

JUN 12 1985

*Kansas Gas  
Udall Comm.*

Dr. Henry Myers  
Science Advisor  
House Interior Committee  
1327 Longworth House Office Building  
Washington, DC 20515

Dear Dr. Myers:

My staff has reviewed your request which was transmitted in your note to me dated March 18, 1985. A discussion of each item is provided in the enclosure.

Sincerely,

Original Signed By  
James M. Taylor

James M. Taylor, Director  
Office of Inspection and Enforcement

Enclosure: As stated

REQUIREMENTS OF AWS D1.1; AND 10 CFR 50, APPENDIX B CONCERNING  
STRUCTURAL STEEL WELDS AT THE WOLF CREEK NUCLEAR STATION

Item 1. Section 3 of AWS D1.1 specifies requirements for structural steel welding. Section 3.3 describes alignment and gap requirements.

Clarification/Response. Section 3 of the AWS D1.1 "Structural Welding Code" specifies the workmanship requirements for structural steel welding performed under the Code. Paragraph 3.3 of Section 3 of the AWS D1.1 Code provides the assembly requirements which includes alignment and gap requirements for structural welds. In addition, the welding specifications contain specific workmanship requirements which were used during sampling inspections to verify that procedures were being followed.

Item 2. Section 6 of AWS D1.1 specifies inspection requirements which include requirements that the Inspector designated by the Engineer shall ascertain that all fabrication by welding is performed in accordance with the requirements of AWS D1.1. Section 6 also specifies that the Inspector shall be furnished with detail drawings and that he shall be notified in advance of the start of any welding operations.

Clarification/Response. Item 2 above correctly describes some of the requirements of Section 6 of the AWS D1.1 code.

Item 3. Requirements for prewelding inspections of fit-up, alignment, weld rod, weld procedures, and welder qualifications are derived from the language of 10 CFR 50, Appendix B, Criteria V, VIII, IX and X. Recordkeeping requirements are derived from Criteria XVII.

Clarification/Response. 10 CFR 50, Appendix B, Criteria IX requires that measures be established to control special processes, including welding. Criteria XVII requires that records be maintained to furnish evidence of activities affecting quality. Criterion V, VIII, X and XVII are related to other quality assurance matters. At the WCGS the designer chose to utilize AWS D1.1 to meet the requirements for welding of structural steel. The specific requirements for fit-up, alignment, weld rod, weld procedures, and welder qualifications were derived from AWS D1.1, and included in welding specifications of the designer and constructor and site welding inspection procedures. At Wolf Creek, the requirements included a random sample of weld joint fit-ups on a daily basis by the constructor and daily verification of these random fit-up inspections by the owner.

Item 4. Test Block Inspection Results obtained by NDE Van Personnel at WCGS in February 1985 indicated that flaws such as cracks, fine porosity, tight undercut and certain types of fusion discontinuities are not visually inspectable through primer or epoxy coating.

Clarification/Response. Cracks, fine porosity, tight undercut and certain types of lack of fusion cannot be visually inspected through primer or epoxy coating. However, the magnetic particle inspection method can detect these types of discontinuities through paint or epoxy coating. The NRC inspectors qualified their magnetic particle inspection (MT) procedure for fine cracks on a sample of structural steel weld metal coated with the coatings in use at WCGS. Several test block weldments (4) were made with fine cracks and porosities. The welds were coated using coating procedures used at WCGS. The dry film coating thickness application was controlled in three steps to determine the sensitivity of the MT to detect fine cracks at various coating thicknesses. The fine cracks were detectable by MT up to a dry film of 10 mils (.010). The 53 joints inspected by the NRC inspectors were first inspected visually and then by the qualified MT inspection, as coated. The joints were then stripped of coatings and the welds were reinspected visually and by the magnetic particle inspection methods.

Item 5. NRC documents produced in conjunction with the verification of structural steel weld quality at WCGS do not contain a listing by drawing indicating the following with respect to welds on the drawing: (1) number of welds on drawing; (2) number of welds on drawing for which the MSSWR is available; (3) number of welds on drawing found during reinspection to be out of compliance with AWS D1.1; (4) number of welds on drawing covered by primer, epoxy coating and/or fire protection material; (5) welds on drawing for which primer, epoxy coating, and/or fire protection material were removed to allow reinspection pursuant to CAR 19.

