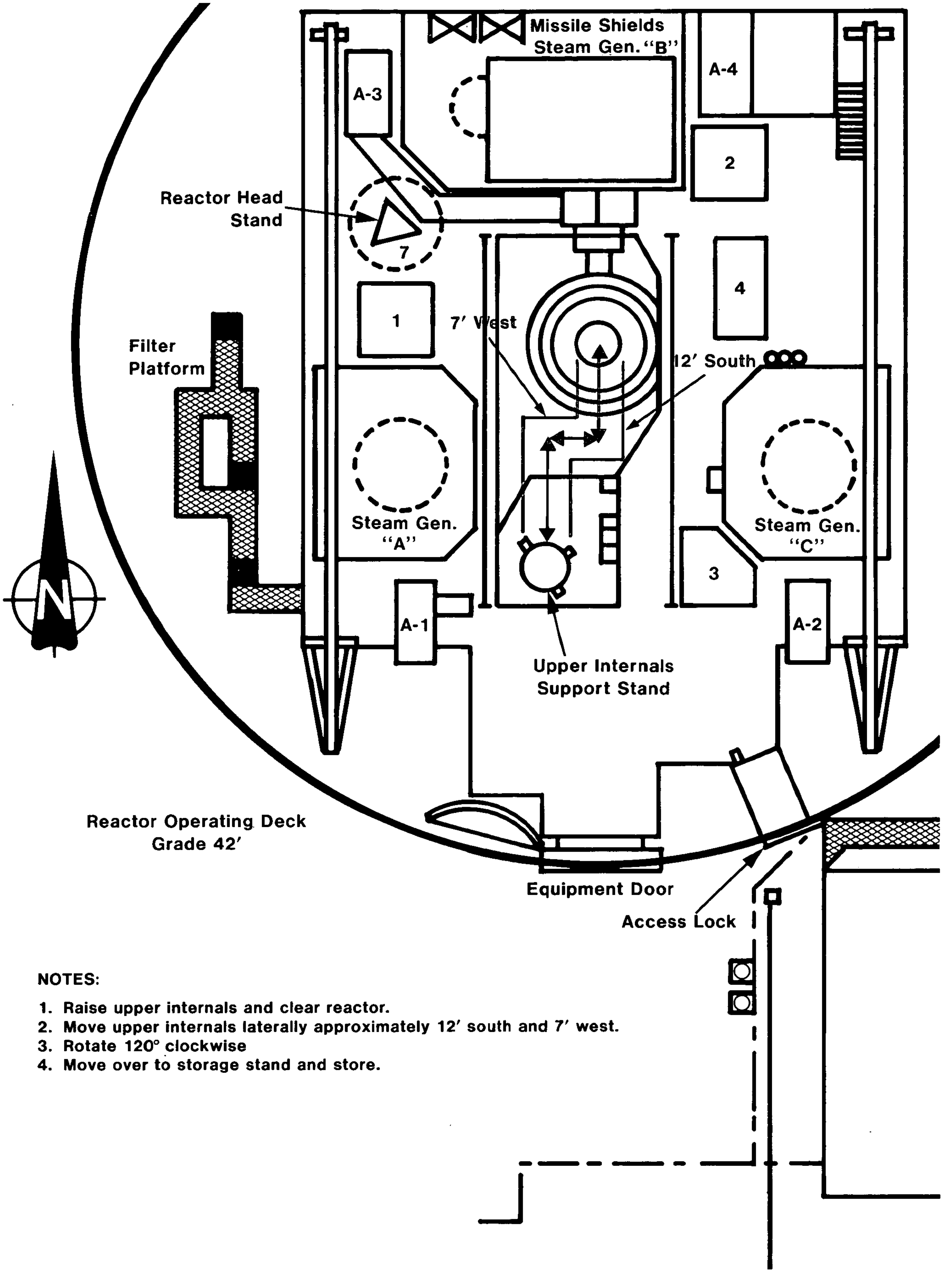
NOTE:

