August 31, 2006

Mr. Christopher M. Crane
President and Chief Executive Officer
AmerGen Energy Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION - RELIEF REQUEST RE: REACTOR INSERVICE TESTING OF MAIN STEAM ELECTROMATIC RELIEF VALVES (TAC NO. MC8672)

Dear Mr. Crane:

By letter dated October 18, 2005, as supplemented by letter dated May 15, 2006, AmerGen Energy Company, LLC submitted Relief Request RV-53. RV-53 contained a proposed alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Inservice Testing (IST) requirements for Electromatic Relief Valves V-1-173, V-1-174, V-1-175, V-1-176, and V-1-177 at the Oyster Creek Nuclear Generating Station.

Based on the information provided in Relief Request RV-53, the Nuclear Regulatory Commission (NRC) staff concludes that the alternative proposed for the fourth 10-year IST interval will provide an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternative for the remainder of the Oyster Creek fourth 10-year IST interval.

The detailed results of the NRC staff's review are provided in the enclosed Safety Evaluation. If you have any questions concerning this action, please call Mr. G. Edward Miller of my staff at (301) 415-2481.

Sincerely,

/RA/

Brooke D. Poole, Acting Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure:
Safety Evaluation

cc w/encl: See next page

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G. Edward Miller, Project Manager
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST RV-53

AMERGEN ENERGY COMPANY, LCC

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

1.0 INTRODUCTION

By letter dated October 18, 2005, as supplemented by letter dated May 15, 2006, AmerGen Energy Company, LLC (AmerGen or the licensee) submitted Relief Request (RR) RV-53. RV-53 contained a proposed alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Inservice Testing (IST) requirements for Electromatic Relief Valves (EMRVs) V-1-173, V-1-174, V-1-175, V-1-176, and V-1-177 at the Oyster Creek Nuclear Generating Station (Oyster Creek).

The proposed alternative would allow demonstration of the capability of the valves to perform their function without requiring that the valves be cycled with steam pressure while installed.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3), alternatives to the ASME Code requirements may be authorized by the Nuclear Regulatory Commission (NRC) if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

AmerGen submitted the subject RR pursuant to 10 CFR 50.55a(a)(3)(i), as a proposed alternative to certain ASME Code requirements for the performance of a Surveillance Requirement on main steam electromatic relief valves.

The applicable Code of record for the Oyster Creek IST program fourth 10-year interval is the ASME Operation and Maintenance (OM) Code, 1995 Edition through OMa-1996 Addenda. The fourth 10-year interval began on October 14, 2002, and will conclude on October 13, 2012.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected:

EMRVs V-1-173 (NR-108A), V-1-174 (NR-108B), V-1-175 (NR-108C), V-1-176 (NR-108D), and V-1-177 (NR-108E).

3.2 ASME Code Requirements from Which Relief is Requested:

Appendix I, Section 3.4.1.d, "Class 1 Main Steam Pressure Relief Valves With Auxiliary Actuating Devices," states "each valve that has been maintained or refurbished in place, removed for maintenance and testing, or both, and reinstalled shall be remotely actuated at reduced or normal system pressure to verify open and close capability of the valve before resumption of electric power generation. Set-pressure verification is not required."

3.3 Licensee's Proposed Alternative:

AmerGen stated that there are five Dresser Model 1525VX EMRVs on the main steamlines between the reactor pressure vessel (RPV) and the main steamline isolation valve within the drywell. The EMRVs consist of a main valve assembly, pilot valve assembly, and a solenoid actuator. The EMRVs are opened by automatic or manual switch actuation of a solenoid actuator. When energized, the solenoid actuates the plunger, which pushes down the pilot valve operating lever, thereby opening the pilot valve. When the pilot valve opens, pressure under the main valve disc is vented. This results in an unbalanced steam pressure across the main disc, which moves the main disc downward from its seat, opening the main valve.

