RELATED CORRESPONDENCE

COMMONWEALTH EDISON COMPANY
Date: July 2, 1984

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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| In The Matter Of | ) | |
| | ) | |
| COMMONWEALTH EDISON COMPANY | ) | Docket Nos. 50-454-OL |
| | ) | 50-455-OL |
| (Byron Nuclear Power Station, | ) | |
| Units 1 & 2) | ) | |

SUMMARY OF THE TESTIMONY OF
LOUIS O. DEL GEORGE
ON CONTENTION 1
(REINSPECTION PROGRAM - INSPECTOR
QUALIFICATION AND WORK QUALITY)

I. Louis O. Del George is Commonwealth Edison Company's Assistant Vice President responsible for licensing and engineering activities within the Nuclear Operations Division, including licensing activities for the Byron Station. Mr. Del George managed the development of the Reinspection Program.

II. Mr. Del George describes the structure of the Reinspection Program and discusses the results of the Program for Hatfield, Hunter, and PTL.

III. Mr. Del George explains that the Reinspection Program was developed to verify the effectiveness of inspector qualification and certification practices utilized by site contractors prior to September, 1982.

IV. Mr. Del George explains the four essential elements of the Reinspection Program.

A. Selection of Contractors - 8 of 19 contractors who performed safety-related work at Byron were subject to the Reinspection Program. These 8 contractors accounted for approximately 93% of the safety-related work. The other contractors were not included because they were subject to a different standard, or they were undergoing a separate reinspection, or their work was neither accessible nor recreatable for purposes of reinspection.

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B. Selection of Inspectors - All inspectors for two contractors were reinspected. An adequate sample of inspectors for the other six contractors was selected.

C. Selection of amounts of each inspector's work subject to reinspection - The first three months of each selected inspector's work was reinspected.

D. Establishment of Acceptance Criteria - For objective inspections, an agreement rate of 95% was applied. For subjective inspections an agreement rate of 90% was applied.

V. Mr. Del George explains that the work performed by Hatfield, Hunter and PTL was categorized into discrete work activities called "attributes," which are comprised of more basic "elements." All "accessible" and "recreatable" attributes (explained by Mr. Del George) of safety-related work for the inspectors three month period were reinspected. Some attributes were not inspected by any of the sampled inspectors for the three month period.

VI. Mr. Del George explains that the attributes were further categorized "objective" (not significantly affected by qualitative interpretation) or "subjective" (require qualitative interpretation). Visual weld examinations were the only subjective attributes.

VII. Mr. Del George explains that acceptable items were defined as those for which the reinspector agreed with the condition on the original inspection record, using criteria that applied at the time of the original inspection.

VIII. Mr. Del George explains the basis of the 95% acceptance level for objective attributes and the 90% acceptance level for subjective attributes. All observed discrepancies were evaluated for design significance.

IX. Mr. Del George explains that if an inspector failed to meet the applicable acceptance criterion, the sample was expanded to focus specifically on areas where qualification was suspect. For Hatfield, Hunter, and PTL, no inspectors were found unqualified regarding objective attributes. For subjective attributes, the indeterminate qualifications of some of their inspectors, and the failure of one PTL inspector, led to sample expansion.

X. Mr. Del George explains that the Reinspection Program results for Hatfield, Hunter, and PTL demonstrate that their procedures for qualification and certification of QC inspectors prior to September, 1982 were effective. These results also show that all other contractors' inspectors certified in accordance with these same practices were also adequately qualified, based on the large data base and the fact that no discrepancies were found to have design significance.

XI. Mr. Del George explains why his conclusions are not affected by the fact that some attributes were inaccessible or not recreatable.

XII. Mr. Del George explains how discrepancies found during the Reinspection Program were dispositioned. None were found to have design significance. Discrepancies were evaluated to determine whether any trends existed which would warrant further review. Two trends were identified, however, the trended discrepancies were found to be insignificant from a design standpoint.

XIII. Mr. Del George explains that the NRC Staff reviewed the results of the Reinspection Program and reached a conclusion that the safety-related work done by the Byron contractors is of acceptable quality. Mr. Del George also discusses two recent NRC reports relating to Hatfield QC activities which identified two apparent items of non-compliance. Mr. Del George explains that these NRC reports do not affect his opinion regarding the effectiveness of Hatfield's QC inspector certification program.

XIV. Mr. Del George concludes that the quality of the work performed by Hatfield and Hunter is adequate and that there is reasonable assurance that the equipment and systems associated with this work will not compromise the safe operation of Byron Station. Mr. Del George explains that the basis for this opinion is based upon the results of the Reinspection Program and on the general effectiveness of programs implemented by CECo to assure the quality of construction activities.

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TESTIMONY OF
LOUIS O. DEL GEORGE

Q.1. Please state your full name and place of employment.

A.1. My name is Louis Owen Del George. I am employed by Commonwealth Edison Company in its Corporate Offices in Chicago, Illinois.

Q.2. Please describe your job responsibilities.

A.2. I am an Assistant Vice-President, responsible for Licensing and Engineering activities related to the nine operating nuclear reactors within Commonwealth Edison's Nuclear Operations Division. I am also responsible for Licensing activities related to the four nuclear reactors which Commonwealth Edison is currently constructing, including the two reactors at Byron Station. In addition, the engineering organization that reports to me maintains functional oversight of the engineering activities related to the reactor facilities under construction to provide for the uniform application of Commonwea.th Edison's engineering procedures at both our operating nuclear plants and nuclear plants under construction.

Q.3. Please state your educational background and work experience.

A.3. I received a Bachelor of Science Degree in Engineering Science from the Illinois Institute of Technology in 1970. I also received a Juris Doctor degree from the Chicago Kent College of Law of the Illinois Institute of Technology in 1977. I began my professional career at the Bettis Atomic Power Laboratory in 1969 where I held various positions of increasing responsibility related to the design and fabrication of nuclear reactor internals. While employed at the Laboratory, I was appointed to the The Shock and Vibration Design Review Committee which assessed the adequacy of vibration design practices for all pressurized water reactor plants designed at the Laboratory, including the Shippingport facility. I also attended the Laboratory's Reactor Engineering School which provided graduate level instruction in the design of nuclear power systems.

In 1974, I joined Commonwealth Edison and have held positions of increasing responsibility in the Station

Nuclear Engineering and Licensing Departments. In connection with my engineering experience, I managed numerous backfit projects related to the Dresden and Quad Cities Stations. These projects included structural, mechanical and electrical design and construction activities, and involved work governed by both the American Society of Mechanical Engineers (ASME) and American Welding Society (AWS) Codes.

In connection with my licensing experience, from 1978 to 1981 I managed all licensing activities related to the LaSalle County Station including development of the Company responses to all NRC questions concerning design and construction activities. In this regard, I participated in the development of corrective action programs some of which involved reinspection of work previously completed and included construction activities governed by the ASME and AWS codes. This includes a reinspection program for hanger welding performed in accordance with AWS D1.1. by the LaSalle County heating, ventilating and air-conditioning (HVAC) contractor, the sample reinspection of large and small bore piping supports and the reinspection of ASME bolting by the LaSalle County mechanical contractor, the sample reinspection of cable routing and separation by the electrical contractor, and a structural steel sample reinspection program which included visual inspection of welding performed in accordance with AWS D1.1.

In 1982 I was appointed Director of Licensing at which time I assumed responsibility for all licensing activities related to the Company's nuclear facilities both operating and under construction. In 1983 I assumed my present position of Assistant Vice-President, after acting for approximately one-year as staff assistant to my predecessor in this position. It was in this latter role as staff assistant to the Assistant Vice-President of Licensing and Engineering that I previously gave testimony in this preceeding.

Q.4. Did you participate in the development of the Reinspection Program at Byron Station concerning the quality of QC inspectors?

A.4. Yes.

Q.5. Please describe your responsibilities concerning the Reinspection Program.

A.5. My responsibility as Director of Nuclear Licensing included the development of the Company's response to NRC Staff inspection findings. In 1982, acting in that capacity, I managed the development of a program for verifying the effectiveness of contractor practices for the qualification and certification of QC inspectors at the Byron site, hereafter referred to as the "Reinspection Program" or "Program". The affected Company departments were assembled under my direction. The principal contributors to the Program definition were the Project Construction Department, which had overall responsibility for site contractor activities; the Quality Assurance Department which maintained oversight of site contractor activities and had insight on the standards affecting these practices and their application at the Byron site; and the Nuclear Licensing Department, which provided technical guidance on methods for resolving the findings based on experience gained in the resolution of similar issues involving reinspection of completed construction work.

Q.6. What was the objective of the Reinspection Program?

A.6. The Reinspection Program undertaken at Byron was developed to verify the effectiveness of inspector qualification and certification practices utilized by site contractors prior to September, 1982. The Program examined, on a sampling basis, inspections performed by QC inspectors who were certified prior to September, 1982 under those practices. By demonstrating that the performance of previously certified inspectors could be reproduced at an appropriate acceptance rate through reinspections performed by inspectors whose qualification and certification met current standards, the qualification of inspectors previously certified under the former practices would be confirmed.

This objective is more easily understood when viewed against the background which preceded the Program. A special NRC inspection was conducted at Byron during the Spring of 1982 by an NRC Construction Assessment Team (CAT). One of the findings of the team, published in IE Report Nos. 50-454/82-05 and 50-455/82-04, questioned the adequacy of the on-site contractors' programs for qualifying, and thereby certifying QC inspectors. Specifically, the NRC inspectors found deficiencies in (1) the contractors' evaluations of initial inspector capabilities, (2) the documentation of initial certification, and (3) the criteria used to establish inspector qualification. Although there was no finding that these deficiencies had compromised the quality of construction, the NRC adopted the position that the site contractors' QC inspector qualification programs had to be upgraded and that the quality of the inspections already completed required verification.

The purpose of the Reinspection Program was to validate former inspector certification practices under ANSI N45.2.6 (1978), and not to confirm the adequacy of construction quality generally. With validation of certification practices the objective, the Reinspection Program focused on demonstrating the repeatability of inspections previously performed, from which the effectiveness of qualification and certification practices could be directly demonstrated. However, the large volume of inspection data associated with the Program does produce a strong inference of the adequacy of construction quality at the site.

Q.7. What is the purpose of your testimony?

A.7. My testimony will describe the structure of the Reinspection Program, and will discuss the results of the Program for Hatfield Electric Company ("Hatfield"), Hunter Corporation ("Hunter"), and Pittsburgh Testing Laboratory ("PTL").

Q.8. In general terms, identify the essential elements of the Reinspection Program.

A.8. The Reinspection Program consisted of four essential elements. These are: (1) Selection of Contractors, (2) Selection of Inspectors (3) Selection of Inspectors' Work, and (4) Establishment of Acceptance Criteria.