1. No travel over reactor vessel.

Reactor Vessel Head Safe Load Path



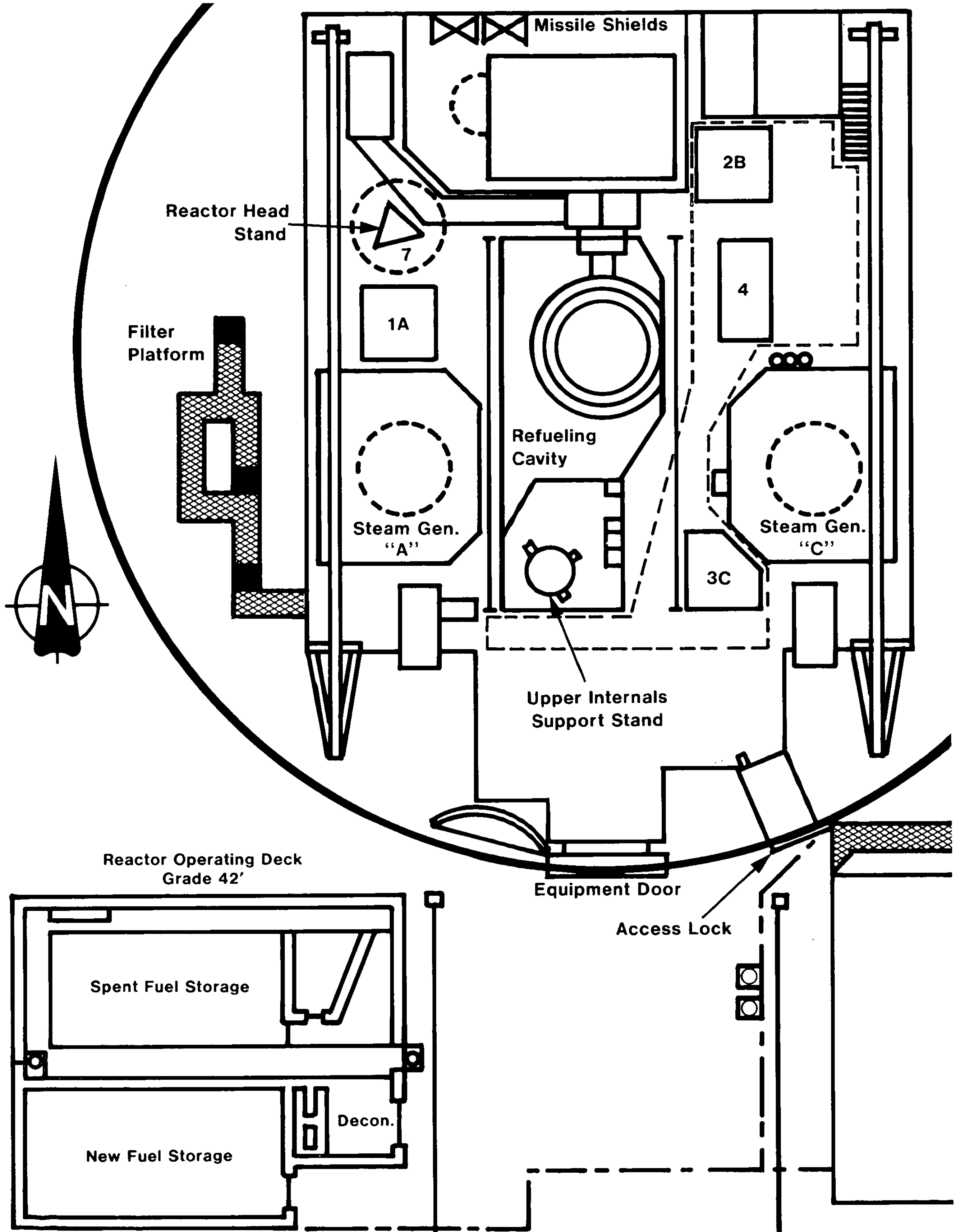
Internals Safe Load Path



NOTES:

1. Raise upper internals and clear reactor.
2. Move upper internals laterally approximately 12′ south and 7′ west.
3. Rotate 120° clockwise
4. Move over to storage stand and store.

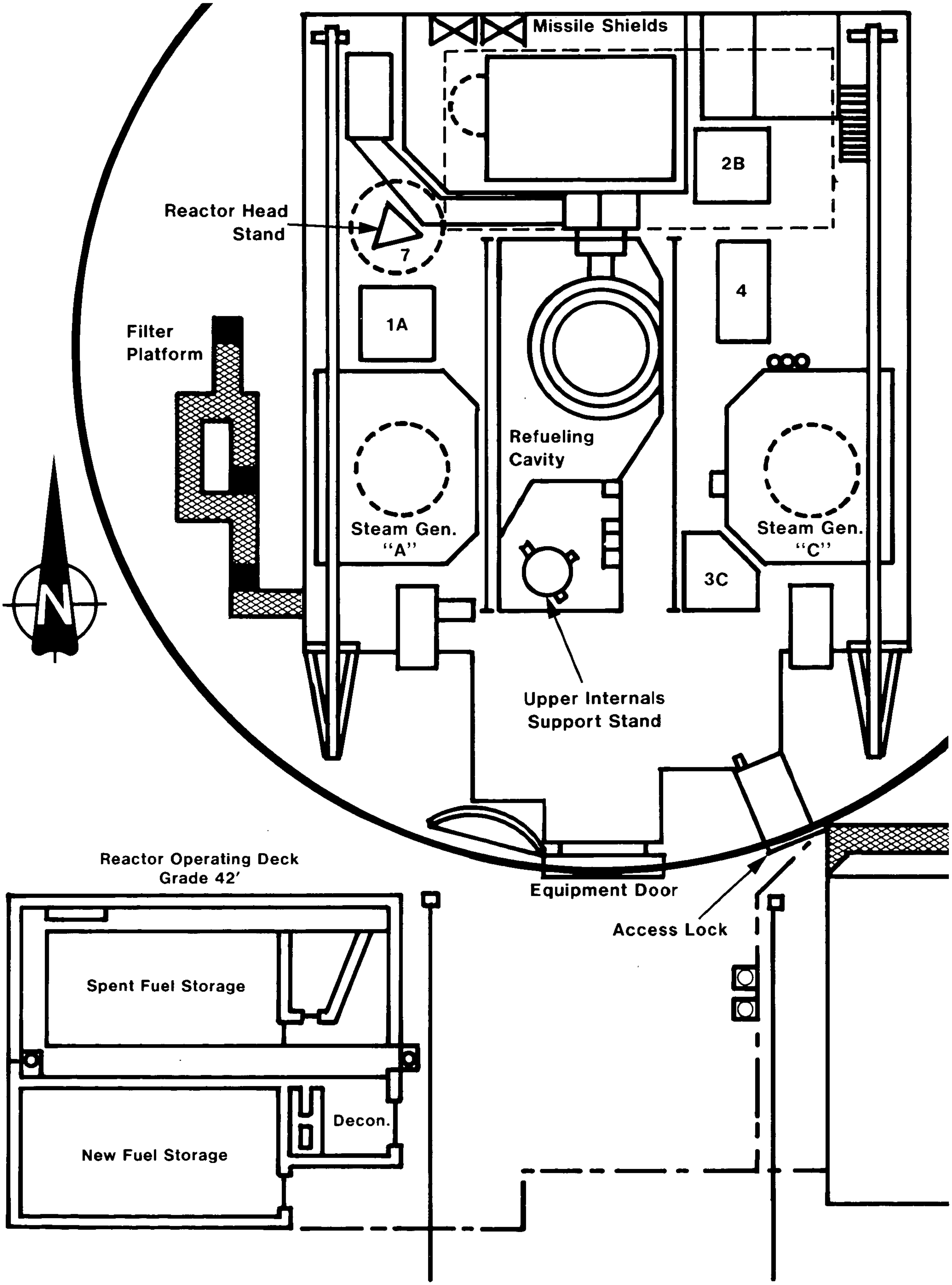
Miscellaneous Load Zone With Missile Shield Removed and Reactor Head Removed