The function of the EMRVs is described in the Oyster Creek Updated Final Safety Analysis Report (UFSAR), Section 6.3.1.2. The EMRVs are part of the automatic depressurization system (ADS), which supports the emergency core cooling system. The ADS is designed to depressurize the reactor during a small-break loss of coolant accident to permit the low pressure core spray (CS) system to inject water into the reactor core. The EMRVs are actuated by simultaneous occurrence of triple low reactor water level, high drywell pressure, and indication that a CS booster pump has started and developed adequate differential pressure. The EMRVs also provide overpressure protection for the RPV as discussed in UFSAR Section 6.3.1.2. In the overpressure mode, the EMRVs are actuated by pressure switches that monitor RPV pressure.

AmerGen stated that operating experience at Oyster Creek has indicated that manual actuation of the EMRVs during plant operation can lead to main and pilot valve seat leakage. Leakage through the main valve results in increased suppression pool temperature and level, and pilot valve leakage results in unidentified drywell leakage.

Currently, AmerGen verifies operability by utilizing the main steam pressure to stroke the EMRV. The proposed alternative test would verify EMRV operability by stroking the EMRV actuator using the manual switch every 24-months. The alternative test would be performed with little or no reactor pressure on a 24-month frequency. Stroke testing of the EMRV main valve will continue to be performed in accordance with the IST program. Additionally, each valve is removed, refurbished, and stroke tested every two refueling outages. The licensee further stated that stroking of the EMRV actuator every 24 months, in combination with the

removal, refurbishment, and stroke testing of the valve every two refueling outages will provide a complete verification of the EMRV functional capability.

The alternative test would be performed with the solenoid actuator mounted in its normal position. This would allow testing of the manual actuation electrical circuitry, solenoid actuator, pilot operating level, and pilot valve assembly. This test would verify pilot valve movement. However, since this test will be performed in the absence of the reactor pressure needed to overcome the main valve closure spring force, the main valve will not stroke during the test. Stroking the pilot valve in the absence of steam pressure is referred to as “dry cycling.”

AmerGen also stated that Nine Mile Point 1, Dresden Nuclear Power Station, Units 1 and 2, and Quad Cities Nuclear Power Station, Units 1 and 2, also utilize the Dresser EMRVs, Model 1525VX. As described in an NRC Inspection Report dated December 22, 2000, Nine Mile Point 1 experienced a spurious opening and failure to re-close for one of their EMRVs. As stated in the Inspection Report, the utility concluded that the event was probably caused by a pilot valve bent stem and partial disc-stem separation. The utility further concluded that dry cycling of EMRV pilot valves may result in partial disc-stem separation.

AmerGen stated that the proposed Oyster Creek valve actuator testing would include manual dry cycling of the pilot valve to verify that the stem travel and level arm adjusting screw gap are within limits. Following this verification, the EMRV solenoid would be energized to stroke the pilot valve. The stem travel and lever arm adjusting screw gap would then be rechecked to verify that these parameters are within limits following the dry cycling. The licensee stated that partial disc separation caused by dry cycling of the pilot valve would be detected during this re-check. The EMRV manufacturer, Dresser, also confirmed that this re-check would detect partial disk-stem separation caused by the dry cycling of the pilot valve. Additionally, dry cycling of the pilot valves has been performed on the EMRVs at the aforementioned stations for many years, with no signs of partial or full disc detachment.

Regarding the potential for a pilot valve bent stem, the licensee stated that the maintenance procedures for the EMRV pilot valves would include appropriate inspections of the stem, pilot valve bushing, and disc to identify any nicks, gouges, or other damage that could impair free movement. The procedure would check the gap at the end of the stem that has the thinnest cross section. The licensee determined that this is the area most likely to be bent if not properly handled. In addition, free movement of the stem in the bushing and of the disc-to-stem connection would be checked. The licensee stated that this check would assure that the stem is straight, the pilot can travel freely, and the pilot disc can seat properly.

Another Nine Mile Point 1 event, as described in NRC event notification Report 39779, was a failure of an EMRV to open when actuated. The failure was reportedly due to inadequate solenoid force, caused by high resistance in the cutout switch, such that the output force was not adequate to overcome the pilot spring force. The licensee’s proposed actuator testing for the Oyster Creek EMRVs will include manual actuation of the electrical circuitry, solenoid actuator, pilot operating lever, and pilot valve assembly. AmerGen stated that this test would demonstrate that the solenoid force is adequate to overcome the pilot spring force.

