FORT ST. VRAIN
CONTROL OF HEAVY LOADS - PHASE I
SAFETY EVALUATION REPORT
AUXILIARY SYSTEMS BRANCH

I. Introduction

As a result of Generic Task A-36, "Control of Heavy Loads Near Spent Fuel, NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," was developed. Following the issuance of NUREG-0612, a generic letter dated December 22, 1980, was sent to all operating plants, applicants for operating licenses and holders of construction permits requesting that responses be prepared to indicate the degree of compliance with the guidelines of NUREG-0612. As indicated above, in accordance with the generic letter dated December 22, 1980, Public Service Company of Colorado, the licensee for Fort St. Vrain was requested to review their provisions for handling and control of heavy loads at Fort St. Vrain to determine the extent to which the guidelines of NUREG-0612 are satisfied and to commit to mutually agreeable changes and modifications that would be required in order to fully satisfy these guidelines. Responses were to be made in two phases, Phase I (six-month response) dealing primarily with load handling procedures and crane design, and Phase II (nine-month response) dealing with the consequences of load drops and the need for single failure proof cranes. By letters dated September 16, 1981, September 10 and December 29, 1982 and January 14, 1983, the licensee provided responses to this request.

By letter dated January 24, 1984 the staff issued the safety evaluation report (SER) for Phase I of NUREG-0612 for Fort St. Vrain (FSV). However, following a staff audit of heavy load handling practices at FSV, it became evident that the licensee had misinterpreted the criteria of NUREG-0612 particularly with respect to the definition of a "heavy load," i.e., any load of weight greater than a fuel assembly and its associated handled tool. This misunderstanding was a result of the uniqueness of FSV (a gas cooled reactor) where the fuel is handled as a single large lift rather than as individual assemblies. Therefore, by letter dated December 5, 1984 Public Service Company of Colorado (PSCC) was requested to re-evaluate Phase I of NUREG-0612 using as guidance a load of approximately one ton or greater for what constitutes a "heavy load" in order to satisfy the intent of NUREG-0612. As indicated above, previous submittals by PSCC had assumed a single heavy load of a weight of 165.5 tons was

the only heavy load handled at FSV. By letter dated June 14, 1985 the licensee provided a revised information on the Control of Heavy Loads which addresses all overhead handling systems which carry loads of weight more than one ton in accordance with the guidelines of NUREG-0612.

II. Purpose Of Review

This safety evaluation report documents our review of the general heavy load handling policy and procedures at FSV. The evaluation was performed with the following objectives:

1. To assess conformance to the general load handling guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," Section 5.1.1; and

2. To assess conformance to the interim protection measures of NUREG-0612, Section 5.3.

III. Evaluation

This section presents a point-by-point evaluation of load handling provisions at FSV with respect to NRC guidelines provided in NUREG-0612. The NRC has established seven general guidelines which must be met in order to provide the defense-in-depth approach for the handling of heavy loads. These guidelines consists of the following criteria from Section 5.1.1 of NUREG-0612.

Guideline 1 - Safe Load Paths
Guideline 2 - Load Handling Procedures
Guideline 3 - Crane Operator Training
Guideline 4 - Special Lifting Devices
Guideline 5 - Lifting Devices (Not Specially Designed)
Guideline 6 - Cranes (Inspection, Testing, and Maintenance)
Guideline 7 - Crane Design

These seven guidelines should be satisfied by all overhead handling systems and programs in order to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems. The licensee's verification of the extent to which these guidelines have been satisfied and an evaluation of this verification are contained in the succeeding paragraphs.

III.1 Guideline 1 -Safe Load Paths

"Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The paths should follow, to the extent practical, structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviation from defined load paths should require written alternative procedures approved by the plant safety review committee."

Summary Of Licensee Statements And Conclusions

The licensee has indicated that safe load paths have been defined for the monorail/hoist systems. These load paths are defined in the procedures, shown on equipment layout drawings. Any deviations from defined safe load paths will require a written alternate approved plan. Safe load paths for the turbine building overhead crane and reactor building crane have not been explicitly defined. However, an exclusion zone has been defined for the reactor building crane such that no load movements are permitted over the prestressed concrete reactor vessel (PCRV) during reactor operation. Further, the licensee has stated that safe load paths will be defined for the turbine building crane away from safe shutdown equipment, and will be incorporated into the plant load handling procedures either prior to lifting the load or by April 15, 1986.

