

ORGANIZATION: Westinghouse Electric Corporation  
Pittsburgh, Pennsylvania

REPORT NO.: 99900404/95-02

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NUCLEAR INDUSTRY ACTIVITY: Nuclear steam supply system components and services

INSPECTION CONDUCTED: July 24 through 26, 1995

TEAM LEADER: Richard P McIntyre 10/5/95  
Richard P. McIntyre Date  
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REVIEWED: Gregory Cwalina 10/5/95  
Gregory C. Cwalina, Section Chief, VIS Date

APPROVED: Robert M Gallo 10/6/95  
Robert M. Gallo, Chief, PSIB Date

INSPECTION BASES: 10 CFR Part 50, Appendix B and 10 CFR Part 21

INSPECTION SCOPE: To determine if activities performed to support the design of AP600 and, specifically, the automatic depressurization system (ADS) Phase B test program at the Ente Nazionale Energia e Ambiente (ENEA) VAPORE Test Facility in Casaccia, Italy, were conducted under the appropriate provisions of WCAP-8370, Revision 12A, the most recent Westinghouse Quality Assurance Plan that has been approved by the NRC.

PLANT SITE APPLICABILITY: None

## 1 INSPECTION SUMMARY

### 1.1 Nonconformance

- Nonconformance 99900404/95-02-01 was identified and is discussed in Section 3.3 of this report.

### 1.2 Unresolved Item

- Unresolved Item 99900404/95-02-02 was identified and is discussed in Section 3.4 of this report.

## 2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspection has been conducted at the VAPORE test facility.

## 3 INSPECTION FINDINGS AND OTHER COMMENTS

### 3.1 AP600 Quality Assurance Program

Chapter 17 of the AP600 Standard Safety Analysis Report (SSAR) describes the Westinghouse Electric Corporation (W) quality assurance (QA) program for the design phase of the AP600 Advanced Light Water Reactor (ALWR) Plant Program. The QA program is identified as Westinghouse Topical Report WCAP-8370, "Energy System Business Unit-Power Generation Business Unit Quality Assurance Plan," Revision 12A, dated April 1992. WCAP-8370 applies to all W activities affecting quality of items and services, including the design certification process for AP600. Accordingly, WCAP-8370 establishes W's commitments to meeting the requirements of 10 CFR 50 Appendix B, ASME NQA-1 and NQA-2, and Regulatory Guide 1.28, Revision 3, "Quality Assurance Program Requirements (Design and Construction)"

Section 17.3 of the AP600 SSAR states that activities supporting the design and design certification phase of the project are performed in accordance with W topical report WCAP-8370 as supplemented by a project-specific Quality Plan. WCAP-12600, "AP600 Advanced Light Water Reactor Design - Quality Assurance Program Plan (QAPP)," dated December 1993, the project-specific QA plan, was developed by W to enhance WCAP-8370 in specific areas and to establish additional commitments needed to support the AP600 program. It also states that the AP600 design certification test programs and related analyses are within the scope of this QAPP.

WCAP-12601, "AP600 Program Operating Procedures," Revision 13, dated July 8, 1994, was developed by W to establish requirements and responsibilities for developing, approving, implementing, revising, and maintaining operating procedures to meet the QA and administrative requirements of the AP600 program. WCAP-12601 includes an "AP600 Program Procedure Matrix," Revision 15, dated April 4, 1995, which identifies the correlation between the W commitments to the QA requirements of (1) ANSI/ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities," 1983 Edition (as endorsed by

Regulatory Guide 1.28, Revision 3) and (2) ANSI/ASME NQA-1 1989 Edition through NQA-1b-1991 Addenda, and the corresponding implementing guidance embodied in WCAP-9565, "Nuclear and Advanced Technology Division (NATD) Quality Assurance Program," Revision 34, dated May 2, 1994, and in WCAP-12601. WCAP-9565 governs the implementation of all NATD activities related to areas within the scope of WCAP-8370.

