U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No:	50-456/99021(DRS); 50-457/99021(DRS)
Licensee:	Commonwealth Edison Company
Facility:	Braidwood Nuclear Plant, Units 1 and 2
Location:	RR #1, Box 84 Braceville, IL 60407
Dates:	December 13-17, 1999
Inspectors:	Mark Mitchell, Radiation Specialist David Nelson, Radiation Specialist
Approved by:	Steven K. Orth, Acting Chief, Plant Support Branch Division of Reactor Safety

EXECUTIVE SUMMARY

Braidwood Nuclear Plant, Units 1 and 2
NRC Inspection Report 50-456/99021(DRS); 50-457/99021(DRS)

This announced inspection included various aspects of the licensee's radiation protection (RP) program. Specifically, the following areas were reviewed:

- Water Chemistry Control Program
- Radiological Environmental Monitoring Program (REMP)

The following conclusions were reached in these areas:

- The REMP program was well implemented, and the 1998 data demonstrated that the environmental impact from plant operations was not a significant contributor to public dose. (Section R1.1)

- Plant housekeeping was effective in maintaining areas free of unnecessary equipment. Radiological posting and labeling in the plant was appropriate. Staff followed required radiation work permits and procedures. (Section R1.2)

- Plant water chemistry continued to be excellent, as indicated by chemistry parameter trend data. (Section R1.3)

- Effluent monitors were operational, calibrated, and had set points in compliance with the Offsite Dose Calculation Manual. However, the inspectors identified an error in the licensee's tracking system, which erroneously indicated that an effluent monitor's calibration had been completed following a maintenance task. The error resulted in the licensee unknowingly entering the grace period for the monitor's calibration. (Section R2.1)

- Quality control data demonstrated that chemistry laboratory instrument were operable and capable of producing accurate analytical results. The chemistry staff effectively maintained and calibrated the instruments, and there were no materiel condition issues. (Section R2.2)

- A chemistry technician exhibited good radiation worker practices during the collection of a Chemical and Volume Control System (CVCS) demineralizer outlet grab sample. However, the inspectors noted some problems with the sampling procedure. Management's response to the finding was appropriate. (Section R4.1)

- The inspectors concluded that the Chemistry Department quality assurance audit was comprehensive and effective in identifying areas of improvement. (Section R7.1)

- Problem Identification Forms related to the Chemistry and REMP programs documented issues that were minor in nature and were the result of personnel error. The corrective actions taken were appropriate. (Section R7.2)

- A comprehensive meteorological/REMP self-assessment program was conducted by licencee personnel. The assessments confirmed compliance with the station procedures and adequate data collection capabilities. (Section R7.3)

Report Details

R1 Radiological Protection and Chemistry Controls

R1.1 Implementation of the Radiological Environmental Monitoring Program (REMP)

a. Inspection Scope (84750)

The inspectors reviewed the 1998 Annual Radiological Environmental Monitoring Report and the Offsite Dose Calculation Manual (ODCM). The inspectors also reviewed a focus area self-assessment of the radioactive waste treatment and effluent and environmental monitoring programs. The inspectors also observed air particulate/iodine and surface water sampling and interviewed various plant staff regarding the operability and materiel condition of the sampling equipment and the implementation of the REMP.

b. Observations and Findings

Prior to the inspection, the licensee performed a self-assessment of the radioactive waste treatment and effluent and environmental program. The auditors focused the assessment on the effluent and environmental monitoring programs. Even though a number of minor deficiencies were identified during the assessment, the auditors concluded that the programs were adequately maintained. The inspectors concurred with that conclusion.

The inspectors observed that the REMP sample collector's air and water collection techniques ensured sample integrity and noted that he was knowledgeable of appropriate sampling principles. The collector appropriately labeled and packaged the samples, and he also properly tested the air sampling train for leakage. The water sampling was conducted appropriately, as the container was rinsed with the sample media prior to sample collection, as required by procedure. During interviews, the individual indicated that equipment availability was excellent. The inspectors determined that the REMP sample collector was sufficiently knowledgeable of sampling requirements, equipment, and transport; and no operability or materiel condition issues regarding the sampling equipment were identified.