Clarification/Response. The NRC documents produced in conjunction with the verification of structural steel weld quality at WCGS are the NRC inspection reports 50-482/85-12 and 50-482/85-13.

The information concerning the 53 welded joints inspected by the NRC NDE van is listed in NRC Inspection Report No. 50-482/85-12. With regard to the statements contained in items (1)-(5) above, the report provides the following clarification: (1) the report does not identify the number of inspected welds per drawing but identifies the linear inches of weld inspected per drawing, (2) the number of welds per drawing for which MSSWRs were available was not listed in the report because the purpose of the NRC inspection was to determine the validity of visual and MT examination to detect rejectable indications through coatings and to verify the adequacy of KG&E's reinspection, (3) the number of welds found to be deficient with respect to the specified acceptance criteria was three undersized welds; P-7, P-8 and P-10. This finding was reported on page 3 of the report, and (4)&(5) Phases II and III in NRC Inspection Report No. 50-482/85-12 show that 66 welded connections were inspected in a coated condition. The coatings of 11 of these connections were subsequently removed and the connections were reinspected. During Phase IV, an additional 53 welded connections were examined visually and by MT with the coatings removed.

With regard to report 50-482/85-13, although the report itself does not specifically document the details of (1)-(5), the overview NRC inspection of the KG&E reverification did observe that the licensee documentation (i.e., computer reports, tables, inspection records, drawings, etc.) of the reverification effort did provide for a record of the type of information covered by items 1-5. It was not the purpose of the NRC report to document the results of the KG&E reverification to that detail.

Item 6. The conclusion that flaws not visually detectable through paint, do not affect structural integrity rests on the following rationale: (1) that rejectable welds were not found among the 53 joints examined pursuant to Phase IV of 85-12 (see page 4), and (2) the assumption that welding was performed by qualified welders, using and following the appropriate procedures and using proper weld material. The second assumption is based on a review of MSSWR's which apparently indicates that the required prewelding inspections were conducted in the instances where MSSWR's were available. [FYI. How does the first assumption stand up in light of zero rejectable welds having been found in a sample of 53 when previous inspections had a substantial number of rejectable welds? Does this mean that somewhere along the road the criteria for rejection changed? How does the second criteria stand up against the fact of the large number of deficiencies found in the various reinspections? What is the significance of the attached MSSWR (CAR 0031, p. 89) vis-a-vis Joint Preparation and Fit-up inspections?]

Clarification/Response. The issue concerning inspections through paint at the WCGS is summarized as follows:

- a. The conclusion that flaws not visually detectable through paint do not significantly affect structural integrity was not reached solely on the inspection results, but rather through an understanding of the structural behavior of welded joints under loads. First, a structural joint consists of more than a single weld. At the WCGS, there are on the average four welds per joint. Second, a defective weld in a joint does not necessarily mean that the joint is defective; it may indicate the potential for an over-stressed condition relative to the Code (AISC in this case) specified design stress limits. Thirdly, even if a joint is over-stressed because of defective welds, it does not mean that the structural integrity of the structure will be compromised because the loads will be redistributed among the remaining joints when the load-carrying capabilities of a joint or a few joints have been reached.
- b. Weld deficiencies such as missing welds, underlength welds, undersized welds, coarse undercut, coarse lack of fusion and large porosity can be readily identified through paint. Our NDE van inspectors visually inspected 55 painted welds and two of those welds were found to be undersized. See Attachment 2 of Phase III of Inspection Report 50-482/85-12.
- c. Weld deficiencies such as tight cracks, fine porosity, tight undercut and tight lack of fusion are difficult to inspect in coated condition because the paint will mask these deficiencies. Our NDE van inspectors inspected 53 welds using the MT inspection method in order to verify that those types of defects do not exist in the completed welds. No deficient welds were found in the inspected sample. It should also be noted that it is unusual to find cracks in the materials used (E7018 electrodes and A-36 structural steel), and there is little or no history of such cracking when these materials are used. Tight undercut or fine porosity are also unusual to find in these material combinations and their existence is not considered relevant because it does not significantly affect the structural integrity of the