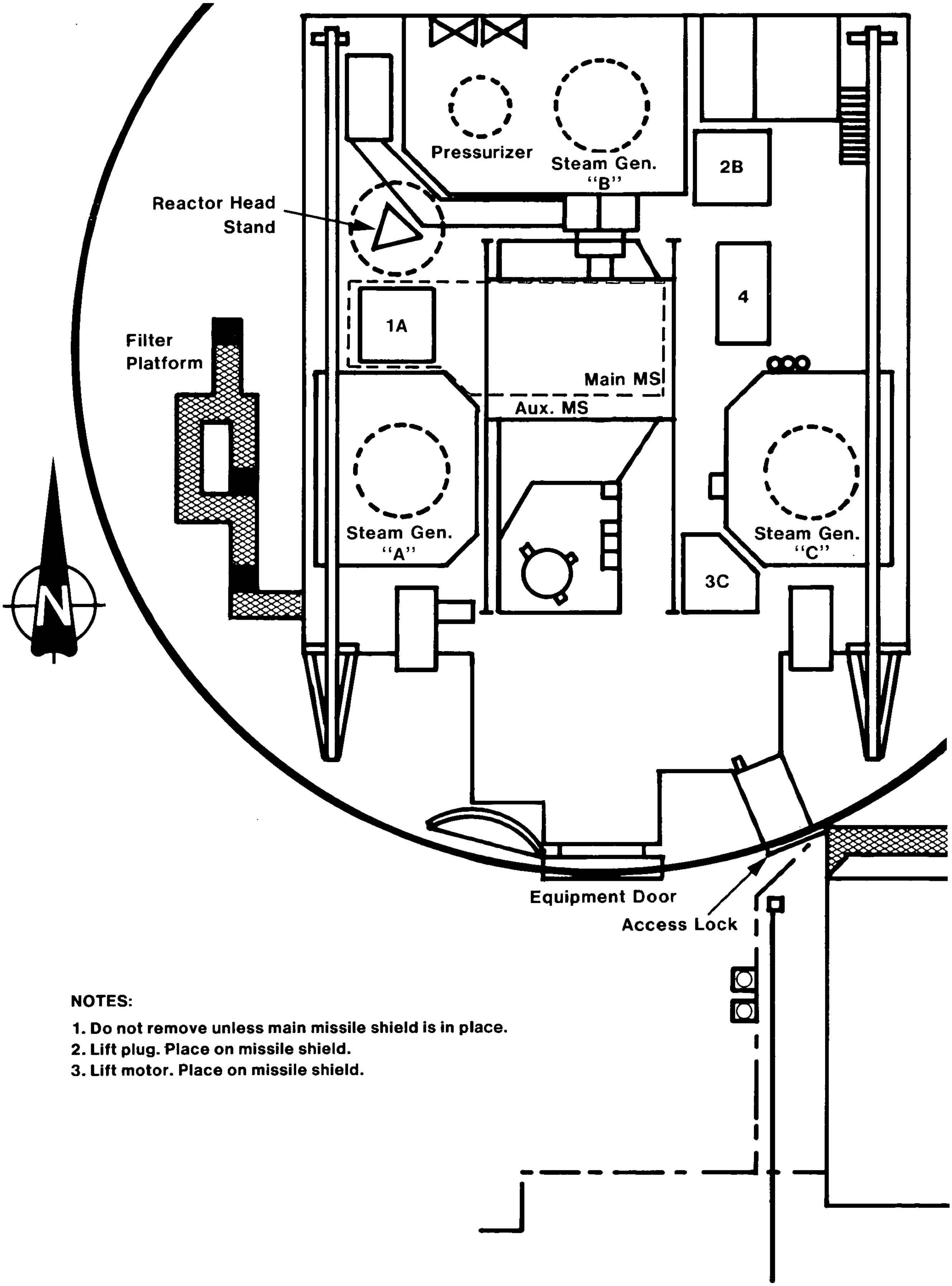
NOTE:

