U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-331/82-15(DEPOS)

Docket No. 50-331 License No. DPR-49

Licensee: Iowa Electric Light and Power Company
IE Towers
P.O. Box 351
Cedar Rapids, IA 52406

Facility Name: Duane Arnold Energy Center

Inspection At: Duane Arnold Site, Palo, IA

Inspection Conducted: August 9-13, 16 and 23, 1982

Inspectors: A. G. Januska 9/8/82

S. Rozak 9/8/82

Approved By: M. C. Schumacher, Chief 9/8/82
Independent Measurements and
Environmental Protection Section

Inspection Summary:

Inspection on August 9-13, 16 and 23, 1982 (Report No. 50-331/82-15(DEPOS))
Areas Inspected: Routine, announced inspection of (1) the Environmental Protection Program including Management controls, program review and audit, radiological monitoring program implementation, (2) Confirmatory Measurements Program including discussion of results of beta analyses of a previous liquid effluent sample collection and analysis onsite of radiological effluent samples in the NRC Region III Mobile Laboratory, and discussion of results, and (3) review of open items from a previous inspection. The inspection involved 71 inspector-hours on site by two NRC inspectors.
Results: Of the seven areas inspected, no items of noncompliance or deviations were identified in six areas; one apparent item of noncompliance was identified in one area (violation - QC program for calibration of instruments - Severity V, Supplement 1; Paragraph 7).

DETAILS

1. Persons Contacted

*,α D. Wilson, Assistant Plant Superintendent, Radiation Protection and Security
*,[1],α K. Young, Radiation Protection Supervisor
* A. Funke, Chemistry Technician
*,[1] R. Lewis, Chemistry Technician
*,[1] R. Pohto, Chemistry
*,[1] G. Taylor, Chemistry
* M. Huting, Quality Control
* J. Vest, Quality Assurance
*,[1] A. Boldman, Chemrad (Contractor)
[1] R. Dyer, Assistant Radiation Protection Supervisor
S. Brown, Technical Engineer
D. Johnson, Environmental Health Physicist
R. Essig, Supervising Quality Assurance Engineer
J. Davis, Administrative Supervisor
α D. Mineck, Plant Superintendent

* Denotes those present at exit interview on August 13, 1982
[1] Denotes those in telephone discussion on August 16, 1982
α Denotes those in telephone discussion on August 23, 1982

2. Licensee Action on Previous Inspection Findings

(Open 331/81-14-01; QC of analytical measurements. Weaknesses in quality control associated with instrument calibration and operability, procedures, and review were evident during this inspection (Sections 5 and 7). This item remains open until these problems are resolved.

(Closed) 331/81-14-02; Charcoal adsorber radioactivity quantification. The licensee investigated counting techniques for adsorbers and calibrated this geometry according to the findings. (See Table I for comparative results)

3. Environmental Protection Program

The licensee's Environmental Radioactivity Monitoring Program, as defined in the Environmental Technical Specifications (Appendix B to Operating License No. DPR-49), was used as the basis for this portion of the inspection.

The program is conducted under the direction of the Radiation Protection Supervisor. All environmental samples, with the exception of aquatic, are collected by personnel from the Duane Arnold Energy Center (DAEC). Aquatic samples are collected by Ecological Analysts, Inc. personnel. Samples from the air, terrestrial, and aquatic environments are analyzed for radioactive content by Hazleton Environmental Sciences.

The inspector accompanied the DAEC sample collector while weekly air particulate and charcoal adsorber samples were collected. All of the eleven air sampling systems observed were operating properly. The collector was very proficient in changing samples, assuring that information regarding the sample parameters was accurately recorded and checking that each system was not leaking. Two or three air samplers are exchanged each week, to satisfy a quarterly calibration frequency.

The implementation of the program and results were reviewed by the inspector. Some sample points differ from those specified in the Technical Specifications. The changes were made because samples were unavailable at the specified locations. The new locations are near the old, maintain the continuity and satisfy the intent of the monitoring program. The licensee stated that these changes have been submitted to NRR as Technical Specifications amendments. The Environmental Monitoring Program Report for 1981 tabulated scheduled collections and analyses that were missing and an explanation. Some statements in the Summary and Interpretation Section were not substantiated by results listed in the Data Tabulation and Analyses Section. Anomalous results were not explained in all instances in either section. The licensee receives a monthly interim report from Hazleton Environmental Services wherein cumulative data is presented, and an annual report for submittal to the NRC. The licensee either has not reviewed these documents or is performing a very poor review of them.