welded joint. Tight lack of fusion can affect the structural integrity of the weld and cannot readily be detected through paint. However, our NDE inspections and also the licensee's inspections have confirmed that the welding procedure and welder qualifications requirements were effective in controlling this type of weld deficiency. In summary, our sample of 53 welds (Phase IV of Inspection Report 50-482/85-12) were inspected using MT inspection to determine whether defects which cannot be identified through paint existed in the completed welded joints. This inspection was used to provide additional confirmation of the results of previous efforts by the licensee and the NRC to establish the acceptability of the structural steel welding. Phase III of our report pertains to visual inspection of welds without paint removal, and 2 welds of the inspected 55 welds were found to be undersized.

Weld defects that are identified during weld inspections may be accepted or rejected by the Architect Engineer (A/E). The dispositions normally utilized by A/Es are:

- o Rework - which would require complete removal of weld and subsequent reweld.
- o Repair - which would allow repair of portions of the weld.
- o Use as is - which would allow for the weld to be used without repair or rework based on an engineering evaluation.

In the corrective action program at Wolf Creek, Daniels International (DIC) repaired or reworked the structural welding to meet the specified requirements, or Bechtel (A/E) performed an engineering evaluation and accepted the welds "use as is". Most of the welds which were identified as deficient during previous reinspections were accepted "use as is" and determined to be adequate for the intended application by the A/E. The NRC NDE inspection was performed on welds which had been reinspected by the licensee, and a portion of these welds were previously evaluated and accepted "use as is" by the A/E. The NRC inspectors used the "use as is" condition in order to ascertain the adequacy of the welded joints. Therefore, welds which previous inspection had identified as deficient but accepted by the A/E were also accepted by the NRC inspectors.

The attached Miscellaneous Structural Steel Weld Record (MSSWR) (CAR 0031, p. 89) indicated that inspections of weld joint preparation and fit-up have not been conducted for these welded joints. Inspection of fit-up and joint preparations is usually governed by the project fabrication control procedures. At the WCGS, DIC has chosen to inspect a random daily sample of welded joints, and KG&E has performed daily verifications of these random inspections. It should also be noted that the final weld requires inspection and if found to be significantly misoriented or not properly fitted in accordance with the drawing requirements, the final weld will be identified as deficient and therefore repaired or appropriately dispositioned.

Item 7. QCP-VII-200, Revision 20 states that the reinspection of structural steel welds shall be in accordance with AWS D1.1-75 with certain exceptions, among them being that inspections of most welds shall be through paint and that an engineering evaluation of the inspection results will be performed knowing that paint exists on most welds. Enclosure I, page 6 (March 11 letter from Mr. Dircks to Mr. Glickman) states that the reinspection would be conducted in accord with AWS D1.1 but omits the fact that QCP-VII-200, Revision 20 contained an exception with regard to inspection through paint.

Clarification/Response. Although the response to Congressman Glickman did not state that QCP-VII-200 contained an exception with regard to inspection through paint, the NRC staff response clearly states in Enclosure 1, page 6 (March 11, 1985 letter Dircks to Glickman) that 56% of the safety-related joints were in painted condition and on page 7, that approximately 56% or 1484 welded joints were reinspected through paint.

Item 8. Neither NRC inspections conducted prior to 1983 nor KG&E or Bechtel audits required pursuant to Criteria XVIII discovered that MSSWR's were "stored in various locations and by various personnel within the individual buildings from the time they were originally initiated..." [FYI. Why did the NRC inspections of less than 1% of the small but significant sample structural steel welds in the 1978-1982 period not discover that MSSWR's were not properly controlled?]