Recent operating experience at Quad Cities indicated that significant degradation of EMRVs and their actuators had occurred after only a few months of plant operation due to flow-induced vibration of the main steamlines at extended power uprate (EPU) conditions. Some parts of the

EMRVs and their actuators were found severely degraded, such that they would not have performed their safety function. In response to an NRC staff question regarding the applicability of this operating experience at Oyster Creek, AmerGen reviewed the root cause of the Quad Cities failures and determined that Oyster Creek has not been licensed to operate at EPU conditions that could result in changes to main steamline vibrations similar to Quad Cities. The licensee also found no significant wear of the Oysteer Creek EMRV actuators over the past 6-year period, which included 3 refueling outages, and found no vibration-induced degradation that would prevent the Oyster Creek EMRVs from remaining functional for the proposed 24-month interval between surveillances. Therefore, the licensee concluded that additional instrumentation to determine current vibration levels or modifications to the EMRVs to address excessive vibration was not necessary.

AmerGen stated that the relief valves will continue to be tested in accordance with the Oyster Creek IST Program, fourth 10-year interval, as required by Technical Specification 4.3.C. The current IST program for relief valves is based on the ASME OM Code, 1995 Edition through OMa-1996 Addenda. As required by Appendix I, Section I 1.3.3, Class 1 PRVs are tested at least once every 5 years, with a minimum of 20 percent of the valves tested within any 24-month interval. This means that two of the five EMRVs will be tested every 24 months, with the other three EMRVs on the subsequent refueling outage. The licensee states that this would be accomplished by replacing the installed valves with new or refurbished valves that have been pre-tested. The ASME OM Code test would be performed at a steam test facility, where the valve (i.e., the main valve and pilot valve) and an actuator representative of the actuator used at the plant would be installed on a steam header in the same orientation as the plant installation. The test conditions in the test facility would be similar to those in the plant installation, including valve body temperature and steam conditions. The valve would then be leak tested and functionally tested to ensure the valve is capable of opening and closing (including stroke time), and leak tested a final time. Valve seat tightness would be verified by a cold bar test, and if not free of fog, leakage would be measured and verified to be below design limits. The licensee states that the storage requirements in effect ensure the valves are protected from physical damage and that, prior to installation and being electrically connected, the valves would again be inspected for foreign material and damage.

As part of the preventive maintenance program during each refueling outage, the licensee replaces the pilot valve assemblies in the EMRVs that are not scheduled for removal and testing. The replacement of the pilot valve assemblies does not involve removal of the EMRVs and does not affect the main valve disc. Additionally, all five solenoid actuators are refurbished on a refueling outage basis. Following replacement of the pilot valve assemblies and installation of the refurbished EMRVs, AmerGen would retest the EMRV actuator without stroking the main valve in accordance with Surveillance Requirement (SR) 4.4.B.1. The licensee further states that this SR would ensure that the affected portion of the valve will be fully tested and that if other maintenance is performed, controls regarding testing requirements following maintenance ensure that appropriate post-maintenance testing is performed. For example, if maintenance is performed that affects the main valve, the capability of the main valve would be tested at the testing facility or on the installed valve at the plant.

The maintenance is also performed on the solenoid actuator with specific attention given to maintenance and testing of the cutout contacts. The contacts are cleaned, the associated springs and mechanisms are inspected, and as-left contact resistances are verified. Resistance checks and meggar tests are performed on both coils. During electrical actuation,

operating currents are verified to be within acceptance criteria limits. The licensee states that these steps provide substantial indication that the solenoid operator is capable of functioning as designed.

The solenoid actuator is designed to operate the pilot valve under design conditions. The actuator includes two coils. One coil can be considered a pull-in coil and the second considered a hold-in coil. The pull-in coil provides sufficient force to actuate the pilot, while the hold-in coil provides sufficient force to maintain the pilot in an open position. Contacts designated as cutout contacts control the energization of these coils during solenoid motion.