The inspector also identified an error in the 3rd Quarter 1981 value reported for Kr-87 in the "Semiannual Effluent Release Report for the Duane Arnold Energy Center, Unit No. 1." This item was discussed at the exit interview.

4. QA Audit

The inspector determined that an audit of the Hazleton Environmental Services had not been conducted since June 1980; one is scheduled for the third quarter of 1982.

The inspectors reviewed the results of a Corporate Quality Assurance Audit (Report I-82-16) in which two findings involving apparent items of noncompliance with Environmental Technical Specifications (ETS) were identified. Instruments used in performing the measurements required by the ETS are required to be included in a calibration program according to Section 5.3.A. This item was responded to within the "reply due" date and included actions planned to prevent recurrence. This is a licensee identified item. The implementation of the corrective actions will be examined during a subsequent inspection. (331/82-15-07) This item was discussed during the exit interview.

The second finding noted that the Safety Committee had not performed timely and continuing audits of the Environmental Monitoring Program as required by Section 5.1.2 of the ETS. This item had not been responded to as of the end of the onsite portion of this inspection and is considered to be an unresolved item. (331/82-15-08)

5. Procedures

The inspectors reviewed counting Room procedures written following a commitment made during the last Confirmatory Measurements inspection.[1] These procedures are incorporated into Sections 8 and 9 of the Plant Chemistry Procedures (PCP) Manual and deal with source preparation and counter operation and calibration.

Generally, the procedures failed to adequately address laboratory quality control and there was no specific procedure for calibration of the gamma spectroscopy system. Procedure PCP 9.4, dealing with calibrations, is not applicable to the spectrometer. Moreover, the procedure is too general in that it lacks specific details regarding sources and counting times to be used for calibrating specific instruments. The inspectors also noted a number of errors and omissions which indicated a poor quality of procedure review. These included:

(a) Absence of a section dealing with calculation of alpha activity in the presence of beta in PCP 9.11,

(b) Incorrect formulas in PCP 8.3, Section 7.2.2 and in PCP 9.5, Section 8.1.2, and

(c) An inappropriate reference to an attachment in PCP 9.5.

These observations were discussed at the exit interview.

6. Sample Comparison in the Confirmatory Measurements Program

a. August, 1982 Split

Collected liquid, gas, air particulate filter and charcoal adsorber samples were analyzed by the licensee and by NRC inspectors using the Region III Mobile Laboratory. Results for these comparisons are tabulated in Table I and the comparison criteria are given in Attachment 1. In addition, a liquid sample has been sent to the Radiological Environmental Sciences Laboratory, the NRC's Reference Laboratory. The licensee agreed, at the exit interview, to perform analyses for H-3, gross beta, Sr-89 and Sr-90 (gross beta to be counted August 30, 1982) and to report the results to Region III. Results for these comparisons will be included as an addendum to this report.

For initial comparisons the licensee had two disagreements out of twenty-five comparisons. The disagreements were for gas and liquid samples. These disagreements were resolved as discussed below. No problems were encountered with comparisons on the air particulate filter or charcoal adsorber.

[1] IE Inspection Report No. 50-331/81-14

Initial comparisons on a "pretreat" gas sample yielded a disagreement for Kr-85m. The licensee's result was obtained using a 5 point peak search parameter in the vendor supplied analysis software. When the disagreement was identified the licensee reanalyzed the spectrum with a 3 point search parameter and achieved the agreement shown in Table I. This was the only case in which a disagreement was traced to this cause. The Kr-85m peak used for quantification apparently slightly overlapped a neighboring peak, enough to cause a problem with the background determination using a 5 point search criterion but not enough for the software to recognize the composite peak as a multiplet, which presumably would have given better results. This problem should occur rarely and unpredictably. Since it was demonstrated that a 3 point search criterion gave better results, the licensee agreed, during a discussion at the exit interview to use this criterion routinely when analyzing gaseous effluent samples.

The licensee used two versions of the spectral analysis program, GAMMA1 and GAMMA2, for reanalyzing the spectrum from the "Pretreat" gas sample. The two versions yielded slightly different results for the activity of Kr-85m in the sample. The difference was not significant; however, the licensee was not certain why there was a difference and which result was more reliable.