The inspectors noted that the 1998 Annual Radiological Environmental Operating Report was submitted by the required date and that the report contained the information as described by the ODCM. The report stated that all required samples were collected and that there were no modifications to the program in 1998. The procedures used during 1998 remained unchanged. Data recovery for meteorological measurements was 99.9% during 1998.

The REMP program included the collection and analysis of air, water, vegetation, fish, and bottom and shoreline river sediment. Thermoluminescence dosimeters (TLD) were used to measure direct radiation and were exchanged quarterly. The quality assurance data of the vendor radioanalytical laboratories demonstrated excellent analytical capabilities. The results from the REMP sampling and analyses, including the analyses of supplemental onsite and offsite groundwater wells, indicated that outside of tritium

emissions, plant operations did not have a discernable radiological impact on the environment.

In 1998, the station released 1.48E+07 liters of liquid waste (prior to dilution) containing 3.06E-01 curies (excluding tritium, noble gasses and alpha), 0.00E+00 curies alpha and 2.26E+03 curies of tritium. The licensee used NRC developed equations to calculate the doses to the whole body, lower gastro-intestinal (GI) tract, thyroid, bone and skin based on liquid effluent pathways. The maximum whole body dose for the year was 2.62E-01 millirem, and no organ dose exceeded 2.66E-01 millirem. These dose calculations were made to establish that the liquids released to the Kankakee River were not significant contributors of dose to the public and were well within the regulatory, technical specification (TS), and station procedure limits.

The inspectors reviewed the REMP program interlaboratory cross check program data for the licensee's environmental sample analysis vendor laboratory. The inspectors reviewed the 1998 results, as described in the 1998 Annual Radiological Environmental Monitoring Report, and the reported results for the 1st, 2nd, and 3rd quarters of 1999. The reviews indicated that the vendor laboratory results were within the acceptance criteria for the known values. On the few occasions when results were outside the accepted limits, an evaluation was conducted to determine the reason for the difference, and corrective actions were implemented when needed.

During reviews of the ODCM, the inspectors noted that the licensee had made changes in the ODCM twice during 1999. The changes were administrative in nature, updating the manual to reflect current practices. The inspectors reviewed the 10 CFR 50.59 safety reviews performed by the licensee before making the changes and determined that the reviews met regulatory requirements as well as the licensee's procedural requirements.

c. Conclusions

The REMP program was well implemented, and the 1998 data demonstrated that the environmental impact from plant operations was not a significant contributor to public dose.

R1.2 Walkdowns Within the Radiologically Controlled Area

a. Inspection Scope (83750)

The inspectors examined various areas of the radiologically protected area (RPA), including the Auxiliary Building. During these walkdowns, plant housekeeping, radiological posting and labeling, and general equipment condition were inspected. In addition, the inspectors interviewed radiation protection (RP) staff regarding radiological conditions and controls within the plant.

b. Observations and Findings

Both plant units were operating at full power, and there was minimal activity around the plant in or near contaminated areas. During the walkdowns, the inspectors observed good worker awareness of radiological hazards (e.g., workers properly donned protective clothing; procedures, survey maps and radiation work permit (RWP) were consulted; dosimetry was worn correctly; etc.).

The inspectors found plant areas to be exceptionally clean and free of unnecessary equipment and tools. The inspectors measured dose rates in various plant areas in order to verify the proper placement of radiological postings. No discrepancies were found in the areas of posting or labeling.

c. Conclusions

Plant housekeeping was effective in maintaining areas free of unnecessary equipment. Radiological posting and labeling in the plant was appropriate. Staff followed required radiation work permits and procedures.

R1.3 Water Chemistry Control Program

a. Inspection Scope (84750)

The inspectors reviewed selected areas of the licensee's water chemistry control program. This included discussions with chemistry staff and reviews of the Updated Safety Analysis Report (USAR), TS, chemistry department procedures, and water quality data for the primary and secondary systems.

b. Observations and Findings

The water chemistry program was consistent with the Electric Power Research Institute (EPRI) pressurized water reactor guidelines. A review of selected chemistry parameter trend records indicated that plant water quality during power operation remained excellent. The inspectors noted that chemistry staff maintained the chloride, sulphate, and fluoride levels for the reactor coolant below the EPRI Action Level 1 guidelines. Radiochemistry trend records for the reactor coolant indicated that there were no problems with fuel integrity.