1. Whenever possible, restrict lifts $\leq$ 12″.

Load Zone for PZR Relief Valves With Missile Shield Removed



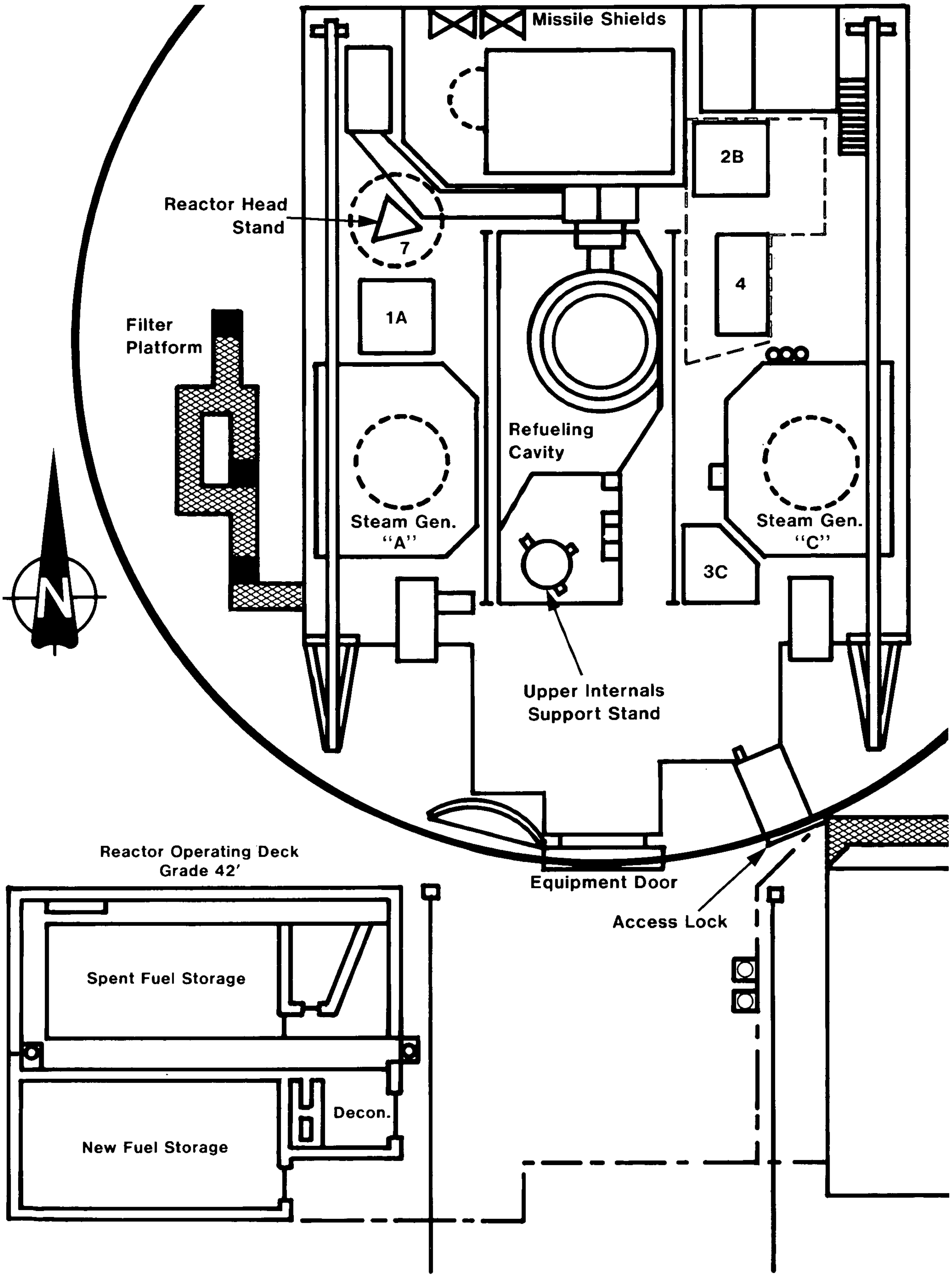
Load Zone for RCP "A" Access Plug and Motor Removal and Installation, With Missile Shield in Place



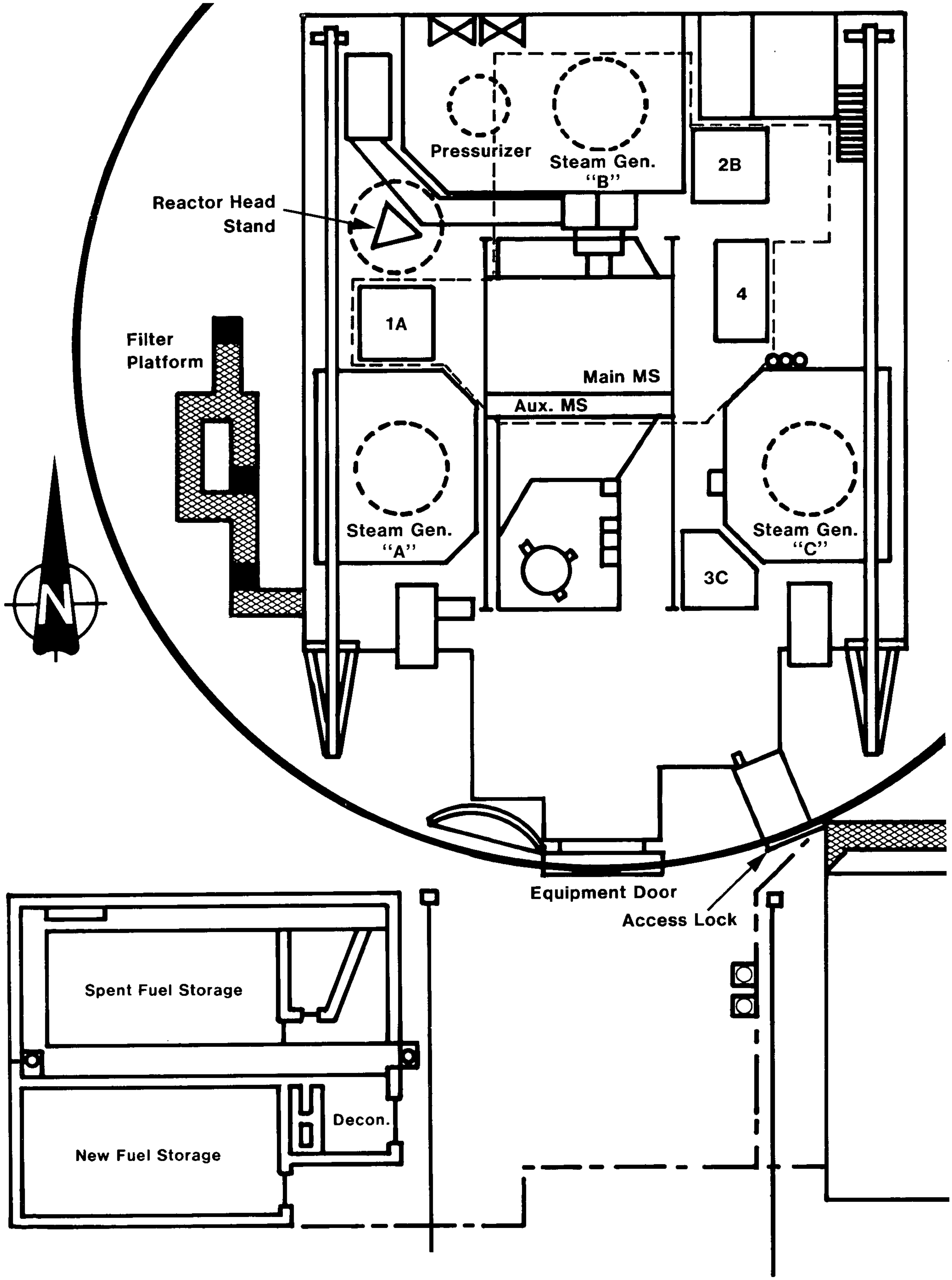
NOTES:

1. Do not remove unless main missile shield is in place.
2. Lift plug. Place on missile shield.
3. Lift motor. Place on missile shield.

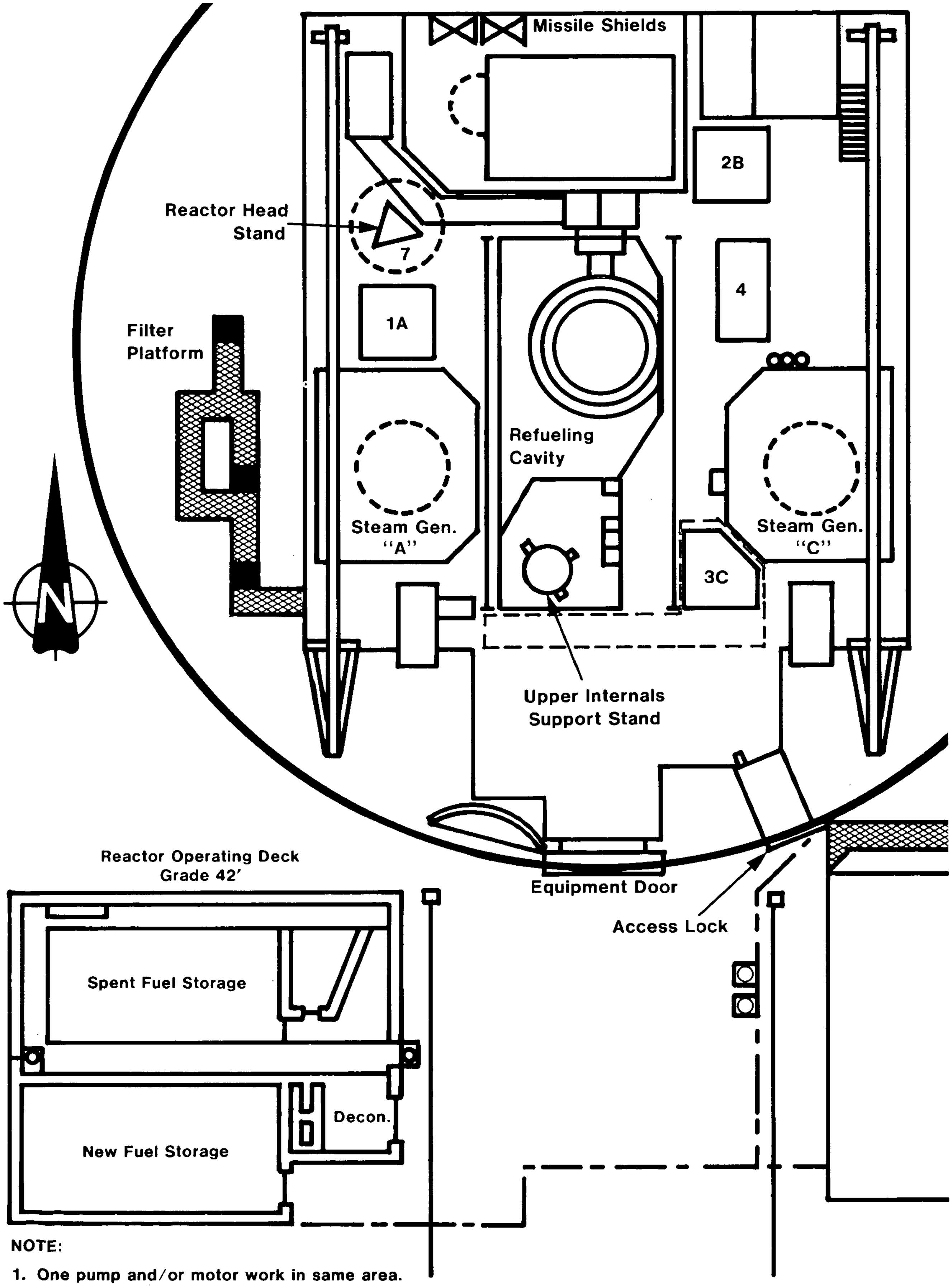
Load Zone for RCP "B" Motor Access Plug and Motor Removal and Installation With Missile Shield Removed, With or Without Head Installed



Load Zone for RCP "B" Motor Access Plug and Motor Removal and Installation, With Missile Shield in Place



