

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401  
400 Chestnut Street Tower II

July 29, 1985

Director of Nuclear Reactor Regulation  
Attention: Ms. E. Adensam, Chief  
Licensing Branch No. 4  
Division of Licensing  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of )  
Tennessee Valley Authority ) Docket Nos. 50-390  
50-391

Please refer to your letter to H. G. Parris dated July 3, 1985 concerning weld inspections at Watts Bar Nuclear Plant, units 1 and 2. The letter requested additional information regarding the TVA employee concerns on visual inspections of welds through paint. Enclosed is the response to your questions.

If there are any further questions, please get in touch with K. P. Parr at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*J. A. Domer*

J. A. Domer, Chief  
Nuclear Licensing Branch

Sworn to and subscribed before me  
this 29<sup>th</sup> day of July 1985

Paulette F. White  
Notary Public  
My Commission Expires 8-24-88

Enclosure

cc: U.S. Nuclear Regulatory Commission (Enclosure)  
Region II  
Attention: Dr. J. Nelson Grace, Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

8508050210 850729  
PDR ADOCK 05000390  
G PDR

*Boo!*

ENCLOSURE  
RESPONSE TO NRC QUESTIONS  
ON WELDING CONTAINED IN E. ADENSAM'S LETTER TO H. G. PARRIS  
DATED JULY 3, 1985

- 1(a) Were the inspections performed between December 1-15, 1982, (we assume you mean December 1-15, 1981) reinspections or the initial acceptance inspections?

Response

The inspections performed between December 1-15, 1981 were intended as initial acceptance inspections contingent on a revision of the visual inspection procedure permitting initial acceptance inspections through primer. No records of these inspections were made because when the procedure was issued it did not allow initial acceptance inspection through primer. The welds were subsequently stripped of primer and the initial acceptance inspection was performed on clean welds. No documentation was retained of an initial acceptance inspection through primer.

- (b) What documents support your position?

Response

This was documented in the OQA report (J. W. Anderson's memorandum to H. N. Culver dated January 30, 1984, OQA 840130 002, attachment 3, page 5 of 11, copy attached) which was referenced by H. N. Culver's memorandum to J. W. Anderson dated February 3, 1984 (GNS 840203 054, copy attached), indicating item R-82-07-WBN-02 was satisfactorily resolved and closed.

- (c) If reinspection, why was it being performed?

Response

Again, the original inspection through primer issue was resolved when OC decided to remove the primer before an initial acceptance inspection as described in (a) above.

- 2(a) How was it determined that only one group of inspectors performed these inspections or reinspections through carbo zinc primer rather than the three groups identified by NSRS? (Refer to G. H. Kimmons' memorandum to H. N. Culver dated September 2, 1982, EDC 820902 023, item 02, response.)

Response

Through interviews with inspectors and a review of available documents it was determined that only one group of inspectors, electrical, actually performed weld inspections through carbo-zinc primer.

- (b) Is this documented in any way?

Response

Yes, this issue is discussed in attachment 3 to J. W. Anderson's memorandum dated January 30, 1984, specifically pages 7 through 11.

3. Supposedly, these 100 to 150 welds were not capable of being located, or their precise number known.

Reference: H. N. Culver's memorandum to G. H. Kimmons dated June 23, 1982 (GNS 820623.050), IV.B, first paragraph

- (a) How can we now say that all of these particular welds were stripped of primer and inspected?

(J. W. Hufham's letter to H. L. Thompson of June 5, 1985, (L44 850605 803) concern (enclosure I - item 8), second page, top paragraph.)

Response

Based on interviews with inspectors and review of the inspection records from the record storage vault of these inspectors who stated to NSRS that they made inspections through carbo-zinc, TVA believes that all welds received an initial acceptance inspection without primer.

Revising the last sentence of J. W. Hufham's letter dated June 5, 1985 concern (enclosure 1 - item 8), second page, top paragraph, to read as follows should clarify this concern.

When the TVA procedure for inspection of welds was revised to include a provision for reinspection of welds through primer it became obvious that the initial acceptance inspection of welds through primer was not acceptable. The welds which had received the initial acceptance inspection through primer were then cleaned (carbo-zinc primer removed) and received a properly documented initial acceptance inspection.

- (b) If this was a reinspection, why was the primer stripped?

Response

As stated in our response to 3(a), primer was stripped from these welds which had received the initial acceptance inspection through primer because the approved procedure did not allow for inspection through primer.

GENERAL OBSERVATION (Not Related to a Specific Question)

The general concern over inspection through carbo-zinc primer is that certain rejectable defects (small cracks and fine porosity) may be masked by the primer coating. That this could theoretically occur is not in question and has been confirmed on test specimens containing deliberately induced defects.

It is our opinion, however, that for the structural features involved in this issue, such defects are extremely rare with respect to occurrence and/or as cause for rejection. We believe that the overall quality of welding at WBN is good and results from a stable workforce, an effective QA/QC program, and conscientious craftsmen and craft supervision. The carbo-zinc issue obscures the fact that weld quality itself is not in question and, even if uninspected, we would expect few, if any, welds to be of unacceptable quality.