Q.9. Were all the contractors who performed construction work at the Byron site subject to the Reinspection Program?

A.9. No. Eight of the 19 contractors who had performed or were performing safety-related work at the Byron Station were subjected to reinspection. These site contractors were:

a. Blount Brothers Corporation - responsible for most structural work including concrete/masonry, installation of post tensioning tendons, miscellaneous structural steel, and fireproofing.

b. Johnson Controls Incorporated - responsible for installation of Heating, Ventilating, and Air-Conditioning HVAC controls and instrumentation including tubing, hangers and instrumentation, and instrument panel installation.

c. Hunter Corporation - responsible for mechanical erection activities associated with equipment setting, piping, component supports, and pipe whip restraints.

d. Nuclear Installation Services Company - responsible for installation of the NSSS system including control rod drive mechanisms reactor vessel setting, r[illegible]tor coolant pump setting, and miscellaneous [illegible] handling equipment erection.

e. Hatfield Electric Company - responsible for electrical work on site including embedded and exposed conduit and underground duct, cable pan installation including hangers, ladders and covers, as well as cable installation and termination. This contractor was also responsible for installation of fire detection, fire protection and security systems.

f. Powers-Azco-Pope - responsible for installation of small bore instrument piping and miscellaneous small bore (2" and under) systems.

g. PTL - responsible for nondestruction testing of welds, concrete testing, aggregate testing, concrete expansion anchor testing, soils testing, calibration and structural steel bolting inspection.

h. Peabody Testing - responsible for same scope as PTL who succeeded Peabody in September, 1977.

The work inspected by these contractors amounted to approximately 93% of the safety-related work at the Byron Station. (See Attachment A).

These contractors all certified their QC inspectors using the guidance provided in ANSI N45.2.6. With respect to the NRC questions concerning the adequacy of inspections performed between the start of safety-related construction in 1976 and September, 1982, the program proposed for resolving the matter was developed based primarily upon experience gained in the resolution of other NRC findings related to programmatic concerns where no construction defects had been identified. In that regard, a reinspection based on a focused sampling process was considered prudent because it allowed for the allocation of resources in a way that would most effectively uncover potential discrepancies.

Of the 11 contractors excluded from the Program, three were excluded because they were not subject to ANSI N45.2.6 (1978) and, hence, the qualification of their QC inspectors was not in question. Three other contractors were already undergoing extensive reinspection of their work, thereby rendering it unnecessary to address the question of their QC inspector qualification. The remaining five were excluded from the Reinspection Program because their work was neither accessible nor recreatable for purposes of reinspection. The procedures and practices for the qualification and certification of QC inspectors for these five contractors were established under the same guidelines as was the case for the eight contractors included in the Reinspection Program.

Q.10. How were the inspectors who were the subject of the Reinspection Program selected?

A.10. All QC inspectors for two contractors (Powers-Azco-Pope and Johnson Controls) were reinspected to the extent their work included reinspectable items. This was responsive to broad concerns raised in the CAT Inspection Report.

The work of the QC inspectors of the six remaining contractors was reinspected by a sampling technique. To ensure a representative selection of inspectors from the total population, Commonwealth Edison compiled rosters of the six contractors' QC inspectors. The names of the inspectors were listed chronologically by date of certification. The first inspector on each roster was selected and every fifth inspector thereafter was included in the Program. After the original sample population was selected, the NRC Senior Resident Inspector (who had conducted the CAT review) reviewed the sample and added two to four names to each contractor's group of inspectors. For example, four names were added to the sample population for Hatfield, three for Hunter, and three for

PTL. This NRC input was solicited to assure that any inspector whose certification might in any way be held suspect by the NRC would be captured by the initial reinspection sample.

Q.11. Was the sampling plan used to select the QC inspectors for reinspection adequate to assure that this group was representative of the total population of inspectors?

A.11. The Reinspection Program sampling scheme as described here was not designed on a formal statistical basis. Rather, it was a result of an engineering judgment that for small populations, a sample size of about 20% will provide a reliable indicator of the quality of the total population. In the Byron Reinspection Program, the selection of every fifth individual on a list chronologically ordered by initial certification date assures a wide ranging representation of inspection activities over the time period of the contractor's participation in the plant's construction. The addition of inspectors identified by the NRC as suspect would result in conservative bias to the sample if those suspicions were justifiable.

As shown in the following table, the inspectors whose work was reinspected span the entire period of interest from the start of safety-related construction to September, 1982.

Distribution of Inspectors Reinspected by Contrator by Year

| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982* | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Blount Brothers | 2/7 | 2/3 | 0/2 | 3/12 | | 0/2 | 1/2 | 8/28 |
| Johnson Controls | | | | | 1/2 | 3/4 | 1/1 | 5/7 |
| Hunter | 1/2 | 2/6 | 1/6 | 2/7 | 4/19 | 9/31 | 3/13 | 22/84 |
| NISCo | | | 1/3 | | 1/1 | 1/2 | 1/2 | 4/8 |
| Hatfield Electric | | 1/3 | 2/4 | 1/1 | 2/5 | 15/60 | 2/13 | 23/86 |
| Powers-Azco-Pope | | | | 2/2 | 5/5 | 9/10 | 3/4 | 19/21 |
| Pittsburgh Testing | | 6/34 | 6/16 | 3/18 | 2/5 | 3/7 | 3/5 | 23/85 |
| Peabody Testing | 1/23 | 5/14 | | | | | | 6/37 |
| TOTAL | 4/32 | 16/60 | 10/31 | 11/40 | 15/37 | 40/116 | 14/40 | 110/356 |

* to September 1982

Note: In the above table, the numbers shown as x/y indicate the number of inspectors reinspected versus the total number of inspectors certified.

Based on the above, it can be seen that the Reinspection Program included a reasonable distribution of inspectors over the timeframe of interest, and the sample size for each contractor was large enough to provide assurance that the results of the Program are representative of each contractor's total inspector population.

The adequacy of the sample size can also be judged by comparison with those specified by Military Standard 105D (Military Standard 105D, "Sampling Procedures and Tables for Inspection by Attributes," Washington, D.C.; U.S. Government Printing Office, 1963. Also appears as ANSI/ASQC Z1.4-1981.) Military Standard 105D is a standard ANSI document containing sampling plans for performing inspection by attributes. The standard specifies sample size as a function of population size. The following table lists the total population of inspectors, number of inspectors who were reinspected, and the number of inspectors required to be sampled for each contractor, based on a Military Standard 105D single sampling plan and a normal inspection level.

Sample Sizes Used
in Reinspection Program vs. Those Required
in Military Standard 105D

| Contractor | Total Population of Inspectors | No. of Inspectors Reinspected | No. of Inspectors to be Reispected per Military Standard 105D |
|---|---|---|---|
| Blount Brothers | 28 | 8 | 8 |
| Johnson Controls | 7 | 5 | 2 |
| Hunter | 84 | 22 | 13 |
| NISCo | 8 | 4 | 2 |
| Hatfield | 86 | 23 | 13 |
| Powers-Azco-Pope | 21 | 19 | 5 |
| Pittsburgh Testing | 85 | 23 | 13 |
| Peabody Testing | 37 | 6 | 8 |
| | 356 | 110 | 64 |

Note: All of the inspector population was reviewed for possible reinspection for Johnson Controls, Powers-Azco-Pope, and Peabody Testing. There were no reinspectable items for those inspectors not included.

Thus, I conclude that the sampling plan used to select the QC inspectors was adequate because its size captured a significant number of inspectors distributed over the entire period of interest. In addition, the samples compare favorably with those suggested for such plans in MIL STD 105D, which is recognized in the field of statistical quality control.

Q.12. How much of each inspector's work was subject to reinspection?

A.12. The Program required that the first 3 months (i.e., 90 days) of each selected inspector's work be reinspected.

Q.13. Why was only the first 3 months used?

A.13. A random sampling of each selected inspector's total work was not judged adequate to indicate the inspector's initial qualification. Rather, the first 3 months of each inspector's work was judged to be a conservative measure of that inspector's qualifications because any deficient work by an inexperienced inspector is most likely to be performed during the early months on the job. This sampling approach introduced a conservative bias which would support the adequacy of the inspector sample discussed in response to Q.11.

Q.14. Was there any requirement that an inspector have a minimum number of inspections before he qualified as a candidate for the Reinspection Program?

A.14. Yes, in order to provide a baseline for assessing the performance of the selected inspectors, a minimum number of reinspections was incorporated into the Program guidelines. Generally, an inspector had to perform a minimum of 50 reinspectable inspections during the period subject to reinspection. In the case of independent testing agency personnel (Pittsburgh Testing and Peabody Testing), 25 inspections were accepted because of the limited number of inspections for the typical inspector. When required, the next inspector listed chronologically was substituted. In those cases for which reinspection was initiated for the original inspector but a "minimum quantity" was not reinspectable, all reinspections actually performed for the original inspector were also included in the Program data base.

Q.15. What work performed by Hatfield, Hunter, and PTL was reinspected.

A.15. The work was categorized into discrete work activities called attributes. Each attribute was subdivided into more basic elements, wherein the inspection of an attribute encompassed inpection of its elements. All attributes of safety-related work inspected in the 90-day period were reinspected if they were both recreatable and accessible. Some attributes were not inspected in the 90-day period by any of the sampled inspectors. In the case of Hatfield, 9 of 11 inspection types were captured in the Reinspection Program, the remaining two (cable pan covers and cable pan identification) were not inspected by any inspector sampled in his first 90 days. In the case of Hunter 43 of 48 inspection types were captured in the Reinspection Program, the remaining five involving component support and equipment final inspection (Type 3 or 4 hardware and document reviews) had not been initiated prior to September, 1982. All of the attributes reviewed for incorporation in the Program are delineated in Attachment B.

Q.16. Is it your testimony that only accessible and recreatable attributes were reinspected?

A.16. Yes.

Q.17. Please explain the manner by which attributes were determined to be either accessible or recreatable.

A.17. An attribute inspection was considered to be recreatable if it could be identified to a specific inspector and the condition or state originally inspected was capable of reinspection at a later time. For example, an inspection was not recreatable if the attribute inspected was reworked at some time after the original inspection. An inspection was not recreatable if the attribute was subjected to inspection on a sampling basis without element specific documentation, such as conduit support bolting for which the inspection of a specific support could not always be identified to a specific inspector. In addition, certain attributes are only amenable to inspection at the time the original work is being done, such as weld interpass temperature or equipment rigging hold points.