During the inspection, the team assessed the implementation of the applicable QA criteria essential to support the AP600 Design Certification application, including Design Certification testing. Specifically, the team evaluated the effectiveness of the QA program and controls, as described above, including the soundness of the data obtained during the AP600 VAPORE ADS test program.

### 3.1.1 Ente Nazionale Energia e Ambiente (ENEA) VAPORE Facility QA Program

In the AP600 design, the automatic depressurization system (ADS) ensures that the reactor coolant system (RCS) is depressurized during pertinent transient and accident conditions, thereby initiating and maintaining long-term gravity injection. Under a technical cooperation agreement, W, ENEA, and ANSALDO S.p.A., combined resources to conduct testing at the ENEA VAPORE test facility in Cassacia, Italy, with two major objectives: (1) advance knowledge and understanding of passive safety system operations, and (2) conduct testing of the ADS to provide both design information and data for computer code validation efforts needed to support design certification.

During phase A of testing, information on the performance of a prototypic sparger was gathered. The ADS phase B tests comprised full-sized simulation of one of the two AP600 ADS flowpaths from upstream of the ADS valves to a sparger and was intended to simulate and/or conservatively bound the operating conditions of the AP600 ADS system configuration.

WCAP-14112, "Automatic Depressurization System Test Specification (Phase B1)," Revision 2, provides that testing, designed to demonstrate overall automatic depressurization system (ADS) performance verification, be conducted under a QA program that conforms to the requirements of the American Society of Mechanical Engineers (ASME) NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities," 1989 Edition through NQA-1-1991 Addenda.

To this effect, ENEA developed AP600-GQ9402 (AP600 Document No. RCS-TIH-001), "Quality Assurance Plan Description: AP600 Test Program Conducted at the VAPORE Plant in ENEA Cassacia (Phase B)," Revision 2 (QAPD), which defines responsibilities, prescriptions and recommendations to govern the AP600 ADS Test Program/Phase B according to W requirements and pertinent ENEA procedures.

During the inspection, the team reviewed the pertinent documents to determine if design certification testing activities associated with the AP600 program and performed at the ENEA VAPORE test facility during the ADS test program were conducted in accordance with the appropriate provisions of W's 10 CFR 50, Appendix B, QA program (WCAP-8370). The team examined the performance of activities in specific areas within the scope of AP600-GQ9402, i.e. test control, test instrument calibration, facility and records configuration

control to confirm that activities in these areas were conducted and accomplished under suitably controlled conditions by properly trained personnel and that the resultant test data collected during such activities was appropriately recorded and maintained.

Based on reviews of these areas, including the QA implementation audit at VAPORE conducted by W on June 6-9, 1995, and documented in W Audit Report No. QLA/ENA0006, dated June 19, 1995, the team concluded that the QA program set forth in AP600-GQ9402, in conjunction with the W's implementation of the pertinent criteria of WCAP-12601, provided sufficient evidence of overall QA implementation appropriate to design certification testing, except for certain areas as identified below.

### 3.2 Test Control

The team reviewed aspects of test control for the AP600 VAPORE Phase B1 test program. These tests involved prototype Stage 1, 2, and 3 automatic depressurization system valves in a full-scale piping network, to acquire thermal-hydraulic performance data for validation of computer models for accident and transient analyses of the AP600 plant. The test program was completed in 1994. Documentation reviewed included the ADS test specification, test procedures, test logs, test checklists, and test results as reflected by selected data and Day of Test reports. WCAP-14112, Revision 2, was developed by W, and the detailed test procedures were developed by ENEA and approved by W.

The test procedures were comprehensive and easy to follow, and included checklists for each type of test that was performed in the Phase B1 program. The procedures implement the W test specification requirements. The test procedure included requirements for the development of a test diary as well as the checklist. Documentation for each test, including completed and signed-off checklists, data plots, Day of Test reports, and other relevant information, was contained in a separate divider in the Design Record File (DRF). Each test was performed by a team of 2-4 individuals and a W resident engineer who was assigned to the VAPORE facility to oversee and participate in the conduct of the test program.