In the comparison on liquid from a radwaste tank, the licensee initially failed to identify Zn-65 using GAMMA1. When the spectrum was reanalyzed using GAMMA2, Zn-65 was identified and the result agreed with the NRC result. Due to the observed differences in the two programs, GAMMA1 and GAMMA2, the licensee agreed to contact the supplier of the software, EG&G ORTEC, and by September 13, 1982, to investigate more fully the differences in the two programs. Until it is determined which is the more reliable program the licensee agreed, at the exit interview, to use both programs when analyzing effluent samples and use the more conservative results.

In the liquid sample split during this inspection the licensee failed to achieve the sample detectable limits (5×10^{-7} µCi/ml) listed in Table 3.3-1 of the Appendix B Technical Specifications for analysis of radioactivity in tanks prior to release. The detectable limits achieved were approximately 2×10^{-6} µCi/ml. By telephone on August 16, licensee representatives stated that the geometry used in the comparison was not the one that would be used for quantification prior to release. A 2 liter Marinelli beaker counted for 2500 seconds would have been used instead of the 1 liter bottle used in the comparison. The licensee has not released liquid waste tanks for several years and it is not clear that the analysts were familiar with the correct geometry or counting time for liquid effluents since they are not specified in any procedure. Licensee representatives stated that they had made measurements using the correct geometry and that they could obtain the limits specified in Table 3.3-1. This will be examined in a future inspection. (331/82-15-09)

Section 2.3.1.C.1 of the Environmental Technical Specifications specifies a limit on the release rate of gaseous activity. A parameter that is used to determine this limit is the average gamma energy of release in Mev. The inspector examined the values that the licensee was using to determine this parameter and significant differences were noted between the licensee and NRC values for several radioisotopes especially Kr-88, Xe-133, and N-13. During the exit interview, the licensee agreed to recalculate $\bar{E}$ numbers by September 13, 1982, using a current reference, to recalculate the 2.3.1.C.1 limit for the preceeding twelve months to insure no violation of Technical Specifications occurred, and to report their findings to Region III.

b. July, 1981 Split

The sample discussed below was collected during a previous inspetion[2] and analyzed by the NRC's Reference Laboratory. The results are given in Table II and comparison criteria in Attachment 1.

Three of four comparisons met the established criteria for agreement. For the second consecutive year the licensee had a disagreement on Sr-90. In both cases, the licensee results were conservative. Licensee representatives stated that they believed that the problem was attributable to an incorrect Y-90 beta efficiency for their beta counter. They had attempted to recalibrate the counter for this isotope but had had a problem in obtaining a reliable standard. The inspectors stated that the magnitude of the disagreements could not be entirely attributed to an incorrect beta efficiency especially since the interim value being used (45%) was a typical value expected for this type of counter. On examination of the chemical procedure used for the separation of Sr and Y, the inspector found no obvious errors; however, they did express a concern that the carrier solutions used to determine chemical yield may be suspect since the solutions are several years old and have never been standardized by analyzing samples of known concentrations. Since the licensee does not have a QC program for laboratory analysis and does not participate in a crosscheck program, a weakness in the analysis technique would not be obvious. The licensee has ordered a new Y-90 calibration standard and has agreed to prepare new carrier solutions for Sr and Y. These are to be used for the analyses to be performed on the sample collected during this inspection.

No items of noncompliance or deviations were identified.

7. Quality Control of Analytical Measurements

The inspectors reviewed selected counting room procedures, records and logs to the date of this inspection. The Counting Room Procedures have been extensively revised in the previous year and are improved

[2] IBID.

since the previous inspection; however, as discussed earlier, (Section 5) they need additional revision and review.

The inspectors toured the counting room and examined all available control charts. During the previous inspection[3] the inspectors had found that a well counter had been operating beyond its acceptable range for a period of approximately two months. The licensee had agreed to have this counter operational by July 24, 1981. During this inspection available records indicated that the counter was not in routine service until November 1981. It was taken out of service in March 1982 and was not operational again until August 5, 1982. This counter is used for Surveillance Test Procedures (STP) related to fuel performance. The gamma spectrometer was used as backup during the periods the counter was out of service.

The records indicated that an NMC beta counter began degrading in December 1981 and was not repaired until July 1982. During this period the efficiency of the detector had decreased by approximately 20% but the only apparent action taken was periodically to run a new chi-squared analysis and to redefine the control levels at a lower value.

Some control charts, especially for the low level alpha/beta counter, had not been filled in consistently and contained several gaps of a week or longer with no explanation.

The above problems indicate a lack of an adequate QC program for instrumentation and a lack of effective management review.