An attribute inspection was accessible for reinspection if extensive dismantling was not required to enable the reinspection to be performed. Thus, certain attributes were inaccessible due to their being embedded in concrete, or located within structural or mechanical enclosures which would require removal of hardware in order to make reinspection possible. Attribute inspections were deemed to be accessible, however, if reinspection could be accomplished through the erection of scaffolding or through the removal of paint, insulation or fireproofing.

Q.18. Were the attributes further categorized for purposes of the Reinspecton Program?

A.18. Yes. For the purposes of the Reinspection Program basic attributes inspected were characterized as either "objective" or "subjective". This characterization was made based on the manner by which a particular inspection was carried out.

Q.19. What is the difference between a subjective and objective attribute?

A.19. An objective attribute is one for which its inspection is not significantly affected by qualitative interpretation. An element of such an inspection can usually be easily quantified or measured, such as material type, size, shape, traceability, dimensional configuration, etc.

A subjective attribute is one for which its inspection requires qualitative interpretation by the inspector. An example is visual weld examination without supporting gauges, for which an inspector is called upon to reach judgments on weld elements which cannot be readily quantified, such elements as overlap, porosity, lack of fusion, etc. Weld length was also considered a subjective feature if it was assessed qualitatively, i.e., without the use of a mechanical measuring device. Visual weld examination was the only subjective attribute in the Reinspection Program.

Q.20. How was it determined that original inspections were acceptable?

A.20. The focus of the Reinspection Program was to assess the qualifications of the site contractors' QC inspectors who had performed inspections during the 1976 to September, 1982 timeframe. This was accomplished by using QC inspectors to reinspect the original inspectors' work who were qualified under the certification procedures accepted by the NRC in mid-1982 and approved for use by the site contractors beginning in September, 1982. The original inspection record and the reinspection record were compared and evaluated to determine whether any discrepancy between the two records existed.

Each contractor used its own QC inspectors as reinspectors and as indicated above, the reinspectors were properly qualified. Reinspections were performed to the same or in some cases more stringent criteria than had been used in the original inspection. Thus, even if design requirements or inspection criteria had been relaxed subsequent to the initial inspection, acceptability of the work performed by the original inspector was evaluated according to the earlier, stricter criteria. It was deemed important to recreate the conditions of the original inspection because the objective of the Reinspection Program was to evaluate the quality of the original inspector's performance.

Acceptable items were defined as those for which the reinspector agreed with the condition recorded on the original inspection record. Without that agreement, the item was graded as unacceptable. These statistics were compiled and recorded in such a way that correlation to the original inspector could be accomplished. The grading was executed in this manner regardless of whether or not the installed item was in conformance with design drawing tolerances. If the original inspector recorded a value for a finite dimensional measurement and the reinspector could not obtain the same measured value, the item was graded as unacceptable (hence an observed discrepancy), even if the installed product dimensions were acceptable to design drawing tolerances. For example, if the original inspector identified the distance between two points as 3 feet 2 inches, but the reinspected value was 3 feet 1-5/16 inches (a difference of 11/16 inch), a discrepancy was recorded even though both measurements meet the requirements of the design drawings, i.e., they are within the design tolerance.

All observed discrepancies were recorded and tabulated and subsequently compared to the Program acceptance criteria. It is important to reiterate that all observed discrepancies were counted against the original inspector whether or not the observed discrepancy was later demonstrated to be a valid discrepancy when compared to current design or installation parameters and tolerances.

Q.21. What were the acceptance criteria?

A.21. For the purpose of this Reinspection Program, the following acceptance criteria applied:

1. For objective inspections - 95% agreement rate.
2. For subjective inspections - 90% agreement rate.

The agreement rate is the rate at which the reinspector agreed with the condition recorded by the original inspector on the original inspection record.

Q.22. What is the basis for the 95 percent acceptance level for objective attributes?

A.22. Acceptance criteria were established that Commonwealth Edison judged would provide reasonable assurance of the adequacy of the inspector's qualifications. For objective inspections, such as an inspection performed with calibrated instruments or the inspection of a material heat number, agreement between the reinspection and the original inspection was required to meet or exceed a rate of 95%. This acceptance criteria was considered a reasonably conservative acceptance level, that recognized that unintentional human error precludes 100% agreement. Moreover, many objective inspections require some subjective judgment on the part of the inspector, thereby reducing the likelihood of complete agreement between the original inspector and the reinspector.

The use of the 95% agreement rate should not be interpreted to mean that 5% of objective work can be defective. All discrepancies were evaluated for design significance. Although the situation did not present itself, had valid discrepancies with design significance been identified, a determination of the root cause of that discrepancy would have been made and further reinspection or other appropriate remedial action would have been implemented. This intent was contemplated within the expansion criteria defined for the Program.

Q.23. What is the basis for the 90 percent acceptance level for subjective attributes?

A.23. Subjective inspections were known from past experience to involve qualitative interpretation. Therefore, agreement between the reinspection and the original inspection was required to meet or exceed a rate of 90%. This acceptance criterion was applied only to visual welding inspections performed without supporting gauges. The 90% acceptance level recognized the likelihood for reasonable disagreement between inspectors and reinspectors where judgmental decision making was involved in the inspection.

For the case of visual welding inspection, Edison's extensive prior experience in the reinspection of similar welding features at other construction sites formed a basis for the 90% criterion. First, the Company was aware that such attributes, even if truly acceptable, are not amenable to a high agreement rate when reinspected. This is supported by the discussion of inspector activities in the Quality Control Handbook (J. M. Juran, et. al., McGraw Hill, 1962), to which reference was made at the time the Byron Program was developed. Second, Edison's experience clearly indicated that inspectors are inherently more conservative in their judgments when they are participating in a reinspection program which is subject to close outside scrutiny. Although that conservatism cannot be quantified, we considered a difference between the expected agreement rates for objective and subjective attributes of 5% to be a reasonable bound.

In order to further ensure that visual weld inspection results were consistent and accurate, the Reinspection Program accepted by the NRC staff provided for a third-party review of identified discrepancies. The third-party review found that the reinspectors were often overly conservative in their interpretations. This judgment was confirmed by the NRC-Region III Staff.

As in the case of observed discrepancies identified for objective attributes, all observed subjective discrepancies were evaluated for design significance. This gives evidence of the Program intent to assure with high confidence that defects of design significance did not go undetected.

Q.24. What action was taken, if any, if an inspector's work did not meet the acceptance criteria?

A.24. As was discussed in response to Q.12. and Q.13., a sampled inspector's first 3 months of inspections were reinspected. If an acceptance criterion was not met for that period, the inspector's certification was considered suspect. In order to determine whether the inspector should be deemed to be unqualified, an expanded sample covering the second 3 months of the individual's inspection tenure was reinspected for the attribute(s) found to fail the acceptance criterion. If the results of the second three month period alone did not meet the acceptance criterion, the inspector was judged to be unqualified. In this event, 100% of the inspections performed by that inspector of the type found to fail the acceptance criterion were reinspected. In addition, the original inspector sample population for the particular contractor involved was expanded by as much as 50% for the attribute in question, depending on the number of inspectors still available for inclusion in the Program.

If an inspector had no inspections beyond 3 months and did not meet a Program acceptance criterion, the next inspector certified chronologically was substituted and his first 3 months of work was reinspected.* The qualification of the original inspector in such a case was considered indeterminate, but his results were retained in the Program data base, and all observed discrepancies were evaluated for design significance.

If expansion was required, Commonwealth Edison's selection of the inspectors to be added to the sample was made from an overall list of inspectors certified in the specific area where the unqualified inspector was identified. Thus, the expansion focused specifically on areas where qualification was suspect. This approach resulted in a very broad sampling of the potentially discrepant area of qualification when a single inspector failed to meet the Program acceptance criteria.

With respect to Hatfield, Hunter, and PTL the application of the Program criteria is shown in Attachment C. For objective attributes, the adequacy of certification for all inspectors was demonstrated through the reinspection of the first 3 month period. No inspectors were adjudged unqualified and consequently no expansion of the reinspection sample was required. For the subjective attribute, both Hatfield and Hunter had one inspector whose qualification was indeterminate after reinspection of the first 3 month period. PTL had two such inspectors. Because these individuals had no further work, their qualification could not be assessed further. A substitution was made for each of these individuals and the substitute's reinspected work was shown to meet program acceptance criteria. Therefore, no expansion resulted.

PTL had one other inspector whose performance did not meet the subjective program acceptance criteria for either the first 3 month period or for the second 3 month period. Therefore, PTL was subjected to an inspector sample expansion. In this case the failure of just one inspector resulted in an expansion that captured the first 3 months of work for the attribute in question (visual welding inspection) of all remaining inspectors whose work was accessible. Each of the 4 additional inspectors passed the Program acceptance criterion.

A Program flow chart that describes the logic path for Program expansion is provided as Attachment D.

Q.25. What were the results of the Reinspection Program with respect to the qualification of the QC inspectors for Hatfield Electric Company?

A.25. The primary result of the Reinspection Program was the demonstration that all Hatfield Electric inspectors sampled, for whom sufficient work could be reinspected to assess their qualifications, passed the Program acceptance criteria. This result demonstrates that the procedures implemented by Hatfield Electric Corporation for the qualification and certification of QC inspectors prior to September 1982 were effective. Thus, the uncertainty raised by the NRC CAT inspection concerning the qualification of Hatfield inspectors is resolved. Moreover, the Reinspection Program results support the conclusion reached by the NRC Staff in 1980 that the Hatfield program for qualification and certification of QC inspectors was adequate. The 1980 judgment is set forth in IE Report No. 50-454/80-01, in which the NRC Staff indicated that all Hatfield inspector certification packages that were reviewed (8 in total) were found to be acceptable. I note that 4 of the 8 inspectors whose documents were reviewed in 1980 were included in the Reinspection Program and met the Program acceptance criteria.

Q.26. Have you drawn any other conclusions from the Hatfield results?

A.26. Yes. I can also conclude with high confidence that all other inspectors certified in accordance with these same practices and procedures were also adequately qualified. This opinion is based on the number of inspectors whose qualifications were demonstrated, the significant number of inspectors whose work was actually reinspected (27%) and the concomitant statistical significance of this sample (see response to Q.11.), the extremely large and diverse data base upon which the conclusion is founded (87,783 inspections total; 60,245 objective and 27,538 subjective), and also the fact that although a limited number of discrepancies were found, no discrepancy was identified which had design significance.

Q.27. What were the results of the Reinspection Program with respect to the qualification of the QC inspectors for Hunter Corporation?

A.27. The primary result of the Reinspection Program was the demonstration that all Hunter inspectors sampled, for whom sufficient work could be reinspected to assess his qualification, passed the Program acceptance criteria. This result demonstrates that the procedures implemented by Hunter Corporation for the qualification and certification of QC inspectors prior to September 1982 were effective. Thus, the uncertainty raised by the NRC CAT inspection concerning the qualification of Hunter inspectors is resolved. Moreover, the Reinspection Program results support the conclusion reached by the NRC Staff in 1980 that the Hunter program for qualification and certification of QC inspectors was adequate. The 1980 judgment is set forth in IE Report No. 50-454/80-01.

