

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos: 50-315; 50-316
License Nos: DPR-58; DPR-74

Report No: 50-315/99018(DRS); 50-316/99018(DRS)

Licensee: American Electric Power Company

Facility: Donald C. Cook Nuclear Generating Plant

Location: 1 Cook Place
Bridgman, MI 49106

Dates: July 26 - 30, 1999
August 16, 1999

Inspector: Martin J. Farber, Reactor Engineer

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EXECUTIVE SUMMARY

D.C. Cook, Units 1 and 2
NRC Inspection Report 50-315/99018(DRS); 50-316/99018(DRS)

This inspection completed our evaluation of the effectiveness of the audit of the Expanded System Readiness Review (ESRR) program by the licensee's Performance Assurance (PA) department.

- The PA horizontal group provided an appropriate level of oversight for the ESRR program and made significant contributions to the quality of the program and the consistency of its implementation. (Section E7.1)
- The conclusion drawn in the PA final audit that there was reasonable assurance that ESRR would correctly evaluate the functionality of systems, was appropriate and supportable. (Section E7.2)
- The PA Department developed appropriate criteria for assessing the significance of findings and applied these criteria conservatively. (Section E7.2)
- "Gap analysis" (evaluation of issues identified by the PA audit but not by the ESRR) was generally acceptable, although the justification for four of the 28 medium significance issues was questionable. Justification for the one high significance gap was correct. (Section E7.2)
- There were no high or medium significance differences between NRC, PA, or ESRR vertical slice findings. (Section E7.2)

Report Details

Background

Both units have been in an extended shutdown since September 9, 1997. As part of the restart effort, the licensee performed Expanded System Readiness Reviews (ESRRs) to provide reasonable assurance that plant systems were capable of meeting their safety and accident mitigation functions. The licensee's Performance Assurance (PA) department audited the ESRR program, and the NRC conducted an oversight inspection of the PA audit as discussed in Inspection Report No. 50-315/99006; 50-316/99006. Due to schedule delays in the ESRR program, the PA audit could not be completed as originally scheduled, and NRC oversight of the PA audit was constrained. This report documents the NRC's inspection of the completed PA audit.

III. Engineering

E7 Quality Assurance in Engineering

E7.1 Horizontal Assessment

a. Inspection Scope

The inspector examined the surveillance reports, condition reports, and field observations prepared by the horizontal audit group. A list of documents is attached to the end of this report. The inspector also interviewed the PA manager, audit team leader, and horizontal group leader regarding the findings and ESRR management's responses to the issues raised by the group.

b. Findings and Observations

The horizontal component of the PA audit was process oriented with a primary focus on monitoring and ensuring consistency in how ESRR management implemented the program. To that end the group attended ESRR team training, examined system attribute assessment activities (where ESRR teams identified systems' functional requirements), evaluated ESRR teams' system investigations, conducted general oversight of ESRR activities, and assessed System Readiness Review Board performance. As part of that effort, the horizontal group maintained daily contact with ESRR management and staff. As a result of PA horizontal group observations between March 6 through May 28, 1999, 107 Field Observation Reports (FO) were written, resulting in issuance of 57 Condition Reports (CR) which documented a variety of deficiencies, discrepancies, and opportunities for process improvement. These were subsequently reviewed and rolled up into a surveillance report that was issued on June 7, 1999. (A horizontal group surveillance report covering early implementation activities through February 1999 was reviewed in Inspection Report 99006.)

The inspector reviewed all of the FOs, CRs, and the June 7 surveillance report. The horizontal group surveillance report was very detailed and provided several substantive comments and recommendations which were well supported by field observations and condition reports. This review revealed that the horizontal group provided not only important oversight of the process to ensure it was implemented consistently but also

provided important input into the process to address deficiencies and weaknesses. This was reflected in the number and quality of field observations and condition reports which were issued by the group.

c. Conclusions

The PA horizontal group provided an appropriate level of oversight for the ESRR program and made significant contributions to the quality of the program and the consistency of its implementation.