The secondary water chemistry parameters for sodium, chlorides, and sulfates were below 10 percent of the EPRI Action Level 1 guidelines. The inspectors noted that cation conductivity for the secondary system was above the EPRI Level 2 guideline limit of 1 micro Siemens per centimeter (EPRI does not list a Level 1 guideline for cation conductivity). Chemistry staff indicated that the elevated cation conductivity was due to the addition of corrosion inhibitors in the steam generators. The EPRI guideline action levels for cation conductivity are based on the cations from chloride and sulfate and allow the subtraction of the cations produced from the addition of corrosion inhibitors. Therefore, the chemistry staff had performed a corrected cation conductivity measurement to account for the cations produced by the addition of the corrosion

inhibitors. A review of the corrected cation conductivity data indicated that the conductivity was below the EPRI Action Level 2 guideline level.

The station used a chemistry performance index (CPI) to assess water chemistry dynamics. The CPI is a summation of numerical performance indicators based on EPRI water quality parameters. The Unit 2 CPI showed little change. During only 6 days in the last six months, the CPI was outside of the licensee's optimum goal. Unit 1 had shown similar outstanding water quality.

c. Conclusions

Plant water chemistry continued to be excellent, as indicated by chemistry parameter trend data.

R2 Status of Radiation Protection and Chemistry Facilities and Equipment

R2.1 Process and Effluent Radiation Monitors (84750)

a. Inspection Scope (84750)

The inspectors reviewed the records to determine if effluent radiation monitors were operational with their alarm/trip set points properly set and were calibrated per the requirements of the ODCM.

b. Observations and Findings

The inspectors determined that the liquid radioactive waste effluent line monitor (ORE-PR001), the fire and oil sump discharge monitor (ORE-PROO5), the condensate polisher sump discharge monitor (ORE-PR041), and the plant vent monitors (1RE-PR028 and 2RE-PRO28) had been operational per the requirements of the ODCM during 1998 and 1999. The inspectors also noted that the effluent monitors had been calibrated within the time constraints of the ODCM and that the set points were properly set.

However, the inspectors noted that the liquid radioactive waste effluent line monitor (ORE-PR001) had not been calibrated since March 16, 1998. Since the ODCM required that the monitor be calibrated every 18 months with a 25 percent grace period, the monitor was within a month of being out of calibration. The licensee indicated that the system used to track instrument calibrations required by the TS should have indicated that the monitor needed calibration but had failed to do so. A subsequent investigation found that on August 28, 1999, maintenance had been performed on the monitor, and the monitor had been partially calibrated. The tracking system failed to indicate that a calibration was due because the partial calibration had been entered into the tracking system as a full calibration and the next due date was moved in error. The licensee also found four other radiation monitors that were in the 25 percent grace period due to the same type of data entry error. A problem identification form (PIF) (PIF#:A1999-03943) was written to address this issue, and the licensee expanded the investigation to include other non-radiological systems.

c. Conclusions

Effluent monitors were operational, calibrated, and had set points in compliance with the ODCM. However, the inspectors identified an error in the licensee's tracking system, which erroneously indicated that an effluent monitor's calibration had been completed following a maintenance task. The error resulted in the licensee unknowingly entering the grace period for the monitor's calibration.

R2.2 Quality Control (QC) and Materiel Condition of the Chemistry Laboratory and Instrumentation

a. Inspection Scope (84750)

The inspectors reviewed chemistry instrumentation QC data, interviewed chemistry staff regarding instrument use and performance, and conducted a walkdown of the laboratory. The inspectors reviewed the QC data for analytical and radioanalytical instruments and discussed the QC program with members of the chemistry staff.

b. Observations and Findings

The inspectors noted that the operability and materiel condition of the in-line instrumentation was affected by in-line instrument sample heat exchanger operability. The laboratory had been without the in-line instrumentation for approximately three weeks. The in-line instruments were used to measure conductivity, pH, and dissolved oxygen for a wide variety of plant water systems. The staff monitored this system repair using the appropriate corrective action tracking system. The lack of availability required that the laboratory staff conduct the normally in-line analysis in the laboratory. The inspectors observed that the staff was able to handle this data accumulation and analysis challenge in addition to normal work loads. In general, the laboratory instrumentation showed excellent operational readiness, as evidenced by the lack of current work requests and its reliable performance as indicated by chemistry staff. The performance checks reviewed demonstrated excellent accuracy and operability for these instruments. The inspectors noted that the chemistry staff demonstrated strong ownership of the instrumentation and effectively managed instrument calibration, performance checks, and maintenance.