Q.28. Have you drawn any other conclusions from the Hunter results?

A.28. Yes. I can also conclude with high confidence that all other inspectors certified in accordance with these same practices and procedures were also adequately qualified. This opinion is based on the number of inspectors whose qualifications were demonstrated, the significant number of inspectors whose work was actually reinspected (26%) and the concomitant statistical significance of this sample (see response to Q.11.), the extremely large and diverse data base upon which the conclusion is founded (73,349 inspections total; 69,624 objective and 3,725 subjective), and also the fact that although a limited number of discrepancies were found no discrepancy was identified which had design significance.

Q.29. What were the results of the Reinspection Program with respect to the qualification of the QC inspectors for PTL?

A.29. The primary result of the Reinspection Program was the demonstration that all but one of the PTL inspectors sampled, for whom sufficient work could be reinspected to assess his qualification, passed the Program acceptance criteria. One individual, whose work ultimately was 100% reinspected, did not pass the Program subjective acceptance criteria for both the first and second 3-month period. This resulted in the expansion in the sample of inspectors reinspected as was discussed in response to Q.24. Thus, the uncertainty raised by the NRC CAT inspection concerning the effectiveness of the qualification and certification practices implemented by PTL is resolved.

Q.30. Have you drawn any other conclusions from the PTL results?

A.30. Yes. I can also conclude with high confidence that all other inspectors certified in accordance with these same practices and procedures were also adequately qualified. This opinion is based on the number of inspectors whose qualifications were demonstrated, the significant number of inspectors whose work was actually reinspected (27%) and the concomitant statistical significance of this sample (see response to Q.11.), the extremely large and diverse data base upon which the conclusion is founded (12,153 inspections total; 6,137 objective and 6,016 subjective), and also the fact that although a limited number of discrepancies were found, no discrepancy was identified which had design significance.

Q.31. Does the fact that certain inspections were inaccessible or not recreatable affect your conclusions on the reinspection program regarding inspector qualifications?

A.31. No. One must keep in mind the fundamental objective of the Reinspection Program which was to verify by reinspection the adequacy of the qualification and certification practices for contractor QC inspectors. The Program demonstrated the effectiveness of those practices for a representative sample of inspectors from which it can be inferred that the same practices were effective as applied to the remaining inspectors and, therefore, as to all inspection work performed by the entire inspector population.

The fact that certain inspection elements were either not recreatable or were inaccessible does not affect my conclusion for several reasons. First, the data base developed within the Reinspection Program is extensive. Hundreds of thousands of inspections were recreatable and accessible, providing an enormous data base from which to assess the effectiveness of qualification and certification practices. Second, the qualification of inspectors for many of the attributes with inaccessible or not recreatable elements can be inferred from the fact that identical accessible elements in other attributes were reinspected and the qualification of the inspectors has been verified. For example, the amount of pipe, conduit or duct run encased in concrete is small by comparison to and is directly represented by the pipe, conduit, and duct run in air subjected to reinspection in the Program. The primary elements of inspection are the same so the results of reinspection of the accessible inspections can be used to draw conclusions regarding the non-reinspectable work. This is further demonstrated by the summary discussion of these attributes contained in Attachment E.

The qualification and certification programs for these inaccessible and not recreatable attributes are the same as those verified by the Byron Reinspection Program. In fact, many of the inspectors whose work was reinspected in the Program also performed inspections in areas not reinspectable. Generally, inspectors were qualified for many attributes. The requirements imposed for prior experience, job training, and performance demonstration have the same general scope and technical content for each of these attributes, and those attributes not reinspected are similar in many respects to those captured for reinspection.

For these reasons, I am convinced that the conclusions reached in the Reinspection Program based on the scope of attributes actually reinspected are valid and defensible.

Q.32 In your previous answers concerning the results of the Reinspection Program for Hatfield, Hunter and PTL you indicate that discrepancies were uncovered as a result of the program. How were these discrepancies dispositioned?

A.32. Before the reinspection effort was undertaken, Commonweath Edison recognized that, in all probability, discrepancies would be found. In order to create a data base sufficient to determine whether the discrepancies were either non-critical or critical to the design basis requirements, the contractors were directed to record all the reinspection results but not to implement corrective action immediately. This approach was taken so that the "as found" physical conditions could be observed at a later date for possible detailed analysis. As the Reinspection Program progressed the various contractors were directed to incorporate the unacceptable conditions into their particular non-conformance systems in order to implement corrective action, including trending of the discrepant conditions.

All discrepancies that were determined to exceed an ASME Code examination acceptance criteria were repaired, even though they were also determined by evaluation not to have design significance..

All other valid discrepancies were either repaired or dispositioned as acceptable "as-is" based on engineering evaluation results. Although physical rework in these latter cases was not mandatory because the discrepant condition did not compromise the design basis, some rework was performed. For example, all objective discrepancies related to documentation were corrected.

Q.33. In response to Q.32. you indicate that discrepant conditions were reviewed for trends. Describe this process, and the results, if any, for Hatfield, Hunter and PTL.

A.33. A brief review of the overall Program data trends is instructive. First, the Program identified 3,247 observed discrepancies associated with 156,926 objective inspections (2% discrepancy rate). The results for Hatfield, Hunter and PTL are given below.

Summary of Objective Discrepancies by Contractor

| Contractor | Number of Inspections | Observed Discrepancies | Valid Discrepancies |
|---|---|---|---|
| Hatfield | 60,245 | 2,115 | 432 |
| Hunter | 69,624 | 684 | 70 |
| PTL | 6,016 | 66 | 65 |

From this it is clear that the general acceptance rate for objective attributes was exceptionally high. When the observed discrepancies for Hatfield, Hunter and PTL were screened to eliminate those observations that are not valid discrepancies, the discrepant population for Hatfield, Hunter and PTL is approximately 1% of the total of inspections performed. In the case of Hunter, only 0.1% of the objective population inspected was shown to have a valid discrepancy associated with it. This includes those discrepancies identified that involved documentation, none of which displayed an apparent trend.

Second, the Program identified 4,001 observed subjective (visual weld) discrepancies associated with

45,858 subjective inspections (9% discrepancy rate). The specific results for Hatfield, Hunter and PTL are given below.

Summary of Weld Discrepancies by Contractor

| Contractor | Number Inspected | Observed Discrepancies | Valid Discrepancies |
|---|---|---|---|
| Hatfield | 27,538 | 1,986 | 1,978 |
| Hunter | 3,725 | 109 | 84 |
| PTL | 6,137 | 905 | 904 |

Although the discrepancy rate is somewhat higher for subjective than for objective attributes, it must be remembered that these visual weld discrepancies are more likely to occur due to the inherently subjective nature of the inspection attribute. However, although the discrepancy rate is higher, the ultimate issue is whether these discrepancies are systematic and significant enough to compromise the design. As was indicated in previous responses, no visual weld discrepancy was found to have design significance.

The results for all attributes were evaluated on a contractor-by-contractor basis to determine whether any trends existed in the observed discrepancies (i.e. reject rates) that might warrant further review. This evaluation involved a sorting of the observed discrepancies into discrete elements with a comparative assessment made of these elements. If any element demonstrated a significant contribution to the discrepancy total, its significance was reviewed and any inspection practice ramifications were considered. With this preliminary discussion complete, I will turn to the specific trends uncovered within the Reinspection Program data concerning Hatfield, Hunter and PTL.

1. For the subjective attribute of visual weld inspection, the results for each contractor were analyzed using approximately five elements. PTL had a minor problem in reproducing the original visual weld inspection report. The requirements for the welds in question were not specific as to the accept- able tolerance range. Therefore, agreement rates between inspectors were predictably lower due to the fact that the applicable drawing requirement was strictly applied on reinspection. This was complicated by the fact that the feature being inspected, i.e., small fillet welds, were inspected for leg and length dimensions without gauges, thereby increasing the subjectivity of the inspection. Because the fillet leg dimension in question was typically small, it was difficult to reproduce inspection results. Currently, both dimensional tolerances and weld gauges are being used to make these inspections more objec-

tive than was the case at the time the original inspections were done.

In addition, PTL showed an undesirable discrepancy rate for the attributes of undercut and overlap. Constant training during the visual weld inspectors' tenure has much improved the consistency of their judgments made in the areas of undercut and overlap. Discrepancies of this type were shown to be insignificant.

2. In evaluating observed discrepancies associated with Hatfield visual weld inspections, it was noted that a disproportionately large fraction of the discrepancies were related to the inspection of sheet steel welds. This is not necessarily an indication of a specific problem with a particular inspector but rather a manifestation of an issue pertinent to the entire industry, related to visual inspection of sheet steel welds. This trend is not unexpected.

The standard applied in the past and which was used in the reinspection program was AWS D1.1., a structural steel code. That code makes no specific provision for welding the light gauge sheet steels at issue here. A modified code has been developed specifically for sheet steels, AWS D1.3. That code is now being implemented at Byron. Most surface finish discrepancies previously recordable under AWS D1.1 have been eliminated by this new sheet steel code.

From a design impact standpoint, these discrepancies are insignificant. Not only were these discrepancies specifically evaluated and determined to be of no consequence but also sheet steel welds generally have very low load requirements. The strength afforded by even a code rejectable weld is almost always much greater than that needed to fulfill the design requirements. This conclusion has been validated by actual tensile tests previously performed on a similar sample of rejected welds on another project. The tests showed that welds which would be rejectable under AWS D1.1 criteria had margin in excess of what is required by design. In fact, in almost all cases, the failure under load resulted in failure of the sheet metal rather than the weld itself.

In summary, all observed discrepancies have been assessed for possible trends. Except for the two discussed above, none was identified.

Q.34. Has the NRC Staff reviewed the results of the Reinspection Program, and have they reached any conclusions relative to the adequacy of work performed by site contractors at Byron.

A.34. Yes. The review of the results of the Byron Reinspection Program by the NRC Staff is documented in IE Report Nos. 50-454/84-13 and 50-455/84-09. In those reports it is stated that contractor inspectors did not overlook significant safety-related hardware deficiencies and that safety related work done by the Byron contractors is of acceptable quality. Although the classification of weld length as a subjective inspection feature was commented on by the NRC Staff when it accepted the program in March, 1983 and in testimony before this Board, the Staff has not communicated any further concern regarding this issue. The Staff has closed the item of noncompliance which gave rise to the Reinspection Program.