Clarification/Response. The NRC inspection program is a sample inspection approach based on the premise that the licensee is responsible for ensuring the proper design, construction, testing, and safe operation of the facility in accordance with technical and quality commitments included in his Safety Analysis Report (SAR). The NRC first learned of the potential record problems in conversation with the licensee's personnel. The licensee had identified the missing MSSWRs during a documentation review which was a part of the building turnover to the operating organization. There are no specific requirements which would require that the MSSWR's be stored at a central location. The storage requirements pertaining to MSSWRs varies from site-to-site and is generally controlled by the project quality assurance procedures.

Item 9. While AWS D1.1 does not require individual weld and joint records, such a requirement (e.g., that such records will be maintained in some form, whether it be in the form of one record package per weld, one record package per joint, or drawing annotations containing the relevant information) does derive from Appendix B, Criteria XVII. At WCGS, for a "considerable period of time" following welding operations, MSSWRs were not provided to "recordskeeping organizations" in the manner required by Criteria XVII.

Clarification/Response. In general, the final documentation package is assembled after the building or structure is completed. Therefore, it is possible that a considerable period of time may elapse between start of work and completion of the documentation package for the completed structure. Record storage requirements and document transfer times are generally established and controlled by the project QA procedures.

Item 10. The MSSWR required information in addition to that specified on page 6 of Enclosure I to March 11 letter to Mr. Glickman. Such information included indications of "Joint Prep" and "Fit-up."

Clarification/Response. The MSSWR form is generic in nature and contains information which may or may not apply to the individual weld joint. At the WCGS, DIC has chosen to inspect fitups randomly on a daily basis and KG&E verified that it was done daily. The two welds listed in your enclosure were not checked and this was identified as "N/C."

In 1984, all structurally significant welds that were accessible were reinspected. The welded joints were also checked for fit-up where the weld configurations allowed a meaningful reinspection for fit-up. A very small number were found to have exceeded the allowances of paragraph 3.3.1 of the D1.1 Code and were rejected. It should be noted that instructions had been given to increase the size of the fillet weld in accordance with paragraph 3.3.1 in the case of excessive gap.

March 18, 1985

TO: Jim Taylor  
FROM: Henry Myers  
RE: Requirements of AWS D1.1 and 10CFR50, Appendix B

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Pursuant to our discussion re structural steel welds at Wolf Creek, please let me know if you believe the following contains errors:

1. Section 3 of AWS D1.1 specifies requirements for structural steel welding. Section 3.3 describes alignment and gap requirements.
2. Section 6 of AWS D1.1 specifies inspection requirements which include requirements that the Inspector designated by the Engineer shall ascertain that all fabrication by welding is performed in accordance with the requirements of AWS D1.1. Section 6 also specifies that the Inspector shall be furnished with detail drawings and that he shall be notified in advance of the start of any welding operations.
3. Requirements for prewelding inspections of fitup, alignment, weld rod, weld procedures, and welder qualifications are derived from the language of 10CFR50, Appendix B, Criteria V, VIII, IX and X. Record keeping requirements are derived from Criteria XVIII.
4. Test Block Inspection Results obtained by NDE Van Personnel at WCGS in February 1985 indicated that flaws such as cracks, fine porosity, tight undercut and certain types of fusion discontinuities are not visually inspectable through primer or epoxy coating.
5. NRC documents produced in conjunction with the verification of structural steel weld quality at WCGS do not contain a listing by drawing indicating the following with respect to welds on that drawing: (1) number of welds on drawing; (2) number of welds on drawing for which the MSSWR is available; (3) number of welds on drawing found during reinspection to be out of compliance with AWS D1.1; (4) number of welds on drawing covered by primer, epoxy coating and/or fire protection material; (5) welds on drawing for which primer, epoxy coating, and/or fire protection material were removed to allow reinspection pursuant to CAR 19.