E7.2 Vertical Slice Assessment

a. Inspection Scope

The inspector examined the surveillance reports, CRs, and FOs prepared by the two vertical slice audit groups. A list of documents is attached to the end of this report. The inspector also interviewed the PA manager, audit team leader, and vertical slice group leaders regarding those findings not identified by the ESRR teams and ESRR management's responses to the issues raised by the groups. Although the inspector's review focused on those issues considered to have more than minimal significance, issues considered "low" significance were sampled to ensure that issues were properly classified.

b. Observations and Findings

b.1 General Comparisons

The ESRR program was intended as an examination of the systems' capabilities to perform their safety or accident mitigation functions. Accordingly the process was built to identify all of the systems' safety or accident mitigation functions and then evaluate the systems' capabilities based on walkdowns and intensive review of documentation. It is important to note that ESRR was not intended to be a design validation effort. In contrast, to ensure independence, the PA vertical slice audits were done using the process outlined in the NRC inspection procedure for Safety System Functional Inspections but focusing on specific components in the systems. Consequently, the PA examination could, and on occasions did, go into greater detail than was expected of the ESRR.

The audit team established criteria for determining the relative significance of PA-identified findings. These criteria were:

- *High:* Issues that had a potential to prevent the system from fulfilling its safety function or meeting its design/licensing basis.
- *Medium:* Issues that had a potential to prevent a single component or single train from fulfilling its safety function or meeting its design/licensing basis, but did not fall into the "high" criteria. Also included in this category were issues in which a major objective of the ESRR process was not achieved
- *Low Restart:* Less significant issues that meet the criteria for restart established in PMP 7200.RST.004, "Expanded System Readiness Review Program."
- *Low Post-restart:* All other issues



For the four systems examined by the PA vertical slice groups, ESRR identified a total of 493 restart items (high, medium, and low); of these more than 50 were considered as high significance. The PA audit identified 116 restart items; 13 were considered high significance. One measure of ESRR effectiveness was based on the significance and quantity of PA findings that were not correspondingly identified by ESRR. The following table shows the number of PA findings in each significance level, the number of corresponding ESRR findings, and the number of differences, hereafter called gaps.

Level	PA	ESRR	Gap
High	13	12	1
Medium	65	37	28
Low Restart	38	10	28
Low Post-restart	47	17	30

The audit team determined that gaps categorized as "low restart" or "low post-restart" were not indicative of deficiencies in the ESRR process or its implementation. The inspector concurred after reviewing these low significance discrepancies.

The inspector reviewed all of the PA findings to evaluate the accuracy of the assigned significance determinations. The review did not reveal any low significance findings that should have been considered as either medium or high. The inspector concurred with the one finding assigned a high significance rating and determined that none of the findings designated as medium significance merited a high rating. PA was extremely conservative in assigning medium significance to findings and the inspector determined that several of those findings could have been acceptably classified as low restart.

b.2 PA/ESRR "Gap" Resolution

Disposition of those discrepancies considered high and medium gaps fell into two categories. The first category included discrepancies which on further review were either considered as not having the potential to cause loss of component, train, or system function, or had been identified by ESRR. The second category included those discrepancies which remained as gaps and required evaluation to determine whether or not the adequacy of the ESRR program was compromised. The PA audit review concluded that 11 medium issues fell into the first category and were no longer considered gaps. The second category then consisted of one high significance issue and 17 medium significance issues.

PA concluded in the final audit report that the one high significance gap did not compromise the effectiveness of ESRR. This issue (CR -99-P-11760) involved the identification by PA of a single failure in the auxiliary building engineered safeguards ventilation (AES) system that was not identified by ESRR. In this case the ESRR team had already identified a number of single failure problems and concluded that a focused single failure analysis of AES was required. Consequently, attempts to identify single failure vulnerabilities were appropriately terminated. The inspector considered this conclusion accurate.

The inspector examined all 28 of the issues initially considered as medium significance gaps. For the purpose of assessing quality of dispositions, the inspector did not differentiate between 17 "gap" issues and the 11 "non-gap" issues. Disposition of all of these issues involved a structured assessment done by engineering and reviewed by the PA audit team. This assessment covered the validity of the finding, whether the specific issue was or was not identified by the ESRR team, and a conclusion as to whether or not the gap was indicative of a concern with the effectiveness of the ESRR program. In general, the disposition of the majority of the medium findings was acceptable; however, there were four with which the inspector took issue. Three of these involved use of extent of condition reviews.