Q.35. Since the completion of the Byron Reinspection Program, has the NRC Staff reported on any other matters concerning the QC inspector activities of Hatfield, Hunter, or PTL.

A.35. Yes. Two sets of inspection reports which relate to Hatfield Electric QC activities have been issued.

Q.36. Would you please summarize those reports.

A.36. First, IE Report Nos. 50-454/84-27 and 50-455/84-19 were issued on June 9, 1984. That report identified two apparent items of non-compliance.

(1) A design drawing notation (Note 47 on S&L Drawing 6E-0-32378, Rev. L) was not incorporated into procedures which required the electrical contractor to install cable tray covers, whether or not explicitly specified, if field conditions resulted in a violation of cable pan separation requirements without the covers. This was considered a Level V violation (minor safety-significance). Although training of Hatfield personnel including QC inspectors was conducted to review this drawing requirement, appropriate procedures controlling the installation of pan covers under these special circumstances had not been implemented. As a result, a limited number of cable pan inspections had been performed (126 cable pan inspection reports) without documentation of a review against the drawing notation. The necessary procedural revisions have since been made and implemented and a 100% reinspection of the affected cable pan previously installed was undertaken, with completion of the reinspection scheduled for July 13, 1984.

(2) Certain cable tray hangers were identified as discrepant after an extensive reinspection of similar

hangers had been completed. This was considered a Level IV violation (more than minor safety-significance). Hatfield Electric had reinspected over 4000 cable tray hangers to verify hanger configuration because the Hatfield QA manager identified a documentation deficiency in 1982. The connection between the structural steel and certain hangers (345) were judged to be inaccessible for reinspection because of fireproofing or encasement in walls. In 1982, it was determined that if these hangers had valid weld traveler records including weld inspection records, no further reinspection was considered to be necessary. In 1984, at the request of the NRC inspector the hangers within this class were reinspected with the fireproofing removed, and 129 apparent discrepancies were observed involving 119 hangers. It has since been established that 91 of the observed discrepancies, affecting 91 hangers involved gaps in the fit-up between the hanger and the auxiliary support steel to which the hanger was attached. An inspection for this fit-up gap was not introduced as an inspection requirement until February, 1984, and all of the fit-up gap discrepancies identified were found to have no design significance. Of the remaining observed discrepancies only 11 affecting 11 hangers were valid discrepancies; the remainder having been shown to be in conformance with current design requirements. Each of the 11 discrepant hangers are being evaluated to determine whether remedial action is required.

Second, IE Report Nos. 50-454/84-09 and 50-455/84-07 were issued on March 19, 1984. That report identified one apparent item of non-compliance involving a single Hatfield discrepancy report (DR-3382) that dealt with the removal of a cable from a conduit. The discrepancy report inaccurately described the pulling force applied in the removal of that cable, resulting in a deficient engineering evaluation. This was considered a Level IV violation (more than minor safety-significance). This event was determined to be an isolated occurrence based on a review of all other discrepancy reports involving cables pulled out of conduit, and was closed by the NRC in IE Report 50-454/84-27. This item is discussed in some detail in testimony filed by Mr. J. O. Binder of Commonwealth Edison and Mr. B. G. Treece of Sargent & Lundy.

Q.37. Do the facts underlying those NRC reports affect your opinion relative to the effectiveness of the Hatfield Electric QC inspector qualification and certification program.

A.37. No. The matters addressed in those inspection reports are not significant. This is true whether viewed individually or collectively.

With respect to the first item involving the failure to incorporate a drawing requirement concerning cable pan cover installation into the inspection procedure, the affected contractor personnel had been trained on the drawing requirement and are believed to have properly implemented it. The procedural deficiency which should be and has been resolved will provide objective evidence that the requirement is being implemented. There is no apparent basis to conclude that inspectors who were trained did not effectively monitor the pan cover installation activities.

The second item involving cable pan hangers identified a very limited number of discrepant hangers attributable to deficient inspector activity. The majority of the observed discrepancies involved an inspection element only recently applied (fit-up gap) and does not, therefore, compromise the integrity of previously performed inspections. The valid discrepancies were shown not to be significant.

The third item involving cable pull tension has been the subject of extensive review by both Commonwealth

Edison and the NRC Staff. The isolated violation involving a single cable rework event has been dispositioned and closed to the satisfaction of the NRC Staff. No like violation has been identified after reviewing all cable pulls of a similar type.

Taken together, these events do identify an apparent weakness in translating design requirements into inspection procedures. However, this fact alone does not compromise the integrity of inspector qualification and certification programs. These procedural discrepancies have not resulted in major rework on the affected safety-related components, which further supports my opinion that the events are not significant.

It remains my conviction that the QC inspection activities of Hatfield were and are effective and that those activities were implemented in a way that systematic problems of design significance have not gone undetected.

Q.38. Do you have an opinion with respect to the quality of the work performed by Hatfield and Hunter?

A.38. It is my opinion that the Hatfield and Hunter work is adequate, and that reasonable confidence exists to conclude that equipment and systems associated with this work will not compromise the safe operation of Byron Station.

Q.39. What is the basis for that opinion?

A.39. As I previously stated, it is my opinion that the work performed by Hatfield and Hunter is adequate and that reasonable confidence exists to conclude that the equipment and systems associated with this work will not compromise the safe operation of Byron Station. In this regard, PTL was not responsible for any underlying construction work and will not be further discussed here.

My opinion is based upon the results of the Byron Reinspection Program and the inferences that can be drawn from the results of that Program. It is further supported by my belief in the general effectiveness of the programs implemented by Commonwealth Edison at Byron to assure the adequacy of construction activities.

First, the vast majority of inspectors whose work was reinspected in the Byron QC inspector Reinspection Program passed the Program acceptance criteria. On this basis the effectiveness of Hatfield and Hunter QC inspector programs were revalidated. The effectiveness of these programs ensures that work performed by these contractors was adequately inspected, from which it can be inferred that the contractors construction work is of adequate quality. Although some uncertainty has been expressed relative to the procedures for documenting work, those uncertainties are resolved by the demonstrated adequacy of the actual work. Recalling the conservatism in the agreement rate calculation, wherein all observed discrepancies were counted against the original inspector, the demonstrated effectiveness of these programs provides reasonable assurance that no systematic problem was left undetected.

As can be seen from the table below, a significant number of items were reinspected in this Program. The rate at which these items were found acceptable is also quite high. Although some discrepancies were found, none were determined to have design significance. This determination is discussed in detail by the S&L witnesses, and gives added support to my conclusion that construction defects of significance have not gone undetected

Reinspection Program Summary

| Contractor | No. of Objective Inspections | Objective Inspection Results Acceptable[1] | No. of Subjective Inspections | Subjective Inspection Results Acceptable[2,3] | Total Objective and Subjective Inspections |
|---|---|---|---|---|---|
| Hunter | 69,624 | 99,0% | 3,725 | 97.0% | 73,349 |
| Hatfield Electric | 60,245 | 96.5% | 27,538 | 92.0% | 87,783 |

Notes for Table ES-1:

1. Program acceptance criterion is 95%.
2. Program acceptance criterion is 90%.
3. Includes concurrence by third-party inspector.

Second, building upon my first point, the extensive and diverse data base developed for Hatfield and Hunter allows me to infer that the quality of work is adequate over the full range of plant work items that were the responsibility of Hatfield and Hunter. Because of the broad Reinspection Program undertaken at Byron, I am convinced that the general work quality of Hatfield and Hunter is adequate. This conviction is based upon my review of the type and number of discrepancies attributable to these Byron contractors. Previous reinspections of similar items at other sites have, in my opinion, yielded similar results. This is particularly true of the fillet weld attribute which was found to have the highest observed discrepancy rate in the Program. With this perspective, I have high confidence that the plant-wide reliabilities that can be derived from the Reinspection Program data base are extremely high and conservatively bound the actual reliability of work performed by these contractors. The data base developed for Hatfield, Hunter and PTL is summarized in Attachment E. The data for each inspector by attribute are tabulated, and the cumulative average of this data by attribute for each of the contractors is provided.

My judgment in this case also takes account of the fact that certain work attributes could not be reinspected in the Reinspection Program. However, as shown in Attachment B, many of the inaccessible and not recreatable attributes had related indicia of acceptability.

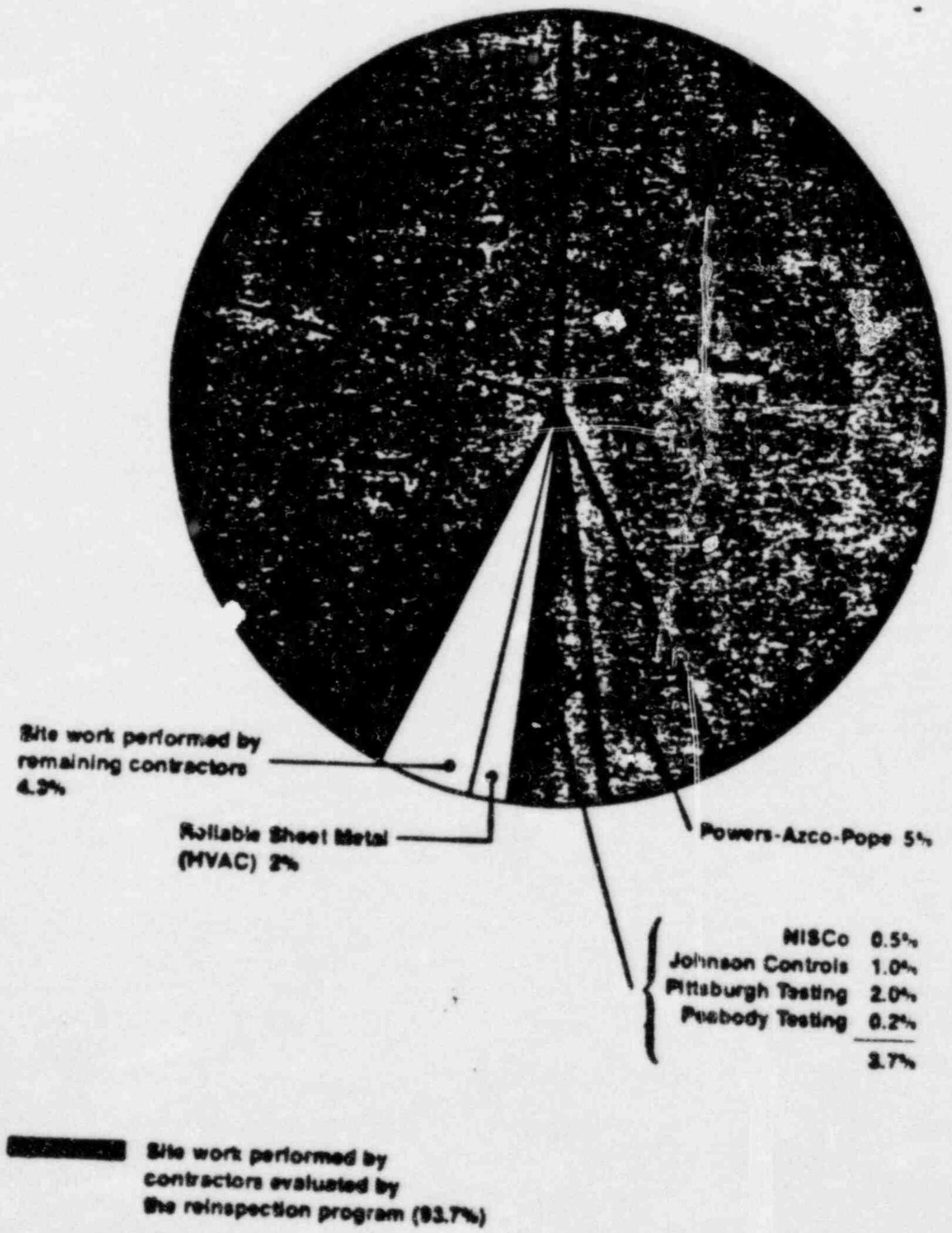
Third, there have been many independent layers of inspection and review of field installations implemented at Byron for both Hatfield and Hunter. The most obvious of these are the multiple tiers of audits and inspections conducted by the contractors, Commonwealth

Edison, and the NRC Staff. I am familiar with these reviews and believe them to be effective.