The quarterly interlaboratory cross check program data for radioanalytical instruments for the first three quarters of 1999 indicated good agreement between the chemistry department and the vendor's results. On the few occasions when results were outside the accepted limits, an evaluation was conducted to determine the reason for the difference, and corrective actions were implemented when needed.

c. Conclusions

The QC data demonstrated that chemistry laboratory instruments were operable and capable of producing accurate analytical results. The chemistry staff effectively maintained and calibrated the instruments, and there were no materiel condition issues.

R4 Staff Knowledge and Performance In Radiation Protection and Chemistry

R4.1 Staff Performance During Sample Acquisition (84750)

a. Inspection Scope (84750)

The inspectors observed a chemistry technician during the collection of a Chemical and Volume Control System (CVCS) demineralize outlet grab sample.

b. Observations and Findings

The technician referred to procedure BwCP 613-7, "CVCS Demineralizer Outlet Grab Sample", while collecting the grab sample. Even though this was a routine sampling evolution, the technician frequently referred to the procedure to ensure the grab sample was appropriately collected. The technician also used good radiation protection technique while collecting the sample. The technician wore double rubber gloves and a lab coat and radiologically surveyed the sample collection area following the collection of the sample.

After the sample had been collected and the sample flow line secured, the inspectors noted that the procedure instructed the technician to shutdown operations and notify the Nuclear Station Operator (NSO) that the CVCS demineralizer outlet purge line had been secured. The technician indicated to the inspectors, however, that the procedure contained a known sequence error, which appeared to be typographical by nature. The inspectors also noted that the procedure had several other instructions that were unclear. The inspectors discussed their findings with chemistry management. Chemistry management indicated that a PIF had been generated to address the procedure (PIF#:A1999-03920). At the exit meeting, management also provided the inspectors with a plan to address all of the potential issues raised by the incident. The plan called for a review of all high radiation sample system procedures, an increase in supervision's observations of field activities, and tailgate sessions to discuss management's expectations.

c. Conclusions

A chemistry technician exhibited good radiation worker practices during the collection of a CVCS demineralizer outlet grab sample. However, the inspectors noted some problems with the sampling procedure. Management's response to the finding was appropriate.

R5 Staff Training and Qualification In Radiation Protection and Chemistry

R5.1 Chemistry and REMP Staff Training and Qualifications (84750)

The inspectors reviewed the training program outlines and exams for chemistry technicians (CTs) and REMP staff training. In addition, the inspectors evaluated the education, experience, and training of selected program personnel.

The inspectors found that the CTs and REMP program staff were properly trained and had sufficient experience to properly execute the plant's chemistry and REMP programs. Comprehensive training and retraining of personnel was provided to the staff, and the course content was kept up-to-date. In addition to the plant scheduled training, the inspectors noted that the REMP contract staff had additional training related to their corporate safety responsibilities. The training program was adequate to assure compliance with the licensee procedures and regulatory requirements.

R7 Quality Assurance in Radiation Protection and Chemistry Activities

R7.1 Chemistry Department Audits and Self-Assessments (84750)

a. Inspection Scope (84750)

The inspectors reviewed the results of a quality assurance audit of the chemistry program to assess implementation of the TS, station procedures, and regulatory requirements. The inspectors reviewed the chemistry self-assessments, management observations of training and field activities, and observation reports.

b. Observations and Findings

The chemistry department used Nuclear Generation Group self-assessment procedure AD-AA-103, Revision 1, to perform the 3rd quarter self-assessment of the chemistry, radioactive waste, and environmental areas. Areas assessed included chemistry management and leadership, chemistry personnel knowledge and skills, chemistry control, chemistry measurement and analysis, chemical and laboratory safety, radioactive effluent control, and non-radiological environmental performance. The assessments in each area were broad in scope and substantive. Findings in the assessment were, in large part, recommendations for improvements as apposed to negative findings. The report format provided an effective method for identification of strengths and weaknesses. Overall assessments for each area were color coded, and each finding was presented as a "-" for a negative finding and a "+" for a positive finding.

c. Conclusions

The inspectors concluded that the Chemistry Department quality assurance audit was comprehensive and effective in identifying areas of improvement.