Section 5.3.A of Appendix B Technical Specifications requires that calibration frequencies for instruments used in performing the measurements required by ETS be included in procedures, that a Quality Control Program be followed for the calibration of instruments, and that records be maintained. Nearly all the counting room instruments are necessary to do the analyses required by Tables 3.3-1 and 3.3-2 of the Environmental Technical Specifications. The gamma spectrometer is not included in any quality control program nor are procedures written for its calibration. This system is the primary counting instrument to perform the analyses required by Tables 3.3-1 and 3.3-2 of the ETS. The lack of specific calibration procedures, the lack of a Quality Control Program for the gamma spectrometer, and the overall poor implementation of quality control for the other counting room instruments is an apparent item of noncompliance with Technical Specification 5.3.A.

Licensee representatives recognized the need for improving the QC program and showed the inspectors an internal memorandum dated August 11, 1982, outlining a proposed QC program for the chemistry lab and counting room. This proposed program, as outlined, addresses the performance of analysts and adequacy of procedures but does not provide for QC of instrumentation. Licensee representatives stated

[3] IBID

that this will be included in the QC program when it is written and implemented.

One item of noncompliance was observed.

8. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during the inspection is discussed in Paragraph 4.

9. Exit Interview

a. August 13, 1982

The inspectors met with licensee representatives denoted in Paragraph 1 at the end of the inspection. The inspectors summarized the purpose and the scope of the inspection and the findings. The licensee acknowledged the inspectors comments and agreed to the following:

(1) issue a correction to the 1981 Semiannual Effluent Report by September 13, 1982 (paragraph 3) (331/82-15-01)

(2) supply a list and a schedule for the writing of additional counting room procedures and a schedule for revising existing counting room procedures by October 1, 1982 (paragraph 5) (331/82-15-02)

(3) recalculate the release rate of gaseous activity for 1981 using corrected $\bar{E}$ (average energy of release in Mev) values by September 13, 1982 (paragraph 6a)(331/82-15-03)

(4) investigate algorithms noted as having produced different analytical results using the same data by September 13, 1982. (paragraph 6a)(331/82-15-04)

(6) analyze the split liquid sample for gross beta, H-3, Sr-89 and Sr-90 according to agreed upon dates and report the results to RIII. The strontium analyses shall involve making new strontium carrier solutions (paragraph 6a and 6b)(331/82-15-05)

(6) continue the use of three point search criteria for gaseous quantification which was discussed and implemented during this inspection (paragraph 6a)(331/82-15-06)

b. August 16, 1982

The inspectors discussed Minimum Detectable Activity levels for liquid sample quantification which are covered in detail in Paragraph 6a. The telephone discussion involved licensee representatives listed in Paragraph 1.

c. August 23, 1982

During a telephone conversation with licensee representatives listed in Paragraph 1 the inspectors discussed the apparent item of noncompliance. (paragraph 7)(331/82-15-10)

Attachments:

Table I, Confirmatory Measurements
Program Results, 3rd Quarter 1982
Table II, Confirmatory Measurements
Program Results, 3rd Quarter 1981
Attachment 1, Criteria for Comparing
Analytical Measurements

TABLE I

U S NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM
FACILITY: DAEC
FOR THE 3 QUARTER OF 1982