Evaluation And Conclusion

Safe load paths and the exclusion zone which have been developed at FSV and the commitment to develop load paths for the turbine building crane satisfy the criteria of Guideline 1.

III.2 Guideline 2-Load Handling Procedures

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

Summary Of Licensee Statement And Conclusions

The licensee stated that the FSV maintenance procedures, MP-104 series are used in the load handling operation of the reactor building overhead and turbine building cranes. These procedures incorporate the above indicated guidance in order to provide for safe heavy load handling.

Evaluation And Conclusion

Based on the information provided by the licensee, the load handling procedures at FSV satisfy the criteria of Guideline 2.

III.3 Guideline 3 - Crane Operator Training

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, "Overhead and Gantry Cranes."

Summary Of Licensee Statements And Conclusions

The licensee has stated that the crane operators at FSV have been trained, qualified and will employ proper conduct in accordance with Chapter 2-3 of ANSI B30.2-1976.

Evaluation And Conclusion

Crane operator training, conduct, and qualification programs at FSV satisfy the criteria of Guideline 3.

III.4 Guideline 4 - Special Lifting Devices

"Special lifting devices should satisfy the guidelines of ANSI B14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials.' This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device."

Summary Of Licensee Statements And Conclusions

The licensee identified the following special lifting devices to be subject to the criteria of Guideline 4:

Cradle for lifting helium circulator
Beam for lifting helium circulator
Shipping cask lifting apparatus
Beam for lifting turbune LP rotor

The licensee has stated that the devices mentioned above were designed and fabricated prior to the issuance of ANSI N14.6-1978. However, these devices will meet the ANSI N14.6-1978 specifications for any future operation, maintenance, and testing of the lifting devices. Further, the licensee intends to perform periodic nondestructive examination (NDE) of load bearing welds of these special lifting devices to comply with the intent of ANSI 14.6-1978.

Evaluation And Conclusion

Based on the information provided by the licensee with respect to special lifting devices at FSV, we conclude that the criteria of Guideline 4 is satisfied.

III.5 Guideline 5 - Lifting Devices(not specially designed)

"Lifting devices that are not specially designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings'. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the static load which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

Summary Of Licensee Statements And Conclusions

PSC has committed to establish a program for use and installation of slings. The program will include guidance on inspection, replacement and other practices to assure the integrity of slings in accordance with the guidelines of ANSI B30.9-1971. The licensee also stated that selection and marking of slings will account for dynamic loading as identified in the general guideline.

Evaluation And Conclusion

The licensee's commitment to establish a program for installation and use of slings in compliance with ANSI B30.9-1971 and the dynamic loading criteria satisfies the criteria of Guideline 5.

III.6 Guideline 6 - Cranes(Inspection, Testing And Maintenance)

"The crane should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' with the exception that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, test, and maintenance should be performed prior to their use)."

Summary Of Licensee Statements And Conclusions

The licensee has developed a program for inspection, testing, and maintenance of overhead and gantry cranes prior to their use in accordance with Chapter 2-2 of ANSI B30.2-1976 and the exceptions provided for the case where cranes see limited use.

Evaluation And Conclusion

The licensee's crane inspection program satisfies the criteria of Guideline 6.

III.7 Guideline 7 - Crane Design

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Traveling Cranes'. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

Summary Of Licensee Statements And Conclusions

The licensee evaluated the turbine building overhead 65/15 ton crane and the reactor building 170/50 ton crane to determine design compliance with CMAA-70 and ANSI B30.2-1976. The licensee stated that these two cranes were certified by Whiting Corporation to be in compliance with CMAA-70 and B30.2-1976 with the exception of the girder web of the turbine building crane. Although the specific CMAA-70 criteria are not met, the girder has been reviewed assuming no longitudinal stiffner. A factor of safety of 1.46 against buckling of the girder web due to the SSE load was determined. Alternatively, using the tension field action provisions of AISC, the factor of safety is 5.4. The above factor of safety against buckling is considered to provide adequate margin against crane failure in an SSE, and thus the design of turbine building crane is considered acceptable.