- [Essential Service Water (ESW)] (CR-99-P-16632/FO-99-G-231) "... Temporary modifications not identified by ESRR ESW team"
- (ESW) (CR-99-P-16623/FO-99-G-163) "... plant did not maintain adequate control of ESW expansion joints"
- Emergency Core Cooling Systems/Safety Injection/Electrical Safety Buses) (CR-17999/FO-99-G-071) "... cable spacing in power cable trays was not in accordance with UFSAR description or the Electrical Design Standard because of broken tie-wraps"

In these three cases PA accepted as justification what the inspector considered speculation. The reasoning extended by the engineering organization was that because ESRR found an item that was similar to the PA finding and wrote a CR on it, the extent of condition review for that CR would have identified the PA finding. The inspector noted that for some issues, extent of condition was appropriate because a focused review of that particular aspect was specified in the CR. For the issues noted above, this was not the case.

The fourth issue with which the inspector took issue was CR-99-P-18063, which identified a deficiency with regard to operators' ability to monitor accumulator liquid temperature. The PA question noted that to ensure that accumulator liquid temperature remained below 100°F as specified by the Updated Final Safety Analysis Report (UFSAR), operators were inferring this temperature from containment ambient temperature. PA also identified discrepancies between accident analysis accumulator liquid temperature requirements, Technical Specifications, and the UFSAR. The disposition of this issue concluded that there was no gap because ESRR identified an issue with containment ventilation problems that bounded the accumulator liquid temperature issue. The inspector found that this justification was incorrect and that the operators' practice of using containment temperature as an indication of accumulator liquid temperature was erroneous. The practice and the justification implied that containment ambient temperature was the dominant factor affecting accumulator liquid temperature; the inspector noted that this was only accurate under long-term equilibrium conditions in the absence of back leakage through emergency core cooling system check valves. The inspector noted that accumulator temperature was more likely to be affected by this type of leakage which is not an uncommon occurrence in pressurized water reactors. Given the relative volumes involved, heat given off by increased accumulator liquid temperature would be unlikely to make a significant change in containment ambient temperature, leading to the determination that using containment temperature as an indication of accumulator liquid temperature was inaccurate.

Although the inspector took issue with the disposition of four of the 28 medium issues, this was not considered grounds for questioning the effectiveness of the ESRR program.

After considering the number and quality of ESRR findings, the high level of correspondence on high significance findings, and the appropriateness of the resolution of 24 of the 28 medium findings, the inspector concluded that the gaps did not represent fundamental deficiencies in the ESRR program

b.3 NRC Team Vertical Slice Issues

There was one medium significance issue which the NRC team identified during the earlier team inspection that was not identified by the PA team. This finding was that at completion of the most recent component cooling water (CCW) system flow balance surveillance, the thermal barrier heat exchanger CCW flows were not left in accordance with the values specified in the UFSAR. According to the UFSAR, thermal barrier heat exchanger CCW flow was to be 35 gallons per minute. Examination of the surveillance revealed that these flows were measured and subsequently left at 20 to 30 gallons per minute. As justification for this, the engineering staff referenced a Westinghouse letter which said that no CCW flow through the thermal barrier heat exchanger was acceptable as long a seal injection was maintained. The NRC team considered this as unreasonable, since one condition when heat exchanger flow would be very important was when seal injection was lost. Although the PA vertical slice team did not identify this particular finding, the licensee presented a CR which demonstrated that the ESRR had identified this particular issue. Consequently, there were no significant NRC-PA-ESRR gaps.

c. Conclusions

The PA Department developed appropriate criteria for assessing the significance of findings and applied these criteria conservatively.

"Gap analysis" was generally acceptable, although the justification for four of the 28 medium significance issues was questionable. Justification for the one high significance gap was correct.

There were no high or medium significance gaps between NRC, PA, or ESRR vertical slice findings.