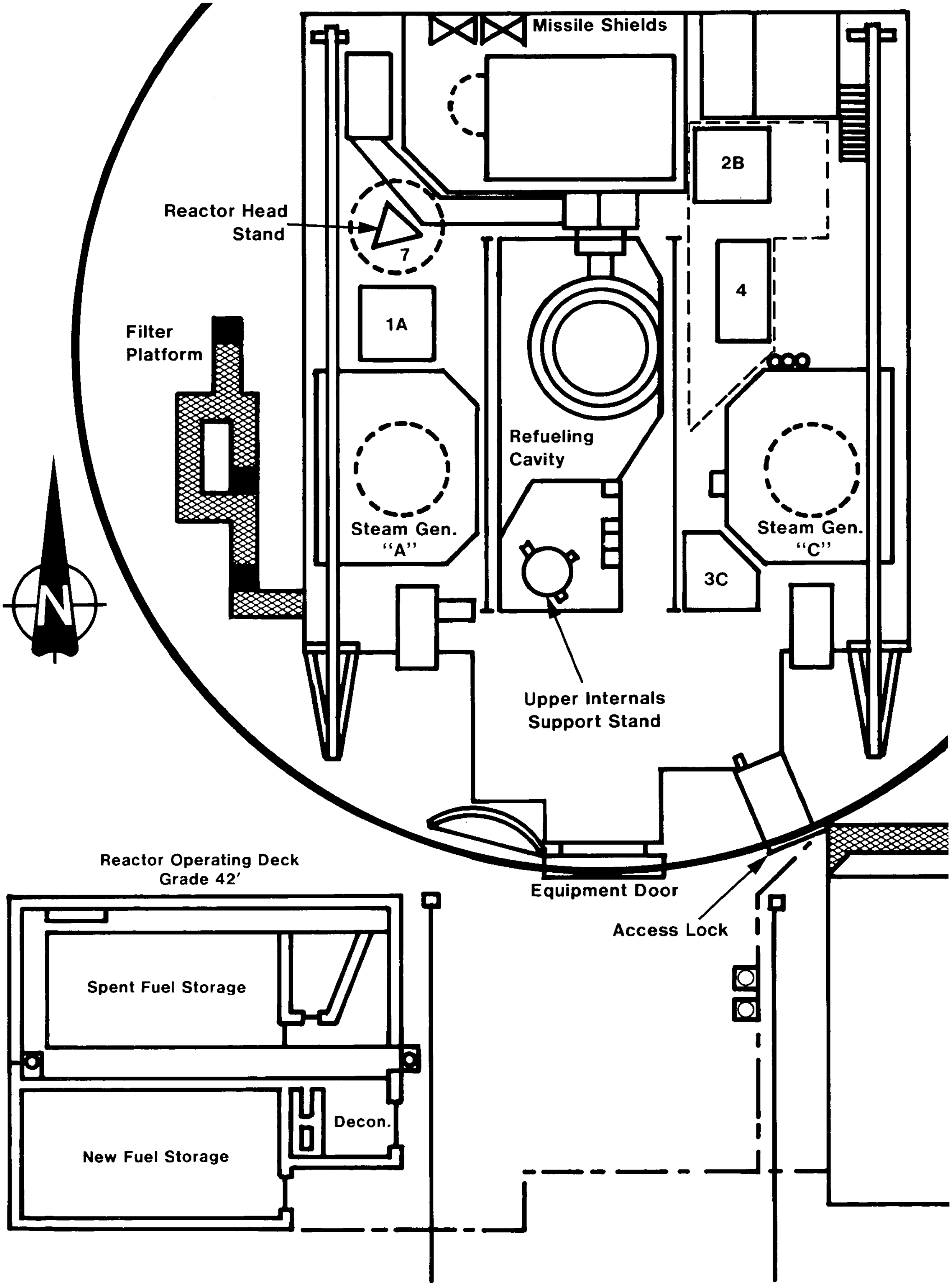
Load Zone for RCP "C" Plug Removal for All Conditions



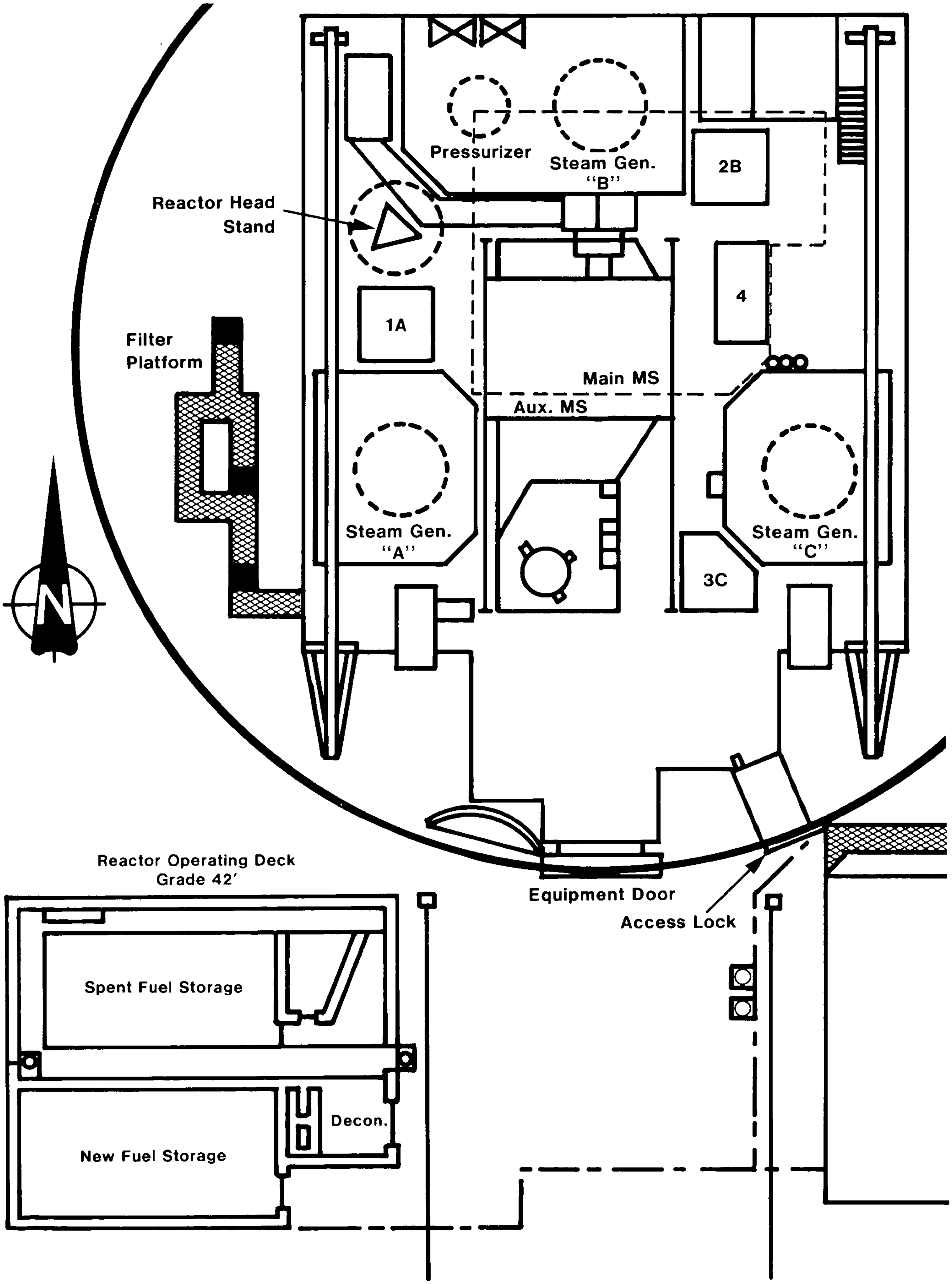
NOTE:

1. One pump and/or motor work in same area.

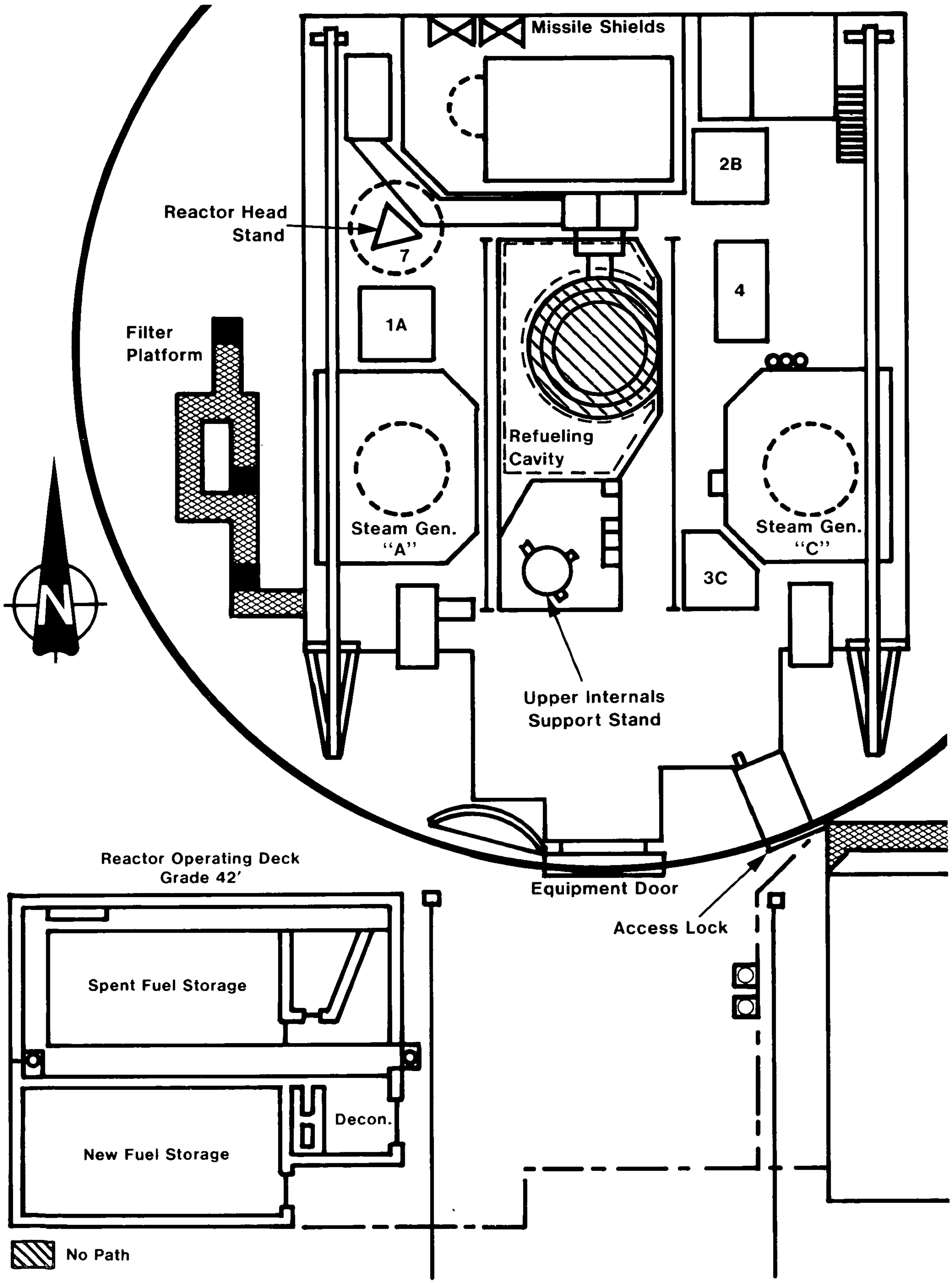
Load Zone for -10 Access Plug Removal, Storage, and Installation With Missile Shield Removed, With or Without Head Installed



Load Zone for –10 Access Plug Removal Storage and Installation, With Missile Shield in Place