My own personal involvement has been more closely connected to reinspection and reverification programs which are the outgrowth of those reviews. In that regard, Hatfield has implemented several reinspection programs over the course of its tenure at Byron. These involved concrete expansion anchor verification in 1979, cable routing reinspection in 1981, 100% weld traveler card validation and 100% cable pan hanger configuration and dimension reinspection between 1982 and 1984, as well as the Byron QC inspector Reinspection Program. In addition, Hunter has also implemented several reinspection programs. These involved a 100% reinspection of all hangers installed prior to 1980, concrete expansion anchors installed prior to 1979, as well as the Byron QC inspector Reinspection Program. From these various programs an extremely large and diverse cross-section of work was reinspected. Although some discrepancies were identified and some rework was required, those remedial actions are not inconsistent with comparable actions ta en by the electrical and mechanical contractor at LaSalle County Station with which I have had extensive experience.

Also of significance to me in this regard is the broad program of overinspection conducted by the Commonwealth Edison Quality Assurance Department, which is referred to as the Unit Concept Inspection (UCI) Program. This program was instituted in September, 1982 and involves the reinspection of all items installed within specific spatial boundaries or in conjunction with specific equipment. The items are inspected for compliance to vendor and engineering design documents. More than 68 of these UCI inspections have been conducted at Byron encompassing a wide spectrum of electrical and mechanical work. For example, over 25,000 mechanical items, over 5000 linear feet of piping and insulation, over 25,000 electrical items, and 1,500 sections of cable pan and conduit have been inspected. The results of this program have not identified any significant construction discrepancies and, therefore, support the judgment that the underlying work quality is adequate.

**Percent of Safety-Related Site Work Performed by Contractors Evaluated by the Reinspection Program**



# HATFIELD ELECTRIC
## Attribute Inspection Summary

| Procedure | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| #2 | Embedded Conduit | Inaccessible | Size, Type, Location, Bends, Condition (Same as Procedure #20) |
| #3 | Underground Duct Runs | Inaccessible | Size, Type, Location, Bends, Condition (Same as Procedure #20) |
| #5 | Material & Equipment Receiving | Not Recreatable | Shipping Damage (Same as Procedure #12 & #20: i.e. Condition) |
| #9A | Cable Pan Hangers | REINSPECTED | Type, Configuration, Location, Bolt Torque |
| #9B | Cable Pans | REINSPECTED | Size, Type, Location, Radius, Separation, Pan Weld Downs, Complete |
| #9C | Cable Pan Covers | Reinspectable, But No Inspections Captured | Type, Location, Condition (Same as Procedure #9B) |
| #9E | Cable Pan Identification | Reinspectable, But No Inspections Captured | Segregation Codes, Colors, Spacing (Like Procedure #20) |
| #10 | Cable Installation | Not Recreatable & Inaccessible | Pan Condition, Conduit Condition, Cable Coiling, Cable Damage, Cable Bends, Cable Tension, Routing Points, Cable Entry Into Equipment, Vertical Cable Supports, Cable Training |
| #11 | Cable Terminations | REINSPECTED | Lug Size & Type, Bolt Size & Type, Taping Kit Size, Exposed Conductor, Minimum Bend, Entry Into Equipment, Training, Segregation |

HATFIELD ELECTRIC
Attribute Inspection Summary

| Procedure | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| #12 | Equipment Installation | REINSPECTED (1) | Type, I.D., Condition, Anchoring, Alignment, Level, Torque* |
| #12A | Equipment Modifications | REINSPECTED | Mounting, Location, Type/Model, Bolt Torque*, Wire Type, Termination Location, Lug/Connector, Weld Traveler |
| #12B | Non-Seg Bus Duct | Inaccessible | Equipment/Support ID's, Installation Configuration, Bolt Torque (Like Procedure #20) |
| #13AE | Visual Weld Inspection | REINSPECTED | Welding |
| #14 | Material Handling | Not Recreatable | Rigging, Tool Inspection, Operation Condition of Rigging Equipment |
| #20 | Exposed Conduit | REINSPECTED | Size, Type, Location, Bends, Condition, Segregation Code Markers, Bolt Torque (1); Includes Inspection of Junction Boxes, Supports, Concrete Expansion Anchors |
| #25 | A325 Bolt Installation | REINSPECTED | Bolt Type, Bolt Size, Condition of Surfaces, Bolt Tension by Turn-of-the-Nut (1) |
| #26 | Stud Welding | Inaccessible | Bonding Adequate by Visual and Load Test (Like Procedure #13AE) |
| #27 | Limit Switch Gasket Replacement | Not Recreatable | Verification of Parts (Note: All switches have since been replaced) |

*Specific inspection feature inaccessible/not recreatable
(1) Reinspected and reported in Supplement 1. Additional inspections performed to increase data base.

HATFIELD ELECTRIC
Attribute Inspection Summary

| Procedure | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| #28 | Removal of Heat Shrink Tubing On Conax Penetrations | Not Recreatable | Conductor Not Damaged, Heat Shrink Removed, Jam Nuts and Lugs Reinstalled (Like Procedure #11) |
| #30 | Housekeeping | Not Recreatable | |
| N/A | Conduit As Built | REINSPECTED | Dimensional, Location, Configuration |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (1) Visual Weld | Piping - Visual Weld Inspection | REINSPECTED | Contour, Reinforcement/Size, Surface Discontinuities |
| (1) Visual Weld | Whip Restraint - Visual Weld Inspection | REINSPECTED | Contour, Size, Surface Discontinuities |
| (1) Visual Weld | Component Support - Visual Weld Inspection | REINSPECTED | Contour, Size, Surface Discontinuities |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (2) Documentation | Piping - Mech. Jt. Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Ferrite Inspection Documentation | Not Recreatable | Recording Data (Like other documentation activities) |
| (2) Documentation | Hydrostatic Test Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Weld Interpass Temp. Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Joules Test Documentation | Not Recreatable | Recording Data (Like other documentation activities) |
| (2) Documentation | Code Name Plate Change Documentation | Not Recreatable | Recording Data (Like other documentation activities) |
| (2) Documentation | Documentation of Weld Defect Removal Cavity | Not Recreatable | Recording Data (Like other documentation activities) |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (2) Documentation | Piping - Weld Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Weld Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Component Support - Weld Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Component Inspection Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Component Inspection Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Fitup Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Fitup Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Bend Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Component Support Inspection - Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Dimensional Location of Field Welds | REINSPECTED | Recording Data |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (2) Documentation | Buried Pipe Covering Inspection - Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Concrete Expansion Anchor - Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Pre-Heat Insp. Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Pre-Heat Inspection Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Pipe Weld - Shield Gas Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Component Support - Snubber Stroking Documentation | Not Recreatable | Recording Data (Like other documentation activities) |
| (2) Documentation | Piping & Component Support, Temporary Attachments Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Bolting - Turn-of-Nut Documentation | Not Recreatable | Recording Data (Like other documentation activities) |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (2) Documentation | Piping - Small Bore Final Inspection (Type 3) Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Small Bore Final Inspection (Type 4) Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Final Inspection (Type 3) Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Whip Restraint - Final Inspection (Type 4) Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Piping - Large Bore Final Inspection (Type 3) Documentation | REINSPECTED | Recording Data |
| (2) Documentation | Component Support - Final Inspection (Type 3) Documentation | Reinspectable, But No Inspections Captured | Recording Data (Like other documentation activities) |
| (2) Documentation | Component Support - Final Inspection (Type 4) Documentation | Reinspectable, But No Inspections Captured | Recording Data (Like other documentation activities) |
| (2) Documentation | Equipment Installation-Final Inspection (Type 3) Documentation | REINSPECTED | Recording Data |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (3) Hardware | Piping - Mech. Jt. Torque | REINSPECTED | Condition, Alignment, Initial Torque*/Sequence*, Intermediate Torque*/Sequence*, Final Torque/Sequence* |
| (3) Hardware | Visual Inspection of Valves | Inaccessible | Internal Cleanliness, Condition (Like Piping/Whip Restraint Component Inspection) |
| (3) Hardware | Ferrite Inspection | Inaccessible | Using Ferrite Indicator Check Four Points on Welds (This was an abnormal, non-routine, special inspection.) |
| (3) Hardware | Piping Hydrostatic Test | Not Recreatable | Inspection of Test Parameter Achievement, Visual Inspection of Welds |
| (3) Hardware | Piping Weld Interpass Temperature Inspection | Not Recreatable | Inspection of Metal Temperature |
| (3) Hardware | Joules Test Inspection | Not Recreatable | Reading Data From Instruments, Calculating Heat Input |
| (3) Hardware | Code Name Plate Change | Not Recreatable | Witnessing Removal of Code Nameplate (Like Temporary Attachment Removal) |
| (3) Hardware | Inspection of Weld Defect Removal Cavity | Not Recreatable | Measurement, Mapping, Evaluation (Like Visual Weld Inspection) |
| (3) Hardware | Piping - Component Inspection | REINSPECTED | Identification, Damage, Internal Cleanliness,* Proper Weld Preparation* |