R7.2 Problem Identification Form (PIF) Corrective Actions and Resolution

a. Inspection Scope (84750)

The inspectors reviewed the chemistry and REMP related PIFs initiated during 1999, which addressed deficiencies in the programs. The inspectors also interviewed the acting Radiation Protection Manager (RPM) and a chemistry supervisor to discuss the PIFs and the corrective actions taken to address deficiencies identified in the PIFs.

b. Observations and Findings

The inspectors noted that the licensee had documented 13 PIFs that related directly or indirectly to the REMP program. The inspectors noted no significant adverse trends in the PIFs; most issues were minor in nature and were the result of personnel error. For example, many dealt with technicians not entering the correct data onto forms. When asked about this, the chemistry supervisor indicated that all of his staff were trained to make data entries. However, certain forms were used very infrequently and were not as familiar to some of the staff. This had led to incorrect or incomplete data entries. To correct this, the department clarified the guidance in the chemistry department's "Reference Book" and began conducting pre-job briefings for the weekend staff. The remaining PIFs dealt mainly with REMP sample collection equipment problems and REMP procedure issues.

c. Conclusions

Problem Identification Forms identified issues related to the Chemistry and REMP programs that were minor in nature and were generally attributed to personnel error. The corrective actions taken were appropriate.

R7.3 Meteorology/REMP Program Audits and Self-Assessments

a. Inspection Scope (84750)

The inspectors reviewed the meteorology/REMP self-assessments, observations of field activities, and observation reports prepared by Nuclear Quality Assurance (NQA) staff and contractor supervision.

b. Observations and Findings

The inspectors noted that both REMP contractor management and NQA auditors had conducted numerous observations of field work, such as REMP/effluents sampling, laboratory quality assurance and QC activities, data reports, ODCM set points, and training. The audits found that plant requirements and expectations were generally met by the contract staff. The management observations of classroom training indicated that the instructor's performance was satisfactory and that the training was effective.

Nuclear Quality Assurance Staff and the meteorological contractor management conducted internal audits of the personnel providing oversight and maintenance services for the collection of meteorological data; a corporate health physicist conducted an historical assessment of meteorological data. These audits concluded that the meteorological data collection program provided outstanding data availability and that the staff performed at the required level to assure continued performance. However, the inspectors noted the station RP staff had limited oversight of this program due to the corporate contract and oversight of the program.

c. Conclusions

A comprehensive meteorological/REMP self-assessment program was conducted by licencee personnel. The assessments confirmed compliance with the station procedures and adequate data collection capabilities.

IV. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee staff in an exit meeting on December 17, 1999. The inspectors noted that no documents provided during the inspection were identified as proprietary. The licensee acknowledged the information presented and agreed that no proprietary information was provided to the inspectors.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

K. Aleshire, Acting, Lead Health Physicist
S. Bultler, Regulatory Assurance
M. Cassidy, Regulatory Assurance - NRC Coordinator
R. DeGolyer, Nuclear Oversight
C. Dunn, Operations Manager
W. Dupuis, Instrument Maintenance
M. Finney, Lead Operational Health Physicist
A. Haeger, Radiation Protection Manager
M. Holmes, Chemistry
C. Hurschik, Chemistry Technician
S. Landahl, Corporate Radiation Protection Manager
T. Luke, Acting Station Manager
T. Meents, Radioactive Waste Supervisor
J. Nalewajka, Nuclear Oversight
T. O'Bert, Maintenance
M. Pappas, Chemistry Technician
R. Pratt, Radiation Protection Supervisor
M. Reigel, Nuclear Oversight Manager
T. Saksefski, Nuclear Oversight
B. Schramer, Chemistry Manager
K. Schwartz, Station Manager
T. Simpkin, Regulatory Assurance Manager
G. Vickers, Health Physicist Specialist

INSPECTION PROCEDURES USED

IP 83750	Occupational Radiation Exposure
IP 84750	Radioactive Waste Treatment and Effluent and Environmental Monitoring