		------NRC-------		---LICENSEE-----		---LICENSEE:NRC----		
SAMPLE	ISOTOPE	RESULT	ERROR	RESULT	ERROR	RATIO	RES	T
OFF GAS	KR-85M	5.1E-04	4.1E-06	4.8E-04	0.0E-01	9.4E-01	1.3E 02	A
	KR-87	3.3E-03	2.8E-05	3.3E-03	0.0E-01	1.0E 00	1.2E 02	A
	KR-88	2.1E-03	1.7E-05	1.7E-03	0.0E-01	8.5E-01	1.2E 02	A
	XE-133	1.9E-04	5.8E-06	1.9E-04	0.0E-01	1.0E 00	3.3E 01	A
	XE-135	2.6E-03	9.5E-06	2.2E-03	0.0E-01	8.8E-01	2.7E 02	A
	XE-135M	1.3E-02	3.8E-04	1.2E-02	0.0E-01	9.0E-01	3.4E 01	A
	XE-138	5.7E-02	1.1E-03	5.7E-02	0.0E-01	1.0E 00	5.2E 01	A
C FILTER	I-131	2.7E-02	1.9E-04	2.8E-02	0.0E-01	1.0E 00	1.4E 02	A
	I-133	4.1E-02	4.2E-04	4.1E-02	0.0E-01	9.9E-01	9.8E 01	A
	I-135	1.1E-02	1.9E-03	6.5E-03	0.0E-01	5.9E-01	5.8E 00	A
P FILTER	I-131	1.1E-04	1.2E-05	1.1E-04	0.0E-01	9.6E-01	9.2E 00	A
	BA-140	1.0E-03	5.9E-05	1.5E-03	0.0E-01	1.5E 00	1.7E 01	P
L WASTE	NA-24	7.7E-05	1.6E-06	7.4E-05	0.0E-01	9.6E-01	4.7E 01	A
	CR-51	3.3E-04	7.6E-06	2.6E-04	0.0E-01	7.9E-01	4.3E 01	A
	MN-54	1.8E-04	2.1E-06	1.5E-04	0.0E-01	8.7E-01	8.5E 01	A
	CO-58	3.0E-05	1.3E-06	2.6E-05	0.0E-01	8.7E-01	2.4E 01	A
	CO-60	7.1E-04	4.2E-06	5.6E-04	0.0E-01	7.9E-01	1.7E 02	P
	ZN-65	3.0E-05	2.8E-06	2.6E-05	0.0E-01	8.5E-01	1.1E 01	A
	I-131	3.3E-06	6.9E-07	2.7E-06	0.0E-01	8.3E-01	4.7E 00	A
	I-133	2.2E-05	1.3E-06	1.6E-05	0.0E-01	7. 3-01	1.6E 01	A
	SR-92	6.7E-06	1.2E-06	7.0E-06	0.0E-01	1 0E 00	5.7E 00	A
	CS-134	9.5E-06	1.0E-06	1.2E-05	0.0E-01	1.2E 00	9.5E 00	A
	CS-137	2.1E-05	9.6E-07	2.9E-05	0.0E-01	1.4E 00	2.2E 01	P
	BA-140	1.4E-05	2.8E-06	1.5E-05	0.0E-01	1.1E 00	5.1E 00	A
	LA-140	5.8E-06	7.9E-07	5.6E-06	0.0E-01	9.7E-01	7.4E 00	A

T TEST RESULTS:
A=AGREEMENT
D=DISAGREEMENT
P=POSSIBLE AGREEMENT
N=NO COMPARISON

TABLE II

U S NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM
FACILITY: DUANE ARNOLD
FOR THE 3 QUARTER OF 1981

		-------NRC-------		---LICENSEE-----		---LICENSEE:NRC----		
SAMPLE	ISOTOPE	RESULT	ERROR	RESULT	ERROR	RATIO	RES	T
L WASTE	BETA	2.7E-04	1.0E-05	2.6E-04	3.0E-06	9.6E-01	2.7E+01	A
	H 3	7.0E-04	3.0E-06	6.5E-04	5.9E-06	9.3E-01	2.3E+02	A
	SR 89	8.7E-06	4.0E-07	1.1E-05	7.8E-08	1.3E+00	2.2E+01	A
	SR 90	2.0E-07	2.0E-08	3.9E-06	1.0E-07	1.9E+01	1.0E+01	D

T TEST RESULTS:
A=AGREEMENT
D=DISAGREEMENT
P=POSSIBLE AGREEMENT
N=NO COMPARISON

ATTACHMENT 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgment limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated one sigma uncertainty. As that ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement should be considered acceptable as the resolution decreases. The values in the ratio criteria may be rounded to fewer significant figures to maintain statistical consistency with the number of significant figures reported by the NRC Reference Laboratory, unless such rounding will result in a narrowed category of acceptance. The acceptance category reported will be the narrowest into which the ratio fits for the resolution being used.

RESOLUTION	RATIO = LICENSEE VALUE/NRC REFERENCE VALUE		
	Agreement	Possible Agreement "A"	Possible Agreeable "B"
<3	No Comparison	No Comparison	No Comparison
≥3 and <4	0.4 - 2.5	0.3 - 3.0	No Comparison
≥4 and <8	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
≥8 and <16	0.6 - 1.67	0.5 - 2.0	0.4 - 2.5
≥16 and <51	0.75 - 1.33	0.6 - 1.67	0.5 - 2.0
≥51 and <200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.67
≥200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is greater than 250 keV.

Tritium analyses of liquid samples.

"B" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is less than 250 keV.

Sr-89 and Sr-90 determinations.

Gross beta, where samples are counted on the same date using the same reference nuclide.