*Specific inspection feature inaccessible/not recreatable

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (3) Hardware | Whip Restraint - Component Inspection | REINSPECTED | Identification, Damage, Internal Cleanliness,* Proper Weld Preparation* |
| (3) Hardware | Piping - Fitup & Tack Weld | REINSPECTED (Limited Amount) | Internal Alignment,* Weld End Condition* Socket Weld Gap |
| (3) Hardware | Whip Restraint - Fitup & Tack Weld | Not Recreatable | Alignment, Configuration Prior to Welding, Weld End Condition |
| (3) Hardware | Piping - Bends | REINSPECTED | Radius, Quality, Surface Discontinuities |
| (3) Hardware | Component Support Inspection | REINSPECTED | Identification, Configuration, Dimensions, Orientation, Weld Completeness, Condition |
| (3) Hardware | Dimensional Location of Field Welds | REINSPECTED | Dimensional Measurement |
| (3) Hardware | Component Support Torque | REINSPECTED | Witness of Torquing Operation |
| (3) Hardware | Buried Pipe Covering Inspection | Inaccessible | Inspection of Protective Type Coating (Like other Piping Features: i.e. surface discontinuities, damage) |
| (3) Hardware | Concrete Expansion Anchor Inspection | REINSPECTED | Identification, Length, Diameter, Embedded Length, Thread Projection, Plumbness, Assembly |
| (3) Hardware | Piping - Pre-Heat Inspection | Not Recreatable | Measurement of Temperature (Like other Measurement Activities: i.e. dimensional) |

*Specific inspection feature inaccessible/not recreatable

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (3) Hardware | Whip Restraint - Pre-Heat Inspection | Not Recreatable | Measurement of Temperature (Like other Measurement Activities: i.e. dimensional) |
| (3) Hardware | Pipe Weld - Shield Gas Verification | Not Recreatable | Measurement of Inert Gas Flow Rate (Like other Measurement Activities: i.e. dimensional) |
| (3) Hardware | Component Support - Snubber Stroking | Inaccessible | Verification of Operability |
| (3) Hardware | Piping & Component Support, Temporary Attachments | REINSPECTED | Verifying Location, Surface Inspection After Removal |
| (3) Hardware | Bolting - Turn-of-Nut | Not Recreatable | Witnessing of Establishment of Snug Tight and Required Rotation |
| (3) Hardware | Piping - Small Bore Final Inspection (Type 3) | REINSPECTED | Complete, Undamaged, Record Verification, Nonconformance Record Status |
| (3) Hardware | Piping - Small Bore Final Inspection (Type 4) | REINSPECTED | In place, Intact, Undamaged |
| (3) Hardware | Whip Restraint - Final Inspection (Type 3) | REINSPECTED | Complete, Record Verification, Nonconformance Record Status |
| (3) Hardware | Whip Restraint - Final Inspection (Type 4) | REINSPECTED | In Place, Intact, Undamaged |

HUNTER CORPORATION
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| (3) Hardware | Piping - Large Bore Final Inspection (Type 3) | REINSPECTED | Complete, Record Verification, Nonconformance Record Status |
| (3) Hardware | Component Support - Final Inspection (Type 3) | Reinspectable, But No Inspections Captured | Complete, Record Verification, Nonconformance Record Status (Like Pipe Final Inspection) |
| (3) Hardware | Component Support - Final Inspection (Type 4) | Reinspectable, But No Inspections Captured | In Place, Intact, Undamaged (Like Pipe Final Inspection) |
| (3) Hardware | Equipment Installation | Reinspectable, But No Inspections Captured | Identification, Location, Orientation, Level, Foundation Bolt Condition,* Mechanical Connections, Grouting, Alignment, Intact, Undamaged |

*Specific inspection feature inaccessible/not recreatable

PITTSBURGH TESTING LABORATORY
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| CEA's - Blount<br>CEA's - Hunter<br>CEA's - Hatfield<br>CEA's - P-A-P<br>CEA's - RSM<br>CEA's - JCI | Supports, Columns<br>Piping, Hangers<br>Conduit / Cable Pan Hangers<br>Instrument Piping Hangers<br>Ductwork Hangers<br>Instrument Piping Hangers | REINSPECTED | Torque, spacing, length, embedded length, washers, plumbness, anchor projection. |
| Rebar Detection -<br>Blount<br>Hunter<br>Hatfield<br>P-A-P<br>RSM<br>JCI | For Installation of CEA's | Not Recreatable | Locate and verify 28 Day Cure |
| Bolting -<br>Turn-of-Nut -<br>Blount | Connections | Not Recreatable | Witness & Record Data. (Like CEA's) |
| Calibrations -<br>Blount<br>Hunter<br>Hatfield<br>P-A-P<br>RSM<br>JCI<br>NISCo<br>Midway | Torque wrenches,<br>Thermometers,<br>Feeler Gauges,<br>Scales, Gauges | Not Recreatable | Visual, Cal/Verify per letter & procedure |

## PITTSBURGH TESTING LABORATORY
Attribute Inspection Summary

| Attribute Classification | Inspection Type | Reinspection Condition | Primary Inspection Features |
|---|---|---|---|
| Cadwelds - Blount | Rebar Coupling | Not Recreatable | Visual, Measure, Record Data (Like CFA's) |
| Soils - Blount | Back Fill | Not Recreatable | Compaction, moisture content, density, |
| Concrete Field - Blount | Placement | Not Recreatable | Monitor pour, sample, slump, air, unit weight, mold specimens, temperature & sign off. |
| Concrete Lab - Blount | Aggregate | Not Recreatable | Sample: run C-29, C-40, C-117, C-123, C-127, C-128, C-136, C-142, C-119, C-235 Monitor curling temps., Cap, Measure & Break Cubes. |
| Visual Weld Inspection - Am. Bridge Mid-City Blount | Weld Inspection | REINSPECTED | Contour, Size, Surface Discontinuities |

## Program Results for Inspectors Performing Objective Inspections

| | QC Inspectors Passing Acceptance Criteria | | | QC Inspectors Did Not Pass Threshold | Qualification Indeterminate | Total No. of Inspectors Reinspected for Subjective Inspections(3 |
|---|---|---|---|---|---|---|
| | At 3 Mo. | At 6 Mo. | Total | | | |
| Hunter | 20 | -- | 20 | -- | -- | 20 |
| Hatfield Electric | 17 | -- | 17 | -- | -- | 17 |
| Pittsburgh Testing | 9 | -- | 9 | -- | -- | 9 |

## Program Results for Inspectors Performing Subjective Inspections

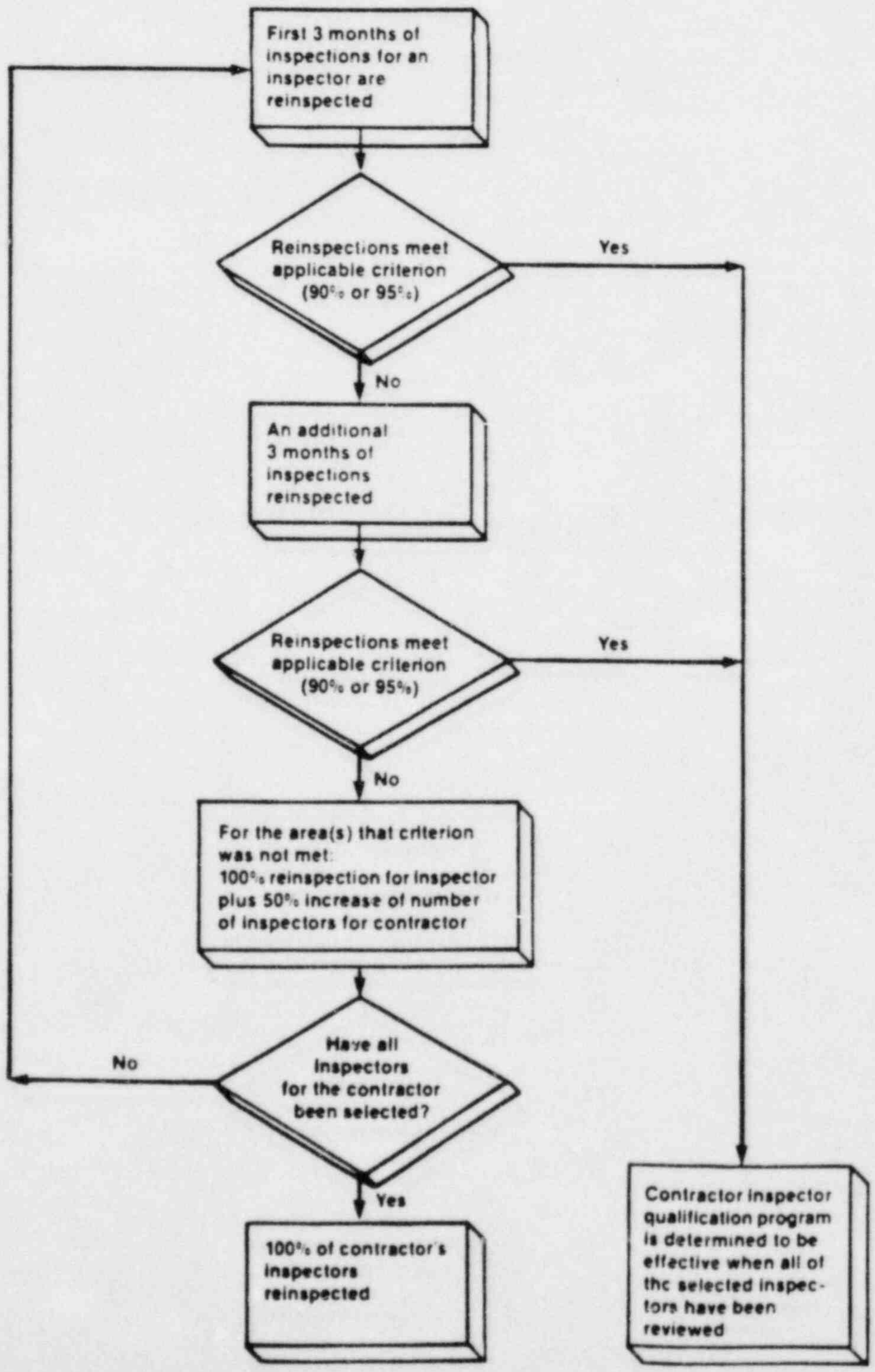
| | QC Inspectors Passing Acceptance Criteria | | | QC Inspectors Did Not Pass Threshold | Qualification Indeterminate(1) | Total No. of Inspectors Reinspected for Subjective Inspections(3) |
|---|---|---|---|---|---|---|
| | At 3 Mo. | At 6 Mo. | Total | | | |
| Hunter | 16 | -- | 16 | -- | 1 | 17 |
| Hatfield Electric | 7 | -- | 7 | -- | 1 | 8 |
| Pittsburgh Testing | 10 | 1 | 11 | 1(2) | 2 | 14 |

Note: (1) Inspectors failed to meet the acceptance criterion at the end of the first 3 month period and had no more reinspectable work. A substitution was made in accordance with Program requirements.