Load Zone for Sand Tank Removal and Installation, With or Without Head Installed



ENCLOSURE 2

CMAA-70 EVALUATION

FOR THE

CRANE TROLLEY AND BUMPER STOPS

AT

SAN ONOFRE UNIT 1

TABLE 1

TURBINE GANTRY CRANE
SAN ONOFRE NUCLEAR GENERATING STATION
UNIT 1

	CMAA-70 Specifications	Evaluation	Conclusion
4.12.1	Bridge bumpers should be provided which are capable of stopping the crane with power off (not including the lifted load) at a rate of decleration not to exceed 3 feet per second when traveling in either direction at 20% of the rate speed. They shall also have sufficient energy absorbing capacity to stop the crane when traveling at 40% of the rated speed. The above criteria does not apply to wood, rubber, polyurethane, etc. bumpers.	Deceleration capability was not quantified in crane design; however, design was consistent with industry practice at the time, and adequacy has been proven by use.	Procedural revisions required for compliance (SO1-I-7.27).
4.12.1.1	Bridge bumpers shall be rigidly mounted in such a manner that the attaching bolts are not in shear, and they shall be designed and installed to minimize parts falling from the crane in case of breakage.	Bolts are not in shear.	Complies
4.12.1.2	Bumpers shall be of sufficient length that no part of either crane will be damaged when two cranes come together and the bumpers are fully compressed.	N/A	N/A
4.12.1.3	Heights of bridge bumpers above the runway rail shall be as specified by the crane manufacturer.	Heights specified.	Complies

TABLE 1 (Continued)

TURBINE GANTRY CRANE
(continued)

	CMAA-70 Specifications	Evaluation	Conclusion
4.12.2.1	Runway stops shall be provided by the purchaser and shall be located at the limits of the bridge travel.	EOCI #61 same as CMAA-70	Complies
4.12.2.2	Runway stops shall be attached to resist the force applied when contacted.	Adequacy demonstrated by use.	Complies
4.12.2.3	Runway stops engaging the tread of the wheel are not recommended.	Stops do not engage wheel tread.	Complies
4.12.3	Trolley bumpers should be provided which are capable of stopping the trolley with power off (not including the lifted load) at a rate of deceleration not to exceed 4.7 feet per second when traveling in either direction at one third the rated speed. The above criteria does not apply to wood, rubber, polyurithane, etc. bumpers.	Deceleration capability was not quantified in crane design; however, design was consistent with industry practice at the time, and adequacy has been proven by use.	Procedural revisions required for compliance (SOI-I-7.27).
4.12.3.1	When more than one trolley is operated on the same bridge, each shall be equipped with bumpers on adjacent ends, and they shall be of sufficient length that no part of either trolley will be damaged when two trolleys come together and the bumpers are fully compressed.	N/A	N/A
4.12.3.2	Bumpers shall be rigidly mounted in such a manner that the attaching bolts are not in shear, and they shall be designed and installed to minimize parts falling from the crane in case of breakage.	Bolts are not in shear.	Complies
4.12.4	Trolley stops shall be provided at the limit of the trolley travel.		Complies

TABLE 2

REACTOR SERVICE CRANE
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UNIT 1

	CMAA-70 Specifications	Evaluation	Conclusion
4.12.1	Bridge bumpers should be provided which are capable of stopping the crane with power off (not including the lifted load) at a rate of decleration not to exceed 3 feet per second when traveling in either direction at 20% of the rated speed. They shall also have sufficient energy absorbing capacity to stop the crane when traveling at 40% of the rated speed. The above criteria does not apply to wood, rubber, polyurethane, etc. bumpers.	Deceleration capability was not quantified in crane design; however, design was consistent with industry practice at the time, and adequacy has been proven by use. Adequate precautions currently exist in procedures to limit travel near the end of bridge movements.	Complies
4.12.1.1	Bridge bumpers shall be rigidly mounted in such a manner that the attaching bolts are not in shear, and they shall be designed and installed to minimize parts falling from the crane in case of breakage.	Bolts are not in shear.	Complies
4.12.1.2	Bumpers shall be of sufficient length that no part of either crane will be damaged when two cranes come together and the bumpers are fully compressed.	N/A	N/A
4.12.1.3	Heights of bridge bumpers above the runway rail shall be as specified by the crane manufacturer.	Height specified.	Complies
4.12.2.1	Runway stops shall be provided by the purchaser and shall be located at the limits of the bridge travel.	EOCI #61 same as CMAA-70.	Complies
4.12.2.2	Runway stops shall be attached to resist the force applied when contacted.	Adequacy demonstrated by use.	Complies
4.12.2.3	Runway stops engaging the tread of the wheel are not recommended.	Stops do not engage wheel treads.	Complies

TABLE 2 (Continued)

REACTOR SERVICE CRANE
(continued)

	CMAA-70 Specifications	Evaluation	Conclusion
4.12.3	Trolley bumpers should be provided which are capable of stopping the trolley with power off (not including the lifted load) at a rate of deceleration not to exceed 4.7 feet per second when traveling in either direction at one third the rated speed. The above criteria does not apply to wood, rubber, polyurithane, etc. bumpers.	Deceleration capability was not quantified in crane design; however, design was consistent with industry practice at the time, and adequacy has been proven by use. Adequate precautions currently exist in procedures to limit travel near the end of trolley movements.	Complies
4.12.3.1	When more than one trolley is operated on the same bridge, each shall be equipped with bumpers on adjacent ends, and they shall be of sufficient length that no part of either trolley will be damaged when two trolleys come together and the bumpers are fully compressed.	N/A	N/A
4.12.3.2	Bumpers shall be rigidly mounted in such a manner that the attaching bolts are not in shear, and they shall be designed and installed to minimize parts falling from the crane in case of breakage.	Bolts are not in shear.	Complies
4.12.4	Trolley stops shall be provided at the limit of the trolley travel.		Complies