The conclusion drawn in the PA final audit that there was reasonable assurance that ESRR would correctly evaluate the functionality of systems, was appropriate and supportable.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors discussed the progress of the inspection with licensee representatives on a daily basis and presented inspection results to members of licensee management at the conclusion of the inspection on August 16, 1999. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

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J. Grobe, Division Director
J. Jacobson, Branch Chief
J. Maynen, Resident Inspector
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INSPECTION PROCEDURES USED

IP 37551: Engineering
IP 40500: Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 40501: Licensee Self-Assessments Related to Team Inspections

ITEMS OPENED, CLOSED, OR DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS USED

AES	Auxiliary Building Engineered Safeguards Ventilation
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
ESRR	Expanded System Readiness Review
ESW	Essential Service Water
FO	Field Observations
PA	Performance Assurance
UFSAR	Updated Final Safety Analysis Report



LIST OF DOCUMENTS REVIEWED

Procedures

- Performance Assurance Audit Plant, PA 99-S06, Revision 1, dtd. February 13, 1999, "System Readiness Review Oversight"
- PMP 7200.RST.004, Revision 6, dtd. June 22, 1999, "Expanded System Readiness Review Program"
- PMP 7200.RST.006, Revision 2, dtd. June 8, 1999, "Expanded System Readiness Review Program for Level 2 Systems"

Reports

- Audit No. PA 99-S06, "System Readiness Review Oversight," dtd July 27, 1999
- Surveillance Summary Report SURV 99-0023, dtd July 15, 1999, "Vertical Slice Assessment of the Essential Service Water (ESW) System Expanded System Readiness Review (ESRR) Discovery Phase Activities"
- Surveillance Summary Report, SURV 99-0024, dtd July 15, 1999, "Component Cooling Water (CCW) System Vertical Slice Assessment of Expanded System Readiness Review (ESRR)"
- Surveillance Summary Report, SURV 99-0032, dtd. June 7, 1999, "Horizontal Slice Assessment of the Expanded System Readiness Review Discovery Phase Activities"
- Surveillance Summary Report, SURV 99-0033, dtd July 15, 1999, "Emergency Core Cooling Safety Injection (SI) System Vertical Slice Assessment of Expanded System Readiness Review (ESRR)"
- Surveillance Summary Report, SURV 99-0034, "Vertical Slice Assessment of the Auxiliary Building Ventilation Engineered Safety Features (AES) System Expanded System Readiness Review (ESRR) Discovery Phase Activities," dtd June 18, 1999
- Surveillance Summary Report, SURV 99-0039, dtd July 15, 1999, "Vertical Slice Assessment of Expanded System Readiness Review (ESRR) Interfacing Systems,"

Miscellaneous Documents

- Memorandum, M. J. Finissi, dtd. May 5, 1999, "Expanded System Readiness Review (ESRR) and Program Interface"

Condition Reports

- ECAP P-99-05908, "ESRR did not identify unauthorized ESW pump modification," March 18, 1999
- ECAP P-99-08108, "SIDS reviews not identifying associated program issues," April 12, 1999
- ECAP P-99-08770, "OE assessments performed by RPS ESRR team were too narrow in scope," dtd April 20, 1999
- ECAP P-99-08922, "Inadequate evaluation of potential common mode failure problems," dtd April 20, 1999
- ECAP P-99-09324, "Trend of CRs involving SIDS "Restart" or system classifications," dtd April 23, 1999
- ECAP P-99-10178, "Trend of untimely or missed CR evaluation owner assignment," dtd May 1, 1999
- ECAP P-99-10823, "Trend - Untimely resolution of ESRR issues," dtd May 6, 1999