The Day of Test reports were prepared by W's on-site resident engineer for transmittal to W Test Engineering in Monroeville, Pennsylvania, and, as was found in the inspection of the SPES-2 program at SIET, provide an excellent contemporaneous record of important test results, "unexpected events," instrumentation condition and potential problems, and other relevant discussion. A list of critical instrumentation was also included as part of the test procedures, but functionality was not verified prior to performing each test. When the team questioned W and ENEA personnel about verification of critical instrumentation, they were informed that the verification was performed after the test, rather than before. It was noted that, although the primary objective of the testing was the acquisition of thermal-hydraulic data, a substantial amount of mechanical-related instrumentation was also included on the loop, including strain gages and accelerometers. These were not considered to be critical instruments for the Phase B1 tests. In general,

functionality of thermal-hydraulic instrumentation (thermocouples, flowmeters, pressure transducers) was adequate.

The test data records were maintained in a well organized manner. The data acquisition system (DAS) software was developed according to British standards and checked independently by W. The test data was recorded on PROSIG system using CD ROM disks and W is custodian of all the data. As has been the case in other W AP600 test programs performed by outside organizations, the final review of the data to determine if test acceptance criteria were met, was performed by W personnel in Monroeville. As a result, there is little documentation of the actual data review itself, other than the initial assessments as contained in the Day of Test reports. In addition, deviations during the tests requiring disposition are also not recorded in ENEA's DRF. The team was informed that this documentation is in W's files in Monroeville and could not be verified during this inspection. Nevertheless, the design record file does contain correspondence between W and ENEA, specifically addressing acceptability of the VAPORE Phase B1 tests. In most cases, tests were considered to have met acceptance criteria; however, several tests were re-run as a result of W's determination that they had not met acceptance criteria. The team considered the documentation of W's review in this manner to be appropriate and adequate to ensure proper test control.

### 3.3 As-Built Drawings and Configuration Control

WCAP-14112, Section 9.0, "Quality Assurance Requirements," and AP600-GQ9402, Section 7.0, "As-Built Records," provide for the preparation and maintenance of the VAPORE test facility as-built drawings which pertain to the ADS Phase B tests that characterize the features which influence thermal-hydraulic and structural parameters. The thermal-hydraulic parameters are needed to allow adequate modelling of the facility for code validation efforts. AP600-GQ9402 also provides that specific as-built features to be recorded shall be as specified by W. Additional configuration control provisions in AP600-GQ9402 are specified under Section 7.2, "Features to be Recorded and Format," Section 7.3, "Method and Responsibilities," and 7.4, "Changes".

Modifications to the VAPORE test facility, necessary to support AP600 ADS design certification testing, were performed by ANSALDO S.p.A. under contract to W. On November 29, 1994, W placed a contract with ANSALDO (MB21177S Change Notice) to provide as-built documentation of the ADS test loop at the ENEA's VAPORE test facility. W stipulated that ANSALDO provide one full set of as-built drawings (comprising P&ID, line list of principal flow paths, valve list, ADS loop layout drawings, ADS loop isometric drawings, ADS loop platform, and ADS loop support drawings) covering both ADS Phases B1 and B2 configurations. W intended to include these drawings as part of the as-built records package for AP600 VAPORE Phase B testing.

During the inspection, however, the team found that as-built drawings, as defined and stipulated in WCAP-14112, and in AP600-GQ9402, had not been generated for AP600 ADS Phase B testing at VAPORE. This issue was identified as Nonconformance 95-02-01.

### 3.4 Procurement and Calibration of Test Instrumentation

WCAP-14112 requires, in part, under Section 9.0, "Quality Assurance Requirements," that the following measures be taken in the detailed test procedure(s): (1) Provisions for ensuring that calibration of test equipment is traceable to recognized national standards, and (2) Verification and documentation, to be submitted to W, by the testing organization that the instrumentation calibrations have been performed prior to testing. Section 6.0, "Instrumentation Management and Control," of the ENEA QAPD Document, AP600-GQ9402, implemented these requirements.