6. The conclusion that flaws not visually detectable through paint, do not affect structural integrity rests on the following rationale: (1) that rejectable welds were not found among the 53 joints examined pursuant to Phase IV of 85-12 (see page 4) and (2) the assumption that welding was performed by qualified welders, using and following the appropriate procedures and using proper weld material. The second assumption is based on a review of MSSWR's which apparently indicates that the required prewelding inspections were conducted in the instances where MSSWR's were available. [FYI. How does the first assumption stand up in light of zero rejectable welds having been found in a sample of 53 when previous inspections had a substantial number of rejectable welds? Does this mean that somewhere along the road the criteria for rejection changed? How does the second criteria stand up against the fact of the large number of deficiencies found in the various reinspections? What is the significance of the attached MSSWR (CAR 0031, p. 89) vis-a-vis Joint Preparation and Fit-up inspections?]
7. OCP-VII-200, Revision 20 states that the reinspection of structural steel welds shall be in accordance with AWS D1.1-75 with certain exceptions, among them being that inspections of most welds shall be through paint and that an engineering evaluation of the inspection results will be performed knowing that paint exists on most welds. Enclosure I, page 6 (March 11 letter from Mr. Dircks to Mr. Glickman) states that the reinspection would be conducted in accord with AWS D1.1 but omits the fact that OCP-VII-200, Revision 20 contained an exception with regard to inspection through paint.
8. Neither NRC inspections conducted prior to 1983 nor KG&E or Bechtel audits required pursuant to Criteria XVIII discovered that MSSWR's were "stored in various locations and by various personnel within the individual buildings from the time they were originally initiated..." [FYI. Why did the NPC inspections of less than 1% of the small but significant sample structural steel welds in the 1978-1982 period not discover that MSSWR's were not properly controlled?]
9. While AWS D1.1 does not require individual weld and joint records, such a requirement (e.g. that such records will be maintained in some form, whether it be in the form of one record package per weld, one record package per joint, or drawing annotations containing the relevant information) does derive from Appendix B, Criteria XVII. At WCGS, for a "considerable period of time" following welding operations, MSSWR's were not provided to "records keeping organizations" in the manner required by Criteria XVII.

10. The MSSWR required information in addition to that specified on page 6 of Enclosure I to the March 11 letter to Mr. Glickman. Such information included indications of "Joint Prep" and "Fit-up."

John Mc  
15/11/50/100w

CAR0031 PG 27 OF 128  
MISC STRUCTURAL STEEL WELD RECORD (SAFETY-RELATED)

DWG. K6728-0-E5, 2/12/84 JOINT NO. 23A2 B AREA/LOCATION  
BASE MATERIAL PIECE OR HEAT NO. 25 PM 2 TO 23A2 B - E5  
MATERIAL TYPE A. 36 - A 51 W-100 Ser. No. 145271  
FILLER MATERIAL HEAT NO./LOT NO. 222571 WELD PROCEDURE N/A  
WELDER ID D 25 CODE AWS D1.1.75 QCP-VII-200  
VISUAL INSPECTION CRG 10-2-84 DATE 5-11-81 JOINT PREP  
TYPE NDE N/A CRG GDM REVIEWED FIT-UP N/A  
RESULTS N/A Initials 45 Data 2/19/84  
QC INSPECTOR N/A DATE N/A  
REMARKS FLV 2062' F-5 line 5' EAST of E-D line  
CRG Initials Data  
CRG Initials Data  
CRG Initials Data

1/11/84  
7-A

NCC 15/11/50/70w

MISC/STRUCTURAL STEEL WELD RECORD (SAFETY-RELATED)

DWG. K6728-0-E6, 2/12/84 JOINT NO. 23B-2 AREA/LOCATION FLV  
BASE MATERIAL PIECE OR HEAT NO. 20 B-2 TO Embed B  
MATERIAL TYPE A. 36 W-100 Ser. No. 145271  
FILLER MATERIAL HEAT NO./LOT NO. 222571 WELD PROCEDURE N.I.A.1-  
WELDER ID D-502 CODE AWS D1.1.75 QCP-VII-200  
VISUAL INSPECTION CRG 4/11/84 DATE 2-16-81 JOINT PREP N/C  
TYPE NDE N/A CRG GDM REVIEWED FIT-UP N/C  
RESULTS N/A Initials 45 Data 2/19/84  
QC INSPECTOR N/A DATE N/A  
REMARKS FLV 2062' F-3 line 13' East of E-D line  
Beam To Embed  
CRG Initials Data  
CRG Initials Data