(2) One inspector unacceptable for the first and second 3 month period. All his work was reinspected. Program expansion was implemented, resulting in all inspectors qualified to perform visual welding being reinspected (4 total). All of the added inspectors met the Program acceptance criterion for the first 3 month period.

(3) The total of Hatfield Electric inspectors reinspected was 23 (15 with objective inspections only, 6 with subjective inspections only, and 2 with both objective and subjective inspections). The total number of Hunter inspectors reinspected was 22 (5 with objective inspections only, 2 with subjective inspections only, and 15 with both objective and subjective inspections. The total number of PTL inspectors reinspected was 23 (9 with objective inspections only and 14 with subjective inspections only).

**Process for Determining the Effectiveness of a Contractor's Inspector Qualification Program**



# Reinspection Results
# Hatfield Electric

**A. Results by Inspection Type**

| Type | Reinspection Results (Acceptable/Total) Level II Reinspection | Third-Party Review |
|---|---|---|
| Subjective | 88.6% (24,402/27,538) | 92.8% (25,552/27,538) |
| Objective | 96.5% | (2) |

**B. Results by Inspection Attribute**

| Attribute | Initial Sample Period No. of People Reinspected | Initial Sample Period Final % Acceptable | Expansion Sample Period No. of People Reinspected | Expansion Sample Period Final % Acceptable |
|---|---|---|---|---|
| 1. Visual weld (Subjective) | 8 | 92.8% | (1) | (1) |
| 2. Conduit | 6 | 97.6% | (1) | (1) |
| 3. Terminations (Objective) | 5 | 99.9% | (1) | (1) |
| 4. Equipment setting (Objective) | 0 | 0% | (1) | (1) |
| 5. A325 bolting (Objective) | 1 | 100.0% | (1) | (1) |
| 6. Equipment modification (Objective) | 3 | 100.0% | (1) | (1) |
| 7. Conduit as-built (Objective) | 3 | 95.9% | (1) | (1) |
| 8. Cable Pan hangers (Objective) | 2 | 95.5% | (1) | (1) |
| 9. Cable Pan (Objective) | 1 | 100.0% | (1) | (1) |

Notes

*Results are cumulative. 3,136 observed discrepancies were reinspected by third-party inspectors.

(1) Not required

(2) Not applicable

## Detailed Inspector Results
## Hatfield Electric

| Inspector | Attributes No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 |
|---|---|---|---|---|---|---|---|---|---|
| A | 833/863 | - | - | - | - | - | - | - | - |
| B | - | - | - | - | - | - | 4795/4974 | - | - |
| C | 630/712 | - | - | - | - | - | - | - | - |
| D | - | 80/80 | 638/638 | (1) | 8/8 | - | - | - | - |
| E | 10554/11501 | 187/188 | 48/48 | - | - | - | - | - | - |
| F | - | 178/179 | 72/72 | - | - | 2/2 | - | - | - |
| G | 1132/1211 | 386/401 | 544/546 | - | - | 1/1 | - | - | - |
| H | - | - | - | - | - | - | 3985/4112 | - | - |
| I | 4462/4701 | - | - | - | - | - | - | - | - |
| J | - | 639/661 | - | - | - | - | - | - | - |
| K | - | 1256/1284 | - | - | - | - | - | - | - |
| L | - | - | - | - | - | - | - | 705/742 | - |
| M | - | - | - | - | - | - | 10952/11457 | - | - |
| N | 3381/3489 | - | - | - | - | - | - | - | - |
| O | 50/50 | - | - | - | - | - | - | - | - |
| P | - | - | - | - | - | - | 2001/2081 | - | - |
| Q | - | - | - | - | - | - | 4818/5055 | - | - |
| R | - | - | - | - | - | - | 11734/12205 | - | - |
| S | - | - | - | - | - | - | 2753/2879 | - | - |
| T | - | - | - | - | - | - | 1917/2014 | - | - |
| U | - | - | 6473/6480 | (2) | - | 24/24(2) | - | - | - |
| V | - | - | - | - | - | - | - | 3854/4034 | 80/80 |
| W | 4510/5011(3) | - | - | - | - | - | - | - | - |
| TOTAL | 25552/27538 | 2726/2793 | 7775/7784 | - | 8/8 | 27/27 | 42955/44777 | 4559/4776 | 80/80 |

### Notes

No expanded sampling was required; a substitution (W) was made for (C) in Attribute No. 1 because (C) failed the first 3-month period but had no further inspections to reinspect.

- Attribute 1 - Visual weld
- Attribute 2 - Conduit
- Attribute 3 - Terminations
- Attribute 4 - Equipment setting
- Attribute 5 - A325 bolting
- Attribute 6 - Equipment modification
- Attribute 7 - Conduit as-built
- Attribute 8 - Pan hangers
- Attribute 9 - Pan

NOTES:

1. Upon review of reinspection report for equipment setting for Inspector "D", it was found that the reinspection had been performed on an installation which has been reworked since the time of the original inspection, thereby making reinspection of the original inspector "not recreatable". As a result of this, the results for Attribute 4 reported in the January 12, 1984, report have been removed in accordance with Program requirements.

2. Upon review of reinspection reports for equipment modification, it was found that the summary tabulation for Inspector "U" had been entered into equipment setting rather than equipment modification tabulation. As a result of this, the results reported for Attribute 4 in the January 12, 1984, report have been removed and located appropriately in Attribute 6.

3. Upon completion of the initial accumulation of data, Inspector "W" failed to achieve the subjective acceptance criterion. Upon further review of reports rejected for "not per detail" and "arc-strikes" it was found that some reports had been improperly graded; for example, the "not per detail" was a condition where excess weld was present and "arc-strike" reported as a visual weld discrepancy was not present on the weld itself. After correction of these items, the results were accumulated as tabulated above.

# Reinspection Results
## Hunter

A. Results by Inspection Type

| Type | Reinspection Results (Acceptable/Total) | |
|---|---|---|
| | Level II Reinspection | Third-Party Review |
| Subjective | 96.8% (3604/3725) | 97.0%* (3616/3725) |
| Objective | 99.0% | (2) |

B. Results by Inspection Attribute

| Attribute | Initial Sample Period | | Expansion Sample Period | |
|---|---|---|---|---|
| | No. of People Reinspected | Final % Acceptable | No. of People Reinspected | Final % Acceptable |
| 1. Visual welding (Subjective) | 17 | 97.0% | (1) | (1) |
| 2. Documentation (Objective) | 20 | 98.9% | (1) | (1) |
| 3. Hardware (Objective) | 17 | 99.3% | (1) | (1) |

Notes

*Results are cumulative. 121 observed discrepancies were reinspected by third-party inspectors.

(1) Not required

(2) Not applicable

## Detailed Inspector Results
### Hunter

| Inspector | Attributes No. 1 | Attributes No. 2 | Attributes No. 3 |
|---|---|---|---|
| A | 47/48 | - | - |
| B | 14/14 | 134/138 | - |
| C | 34/34 | 1181/1186 | - |
| D | 33/33 | 101/102 | - |
| E | 283/301 | 2088/2144 | 61/64 |
| F | 208/214 | 40/41 | 258/265 |
| G | 116/129 | 161/161 | 21/21 |
| H | 49/55 | 19/19 | 12/12 |
| I | 315/319 | 47/47 | 129/133 |
| J | - | 2195/2269 | 7836/7893 |
| K | 334/344 | 280/284 | 186/190 |
| L | 273/273 | 366/366 | 204/206 |
| M | - | 126/130 | 331/339 |
| N | - | 289/294 | 903/921 |
| O | - | 416/442 | 1246/1253 |
| P | 249/263 | 8141/8214 | 925/935 |
| Q | 383/392 | 6315/6381 | 5355/5372 |
| R | 232/237 | 8503/8520 | 81/81 |
| S | 181/181 | 329/331 | 949/952 |
| T | - | 1789/1804 | 6248/6323 |
| U | 803/822 | 3671/3759 | 8004/8032 |
| V | 62/66 | - | - |
| **TOTAL** | **3616/3725** | **36191/36632** | **32749/32992** |

**Notes**

No expanded sampling was required; a substitution (V) was made for (H) because (H) failed the first 3-month period but had no further inspections to reinspect.

Attribute 1 - Visual welding
Attribute 2 - Documentation
Attribute 3 - Hardware

## Reinspection Results
## Pittsburgh Testing

### A. Results by Inspection Type

| Type | Reinspection Results (Acceptable/Total): Level II Reinspection | Third-Party Review |
|---|---|---|
| Subjective | 83.7% (5,138/6,137) | 85.3%* (3) (5,232/6,137) |
| Objective | 98.9% | (2) |

### B. Results by Inspection Attribute

| Attribute | Initial Sample Period: No. of People Reinspected | No. of Final % Acceptable | Expansion Sample Period: People Reinspected | Final % Acceptable |
|---|---|---|---|---|
| 1. Visual welding (Subjective) | 14 | 86.0 | 2 | 77.0 (3) |
| 2. Concrete expansion anchor (Objective) | 9 | 98.9 | (1) | (1) |

### Notes

*Results are cumulative. 999 observed discrepancies were reinspected by third-party inspectors.

(1) Not required

(2) Not applicable

(3) 100% of the work was inspected for the two inspectors in the expansion sample period. Discrepancies had no design significance.

## Detailed Inspector Results
## Pittsburgh Testing

| | Attributes | |
|---|---|---|
| Inspector | No. 1 | No. 2 |
| A | - | 1759/2125 |
| B | - | 442/487 |
| C | - | 35/68 |
| C(exp) | - | 27/28 |
| D | - | 18/18 |
| E | 522/524 | - |
| F | - | 506/616 |
| G | - | 11/12 |
| H | - | 7/7 |
| I | - | 517/558 |
| J | - | 749/929 |
| J(exp) | - | 377/497 |
| K | 299/300 | - |
| L | 377/381 | - |
| M | 1057/1058 | - |
| N | 859/874 | - |
| O | 975/1008 | - |
| P | 933/935 | - |
| Q | 883/890 | - |
| R | 46/46 | - |
| S | - | 125/131 |
| T | - | 68/69 |
| U | - | 482/482 |
| V | - | 78/79 |
| W | - | 31/31 |
| **TOTAL** | **5951/6016** | **5232/6137** |

Notes

*Expanded sampling was required. T, U, V, and W were added in Attribute 2 due to failure of J.

The "exp." designation represents the expansion of an inspector's sample period when the acceptable threshold was not met.

Attribute 1 - Concrete expansion anchors
Attribute 2 - Visual welding