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS USED
Radiation Protection and Chemistry

BwAP	Braidwood Administrative Procedure
BwOP	Braidwood Operation Procedure
CFR	Code of Federal Regulations
CPI	Chemistry Performance Index
CT	Chemistry Technician
CVCS	Chemical and Volume Control System
DRS	Division of Reactor Safety
EPRI	Electric Power Research Institute
GI	Gastro-intestinal
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
NSO	Nuclear Station Operator
ODCM	Off-site Dose Calculation Manual
PDR	Public Document Room
PIF	Problem Identification Form
QA	Quality Assurance
QC	Quality Control
REMP	Radiological Environmental Monitoring Program
RP	Radiation Protection
RPA	Radiologically Protected Area
RPM	Radiation Protection Manager
RWP	Radiation Work Permit
TLD	Thermoluminescence Dosimeter
TS	Technical Specification
USAR	Updated Safety Analysis Report

PARTIAL LIST OF DOCUMENTS REVIEWED

Braidwood, Units 1 and 2 Technical Requirements Manual, (Revision 1), "Meteorological Monitoring Instrumentation";
EPRI TR-105714, "PWR Primary Water Chemistry Guidelines - Revision 3";
EPRI TR-102134-R4, "PWR Secondary Water Chemistry Guidelines - Revision 4";
Maintenance Rule- Evaluation History, December 7, 1999;
1998 Annual Radiological Environmental Operating Report;
TLM-SPM-1-13, "Teledyne Midwest Laboratory Sampling Procedures Manual";

Problem Identification Forms
PIF A1999-02431, "Missed ODCM Bi-weekly Milk Sample";
PIF A1999-02594, "Isotope Not Properly Accounted for in Liquid Release Package";
PIF A1999-02991, "Identified Isotope Not Entered into Liquid Release Program";
PIF A1999-03891, "Waste Water ODCM Compositor Found Unplugged";
PIF A1999-03820, "Problem with Chemistry Sampling Procedure";
PIF A1999-03943, "OPR01J Predefine Updated in Error Causing Past Due on Surveillance";

Audits and Self-Assessment Documents
10 CFR 50.59 Safety Evaluation Form, Tracking Number BRW-SE-1999-1022, ODCM Revision;
10 CFR 50.59 Safety Evaluation Form, Tracking Number BRW-SE-1999-819, ODCM Revision;
Braidwood Emergency Planning/REMP/ODCM Debrief Notes, April 10, 1998;
CE-98-03, "Audit Notification and Plan for Emergency Planning an REMP/ODCM";
ComEd 98-03, "Nuclear Generation Group EP/REMP/ODCM Audit Report";
Focus Area Self-Assessment Report, Radioactive Waste, and Effluent and Environmental Monitoring (November 11, 1999 to December 9, 1999);
Monthly Report on the Meteorological Monitoring Program at Braidwood Nuclear Station;
Murray and Trettel, "1999 Scheduled Audits";
AD-AA-103 (Revision 1), "NGG Self-Assessment Procedure;
NGG Self-Assessment, Braidwood Station Chemistry, Radioactive waste & Environmental Areas, 3rd Quarter 1999;
N.O.-36, Attachment D, (Revision 0), "Nuclear Oversight Master Audit Plan";
NOA-20-99-019, "Plant Support-Common PWR Chemistry Programs";
NOA 20-99-006, "Plant Support-Radioactive Waste Program";
NOA-20-99-012, "Plant Support-Chemistry Programs";
NSP-AP-3003, (Revision 0), "Nuclear Plant (PWR) Chemistry Report";
QAS 20-98-001, "Effluent Assessment Report"
QAA 20-97-011, "REMP/ODCM/PCP/RW Shipping Quality Audit Report";

Training Records
Chemistry Curriculum Review Committee Meeting Minutes-1999;
N-TCACT-99-01, "Chem Tech Continuing Training - Program Evaluation Summary";
Teledyne Brown Engineering Environmental Sample Collector Evaluation, November 19, 1999;
Environmental Sample Collection Training Outlines, 1998 and 1999;
VA1999-02, "Illinois Power Quality Assurance Audit of Teledyne Brown Engineering Environmental, April 26-29, 1999;