AmerGen concluded that the combination of the test using steam at a test facility, and the proposed valve actuator testing at the site, will provide a complete check of the capability of the valves to open and close. Further, the licensee concluded that the proposed changes provide for the testing of the EMRVs such that full functionality is demonstrated through overlapping tests, without cycling the valves under steam pressure with the valves installed. This approach would reduce the potential for valve seat leakage and the proposed alternative test for the EMRVs reflects the recommendations of NUREG-0737, "Clarification of TMI [Three Mile Island] Action Plan Requirements," Item II.K.3.16, "Reduction of Challenges and Failures of Relief Valves," that the number of relief valve openings be reduced as much as possible and unnecessary challenges should be avoided.

The licensee did indicate that the proposed EMRV actuator test, which avoids the discharge of steam through the valve discharge piping to the suppression pool, eliminates confirmation of discharge pipe blockage. AmerGen stated that, as implemented at Oyster Creek, the Foreign Material Exclusion (FME) program provides the necessary requirements and guidance to prevent and control introduction of foreign materials into structures, systems, and components and minimizes the potential for debris blocking a relief valve discharge line. The licensee concluded that, considering the size of the discharge pipe (8 inches), the energy associated with high-pressure steam, and the FME program, the probability of blocking a relief valve discharge line and preventing the valve function is extremely remote.

As a result of the proposed alternative for full functional testing of the EMRVs, the only change in the frequency of testing is that the main valve disc of the EMRVs will be lift tested every two operating cycles (approximately 4 years) compared to the current one operating cycle (approximately 2 years). The licensee stated that a review of the surveillance testing results for the past 10 years at Oyster Creek was performed for the EMRVs and checked for any failures of the main valve disc to stroke open. Based on this review, the licensee concluded that no failures of the valves to lift have occurred in the past 10 years, and therefore extending the frequency of checking the function of the main disc as described is not expected to result in additional valve failures.

3.4 NRC Staff Evaluation of Proposed Alternative:

The NRC staff has reviewed AmerGen's basis for the proposed alternative and finds that with the proposed testing, the functional capability of the EMRVs are adequately verified. A manual actuation and valve leakage test will be performed at a steam test facility using conditions similar to those for the installed valves in the plant, including valve orientation, ambient temperature, valve insulation, and steam conditions. Following EMRV installation, the licensee's proposed testing includes verifying electrical supply connections and

actuator performance. It is noted that, although the tests of the EMRVs at the steam test facility are not performed with the actual valve solenoids at Oyster Creek, the in-plant EMRV solenoids are adequately tested and verified by actuation during the proposed surveillance. Further, the NRC staff finds that the licensee has adequately considered the applicable operating experience regarding the necessary verification and testing of the EMRV solenoid capability and the prevention and detection of possible damage to the EMRV pilot valves during the proposed dry stroke testing following installation. Additionally, the licensee has adequately considered the operating experience regarding possible degradation due to excessive vibration.

Therefore, the NRC staff finds that all of the components necessary to actuate the EMRVs will continue to be tested as necessary to demonstrate the functional capability of the valves, without the need to stroke test the valves on-line with system pressure conditions.

The NRC staff also finds that although the proposed alternative does not verify the absences of foreign material, by passing steam, the licensee's FME program can prevent and control the introduction of foreign bodies and minimize the potential for debris blockage. Thus, the FME provides reasonable assurance that the EMRV discharge lines would remain unblocked and that foreign material would not interfere with valve operation.

The test frequency of the EMRV main valve discs from every cycle to every two cycles is acceptable since the licensee has had no failures of the valves to stroke open in the past 10 years. The maintenance and testing programs described by the licensee provide reasonable assurance that the operational problems would be detected and that corrective action would be taken.

Therefore, the NRC staff finds that the licensee's proposed alternative for stroke testing the Oyster Creek EMRVs will provide an acceptable level of quality and safety and is, therefore, acceptable.

4.0 CONCLUSION

The NRC staff has reviewed AmerGen's submittal and determined that, in accordance with 10 CFR 50.55a(a)(3)(i), the proposed alternative program will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternative for the remainder of the Oyster Creek fourth 10 year IST interval.

All other ASME Code requirements for which relief was not specifically requested and approved in this RR remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: C. G. Hammer

Date: August 31, 2006

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