- ECAP P-99-11820, "Missing MS matrix safety function + system boundaries," dtd May 13, 1999
- ECAP P-99-16632, "Modifications performed on plant systems without using the Temporary Modification process," dtd June 24, 1999
- ECAP P-99-16623, "Plant has not maintained adequate configuration control of ESW expansion joints," dtd June 24, 1999
- ECAP 99-P-16495, "ESW flow balance procedure 1EHP4030STP.241 appears to be inadequate," dtd June 23, 1999
- ECAP 99-P-16499, "ESW system was inappropriately modified to delete leak detection alarms described by the UFSAR," dtd June 23, 1999
- ECAP 99-P-16665, "ESW Pump Impeller Replacement MOD 12-MM-227 did not include re-baselining the pump curves," dtd June 24, 1999
- ECAP 99-P-16798, "ESW flow model calculation NEMP950612AF uses inappropriate inputs and incorrectly models the CCW heat exchanger," dtd June 25, 1999
- ECAP 99-P-16850, "Control of vendor supplied information," dtd June 25, 1999
- ECAP 99-P-16150, "CCW system chemical charging tank bypass valve (1,2-CCW-206) is not addressed in off-normal procedures used to split CCW trains," dtd June 21, 1999
- ECAP 99-P-16188, "CCW flow balance test procedure does not consider operator actions taken in EOP ES-1.3 when establishing CCW to RHR Heat Exchanger flow requirements," dtd June 21, 1999
- ECAP 99-P-16251, "Application of industry operating experience with regard to water hammer has not been appropriately addressed in CCW off-normal procedures associated with Residual Heat Removal," dtd June 22, 1999
- ECAP 99-P-16365, "1-CCM-454 and 2-CCM-454 design pressure exceeded the vendor specified maximum working pressure," dtd June 22, 1999
- ECAP-99-P-16456, "The safety classification of the centrifugal charging pump lube oil instruments was inconsistent and the basis for pressure boundary integrity of the instruments was not retrievable," dtd June 23, 1999
- ECAP-99-P-16129, "CR-96-2023 documents Charging Pump vendor recommendations to ensure that idle charging pump bearing oil film is maintained. Associated CR commitments were inappropriately implemented," dtd June 21, 1999
- ECAP-99-P-16492, "The centrifugal charging pump (CCP) suction valve interlock circuits do not satisfy the Cook licensing basis for independence and separation," dtd June 23, 1999
- ECAP-99-P-16498, "Control relays used in safety-related ECCS valve circuits (ECCS pump suction valves) are not classified as safety-related," dtd June 23, 1999
- ECAP-99-P-15860, "No procedure that covers periodic venting using the vent valve RH-153 installed by 12-DCP-890," dtd June 17, 1999
- ECAP-99-P-16648, "The adequacy of instrumentation and procedures for detecting a void in the BIT and its outlet piping is questionable and configuration discrepancies exist for the instruments and circuits," dtd June 24, 1999
- ECAP-99-P-15785, "ICM-311 & ICM-321 (RHR to RCS hot and cold leg isolation valves) are not included in the Environmental Qualification program," dtd June 17, 1999
- ECAP-99-P-16755, "Discrepancies exist in design, qualification, configuration, and licensing basis for ECCS BIT injection flow instrumentation; the basis for accuracy is questionable and the transmitters are not qualified for their use as described in the EOPs," dtd June 25, 1999
- ECAP-99-P-16512, "Current acceptance criteria invoked in pump IST test procedures 12 EHP 50 70 ISI.017R, Rev 3 and 01(2)-OHP-4030.STP.052E(W) may not reflect design basis required conditions," dtd June 23, 1999

- ECAP-99-P-15812, "Charging pump discharge check valve 1(2)-CS-299E(W) has insufficient velocity that results in disk oscillation," dtd June 17, 1999
- ECAP-99-P-16585, "Step 5 of emergency procedure ES-1.3 places the centrifugal charging pumps (CCP) at risk of deadheading," dtd June 24, 1999
- ECAP-99-P-11760, "Single failure mechanism for an electrical termination in the control circuit that could cause the concurrent failure of both Engineered Safety Feature Ventilation (AES) fans," dtd May 13, 1999
- ECAP-99-P-12808, "Non-seismic design of the AES fan drain valves could reduce the design suction flow by bypassing the suction source flow path and also the charcoal filter downstream valves could lead to a release of radioactivity," dtd May 21, 1999
- ECAP-99-P-13567, "Contrary to the original SER, which includes a licensing/design basis for the ESF ventilation system to be actuated on a high radiation signal, the function does not exist, nor is there a change document on record to alleviate the requirement," dtd May 26, 1999
- ECAP-99-P-13096, "Lesson plan RO-C-AS09, "Auxiliary Building and Control Room Ventilation," does not reflect the change from series to parallel configuration of ESF charcoal filter bypass dampers installed per 12-DCP-0049 in mid-1997," dtd May 24, 1999
- ECAP-99-P-13099, "AES ESRR team failed to the Condition Report system to report deficiencies in Lesson plan RO-C-99-AS09," dtd May 24, 1999
- ECAP-99-P-18063, "Inconsistencies exist between the inputs used in the accident analysis and information found in the UFSAR and Technical Specifications," dtd July 9, 1999
- ECAP-99-P-18013, "Configuration of SI accumulator outlet MOVs does not satisfy TS 4.5.1c because the MOV breakers are not racked out per TS 4.5.1c and RG 1.97 licensing basis," dtd July 8, 1999
- ECAP-99-P-17999, "99G071- Power cable ampacity-minimum spacing not maintained," dtd July 8, 1999