The hot service facility hoist monorail was not evaluated against the above crane specifications, because it was not possible to obtain as built measurements due to contamination in the hot service facility. In lieu of a review of this monorail, the licensee has performed load drop analysis for this monorail and determined that no load drop will result in unacceptable consequences.

Evaluation And Conclusion

The design of the cranes at FSV is consistent with Guideline 7.

IV. Interim Protection Measures

The NRC has established six interim protection measures to be implemented at operating nuclear power plants to provide reasonable assurance that no heavy loads will be handled over the spent fuel pool and that measures exist to reduce the potential for accidental load drops which may impact on fuel in the core or spent fuel pool. Four of the six interim measures of the report are consistent with the previously discussed guidelines. These are Guideline 1, Safe Load Paths; Guideline 2, Load Handling Procedures; Guideline 3, Crane Operator Training; and Guideline 6, Cranes (Inspection, Testing and Maintenance). The two remaining interim measures cover the following criteria:

1. Heavy load technical specifications
2. Special review for heavy loads handled over the core.

Licensee implementation and evaluation of the interim protection measures is contained in the succeeding paragraphs of this section.

IV.1 Technical Specification [Interim Protection Measure 1, NUREG-0612, Section 5.3(1)]

"Licenses for all operating reactors not having a single-failure-proof overhead crane in the fuel storage pool area should be revised to include a specification comparable to Standard Technical Specification 3.9.7, 'Crane Travel - Spent Fuel Storage Pool Building,' for PWR's and Standard Technical Specification 3.9.6.2, 'Crane Travel,' for BWR's, to prohibit handling of heavy loads over fuel in the storage pool until implementation of measures which satisfy the guidelines of Section 5.1."

Evaluation And Conclusion

Interim protection measure 1 is written to address safe load handling over fuel storage pools. FSV does not have a spent fuel storage pool, and therefore, this guideline is not applicable to FSV.

IV.2 Administrative Controls [Interim Protection Measures 2, 3, 4 and 5 NUREG-0612, Section 5.3(2)-5.3(5)]

"Procedural or administrative measures [including safe load paths, load handling procedures, crane operator training, and crane inspection]... can be accomplished in a short time period and need not be delayed for completion of evaluations and modifications to satisfy the guidelines of Section 5.1 of [NUREG-0612].

Evaluation And Conclusions

The concerns addressed in these interim measures are the same as those previously discussed under Guidelines 1, 2 3 and 6 of NUREG-0612. Summaries of the licensee statements and staff conclusions against them are contained in the discussions of the respective guidelines in Sections III.1, III.2, III.3 and III.6 of this SER.

IV.3 Special Reviews For Heavy Loads Over The Core [Interim Protection Measure 6, NUREG-0612, Section 5.3(6)]

"Special attention should be given to procedures, equipment, and personnel for the handling of heavy loads over the core, such as vessel internals or vessel inspection tools. This special review should include the following for these loads: (1) review of procedures for installation of rigging or lifting devices and movement of the load to assure that sufficient detail is provided and that instructions are clear and concise; (2) visual inspections of load bearing components of cranes, slings, and special lifting devices to identify flaws of deficiencies that could lead to failure of the components; (3) appropriate repair and replacement of defective components; (4) verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operations, and content of operations, and content of procedures."

Summary Of Licensee Statement And Conclusions

The licensee stated that special attention will be given to procedures, and training of crane operators, and inspections and repairs for cranes used in handling heavy loads over the core including reactor vessel internals.

Evaluation And Conclusion

We conclude that the licensee's response satisfies the criteria of this interim protection measure.

Concluding Summary

Based on the above, we conclude that the licensee meets the guidelines of NUREG-0612, Phase I, and therefore heavy loads handling at FSV is acceptable.