During the inspection, the team confirmed that all test instruments used in the ENEA VAPORE test facility had been calibrated, prior and after testing, using standards or reference instruments traceable to the Servizio di Taratura in Italia or, Italian calibration System (SIT). In Italy, under the auspices of the Western European Calibration Cooperation (WECC), national calibration standards equivalent to NIST are established and maintained by SIT.

During the inspection, the team reviewed the VAPORE test facility calibration records which provided evidence of traceability to the appropriate ENEA controlled SIT-certified standards. This review also provided evidence of the adequacy of the facility instrumentation calibration status during each testing phase. The team found, however, that the ENEA QA program does not include adequate measures to effectively control the calibration status of reference instruments or standards used for instrument calibration, as no provisions were in place to require re-calibration by SIT at the requisite intervals. This may have resulted in the introduction of uncertainties in the adequacy of calibration of test facility instrumentation which relied on these standards to establish and maintain their accuracy.

Pending confirmation by W that this lapse in the SIT-certified calibration interval for the ENEA standards did not undermine or adversely impact the VAPORE ADS test results, this issue will remain unresolved. This issue has been identified as Unresolved Item 95-02-02.

### 3.5 Quality Assurance Records

QA records and documents associated with the W AP600 ADS testing at the VAPORE facility were processed in accordance with the provisions in the ENEA QAPD (AP600-GQ9402). The QAPD lists all of the applicable ENEA procedures for implementation of QAPD requirements. Although ENEA does not have a separate QA department, one individual, the designated QA Responsible, has responsibility for all QA activities at the facility. The QA Responsible is charged with maintaining all QA records, including, QAPD and audits, procedures, test specifications and test matrix modifications, instrument calibration records, data acquisition, test results, training and informal meetings, ENEA surveys, and nonconformance reports.

ENEA maintains a single "dossier" document file of instrument calibration records for each instrument, as required by ENEA Document EIHE-94021, "Instrument Management." Each dossier contains an instrument card,

calibration certificates and/or calibration control certificates, and any existing instruction manuals.

As part of its contract with W, ENEA has developed an overall design record file that archives all documents associated with AP600 ADS testing at the VAPORE facility. This design record file, conforming to the ENEA QAPD, is a deliverable from ENEA to W and serves as the official record of testing activities at VAPORE.

### 3.6 Instructions, Procedures and Drawings

Procedures and drawings were processed and maintained in accordance with the provisions of Section 5.0, "Documentation Management," of the ENEA QAPD Document, AP600-GQ9402. The QAPD requires that a copy of the procedures applicable to test activities be sent to the QA Responsible for approval and distribution to the relevant departments. Drawings and as-built records pertaining to the AP600 ADS tests at VAPORE are maintained to document the features that influence thermal hydraulic and structural parameters of the tests.

ENEA maintains all testing-related procedures and drawings in the design record file that archives all documents associated with AP600 ADS testing at the VAPORE facility. Based on the team review, it was determined that appropriate procedural controls had been developed and implemented to govern the conduct of AP600 quality-related test activities at VAPORE.

### 3.7 Audits

The ENEA QAPD does not include any requirements for conducting internal audits of work performed at the VAPORE facility. However, W has assumed this responsibility under their QA program and conducted a series of readiness assessments (in 1993 and 1994) and implementation audits (in 1991 and 1995) of the activities associated with the AP600 ADS development. In these assessments and audits, W treats ENEA as an approved supplier. The most recent W audit, WES 95-243, was conducted on June 6-9, 1995, and evaluated ENEA's implementation of the activities described under Criterion 7, "Procurement," of WCAP-12601. The audit report, QLA/ENAO006, dated June 19, 1995, contained 7 findings and 2 recommendations and requested a response from ENEA by July 20, 1995. The audit report was distributed to ENEA management and department heads. In a July 21, 1995, memorandum, the W lead auditor concluded that the actions taken by ENEA, as described in the July 20, 1995 response, were acceptable for each of the findings and the recommendations, and that the findings were closed.

The staff concluded that the W procedures for the conduct of internal audits were appropriately followed in the evaluation of QA activities at the VAPORE test facility and were effective in evaluating activities associated with AP600 ADS testing.

#### 4 PERSONNEL CONTACTED

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