Field Observations

- FO-99-D-002, "Review of CRs in SIDS assigned to CCW," dtd April 13, 1999
- FO-99-D-003, "Review of CRs in SIDS assigned to ESW," dtd April 13, 1999
- FO-99-D-006, "Review of RPS ESRR Assessment Records and Reviews to Date," dtd April 20, 1999.
- FO-99-E-002, "Problems impacting ESRR Efficiency," dtd April 29, 1999
- FO-99-E-004, "Followup of PA CRs on ESRR Process," dtd April 30, 1999
- FO-99-E-007, "ESRR Issues Management," dtd May 6, 1999
- FO-99-E-009, "Tracking resolution of ESRR Issues," dtd May 6, 1999
- FO-99-E-013, "SRRB Review of MS Matrix Assessment," dtd May 13, 1999
- FO-99-G-231, "Investigation of ESW Walkdown Issues," dtd February 22, 1999.
- FO-99-G-163, "Inadequate ESW Expansion Joint Configuration Control," dtd June 22, 1999
- FO-99-G-158, "ESW Flow Balance Procedure Inadequate," dtd June 22, 1999
- FO-99-G-159, "Inadequate ESW Leakage Detection," dtd June 22, 1999
- FO-99-G-217, "ESW Pump Impeller Mod and IST," dtd June 23, 1999
- FO-99-G-221, "ESW System Flow Balance," dtd June 26, 1999
- FO-99-G-147, "CCW Chemical Charging Tank Flow path," dtd June 22, 1999
- FO-99-G-158, "Flow Balance v. ES 1.3 Directed Flow," dtd June 22, 1999
- FO-99-G-164, "Potential for CCW Water Hammer in Off-Normal Procedures," dtd June 22, 1999

- FO-99-G-182, "Charging Pump Lube Oil Instrumentation," dtd June 24, 1999
- FO-99-G-146, "Charging Pump Potential Bearing Damage," dtd June 23, 1999
- FO-99-G-184, "Centrifugal Charging Pump Suction Valve Interlocks/VCT Level Interface," dtd June 24, 1999
- FO-99-G-126, "Gas Intrusion into CCP Suction Line," dtd June 17, 1999
- FO-99-G-186, "BIT Instrumentation & BIT MOV Control," dtd June 24, 1999
- FO-99-G-119, "EQ Program (ICM-311 & ICM-321)," dtd June 18, 1999
- FO-99-G-185, "CCP/BIT Injection Flow Indication," dtd June 25, 1999
- FO-99-G-177, "Acceptable CCP Pump Degradation," dtd June 22, 1999
- FO-99-G-123, "CCP Discharge Check Valve," dtd June 17, 1999
- FO-99-G-138, "Closing CCP Mini-flow Valves in ES-1.3," dtd June 24, 1999
- FO-99-E-083, "AES Fans and Solenoid Control Circuit," dtd May 13, 1999
- FO-99-E-088, "AES Fan Non-seismic Drain Valves," dtd May 21, 1999
- FO-99-F-030, "Original SER Describes ESF Ventilation Actuation on High Radiation Signal," dtd May 25, 1999
- FO-99-E-106, "AES Lesson Plans - RO Training," dtd May 24, 1999
- FO-99-H-037, "Accumulator Accident Analysis Inputs," dtd July 9, 1999
- FO-99-G-189, "Surveillance of SI Accumulator Outlet Valves," dtd July 8, 1999
- FO-99-G-071, "Power Cable Ampacity," dtd June 10, 1999