Refer to J. W. Anderson's memorandum to H. N. Culver dated January 30, 1984 (OQA 840130 002), attachment 3, page 1 of 11, which reports the results of a sampling program performed on various structural features. Note that inspections were performed with respect to configuration (primer present) and quality (primer removed). All welds examined for quality were reported acceptable, indicating no rejection for the defects of concern.

We believe that some statistical inference may be made from this data. Considering the data on weld quality, which would include the defects of concern, and converting the lineal inches examined to an estimated number of welds the data indicates:

<u>Category</u>	<u>Welds Examined</u>	<u>Results</u>
Cable tray supports	3500" est 16"/weld = 218 welds	100% acceptable
Duct hangers	2100" est 16"/weld = 131 welds	100% acceptable
Misc. str. steel	18,000" est 36"/weld = 500 welds	100% acceptable

The above data predicts at a 95-percent confidence level and greater than 95-percent reliability that the entire population of welds in each category would be acceptable.

# Memorandum

TENNESSEE VALLEY AUTHORITY

0QA '840130 002

TO : H. N. Culver, Director of Nuclear Safety Review Staff, 249A HBB-K

FROM : J. W. Anderson, Manager of Quality Assurance, M155G MIB-K

DATE : January 30, 1984

SUBJECT: WATTS BAR NUCLEAR PLANT - AWS WELD PROGRAM

The purpose of this memorandum is to document final resolution and closure of NSRS concerns with the AWS Welding Program at the Watts Bar Nuclear Plant.

The following is a summary of the key events that led to the eventual resolution of the NSRS concerns:

1. In your memorandum to me dated August 10, 1983 (GNS 830811 050), you identified three concerns your organization had with respect to the AWS Welding Program at Watts Bar Nuclear Plant. They were filler material records, inspection records, and inspection through carbo-zinc.
2. We attempted to respond to your concerns in my memorandum to you dated October 20, 1983 (OQA 831020 002).
3. Your concerns were not resolved and on October 28, 1983, we met with you to attempt to reach a resolution. The meeting was documented by a memorandum to the Systems Engineering Branch Files dated November 18, 1983 (OQA 831118 425). A plan of action was agreed to in the meeting, and OQA proceeded to implement the plan.
4. Numerous informal meetings were conducted between our organizations to attempt to clarify the concerns and their resolutions. Attachment 1 of this memorandum is the final resolution on filler material records and supporting information which was used to draw OQA conclusions. Attachment 2 of this memorandum is the final resolution on inspection records and supporting information which was used to draw OQA conclusions. Attachment 3 of this memorandum is the final resolution on inspection through carbo-zinc and supporting information which was used to draw OQA conclusions.
5. On January 18, 1984, NSRS and OQA met with the TVA Board of Directors. In that meeting you concluded that all of your concerns were resolved and that you agreed with OQA's conclusions.

We believe that all of your concerns have been satisfactorily resolved and we no longer consider your AWS Welding Program concerns to be an open issue.

JAN 30 1984

SEARCHED

SERIALIZED

INDEXED

FILED

Price

Castell

FEB 07 '84	CEDC	Date					
	Project Manager						File Code
		KAP	3/7				
		JWC	2/7				
		RCM					
	APB						
	JER						



H. N. Culver  
January 30, 1984

WATTS BAR NUCLEAR PLANT - AWS WELD PROGRAM

We will place a copy of this memorandum and all attachments in the permanent record files for our closure of each of the following NSRS findings: R-82-02-WBN-24, R-82-07-WBN-02, R-82-07-WBN-06.

  
J. W. Anderson

JRL:JAT:LAO

Attachments

cc (Attachments):

G. F. Dilworth, E12D46 C-K

G. H. Kimmons, E12A9 C-K

J. R. Lyons, M144 MIB-K

MEDS, W5B63 C-K

FILLER MATERIAL RECORDS

- NSRS CONCERN
- o That the WBN welding program did not provide filler material records necessary to satisfy AWS D1.1.-1972.
- OEDC PROGRAM
- o Designer requirements for structural welding, including filler material and inspection activities, are specified by EN DES via Construction Specification G-29C. G-29C incorporates the TVA licensing commitment to the NRC regarding AWS D1.1-1972, with any modifications or deviations from the code specified in G-29C.
  - o OEDC management control systems relative to control of filler materials include:
    - o Procurement
    - o Receipt inspection
    - o Warehouse storage
    - o Storage in the field
    - o Field weld rod center issuance controls
    - o Verification by the welder and welding foreman
    - o Surveillance of welding activities.
  - o The surveillance program provides a weekly record of the results of daily surveillance activities, which include verification of material controls.
- OQA CONCLUSION
- o The OEDC program satisfies regulatory requirements and TVA commitments to the NRC and provides adequate confidence that only materials conforming to requirements of the AWS Code are used.
- NSRS POSITION
- o NSRS agrees with the OQA conclusions regarding the adequacy of the OEDC program.

FILLER MATERIAL RECORDS

A. Statement of Concern

TVA must be able to show that the correct filler material was used in the various safety-related structural welds at WBN. This cannot be done through existing documentation (GNS 83 0811 050).

B. AWS Code Requirements

Section 4.0 gives the specific requirements for filler material. Paragraph 6.2 states, "The Inspector shall make certain that only materials conforming to the requirements of this code are used."

Paragraph 6.5.4 states, "The Inspector shall, at suitable intervals, observe the technique and performance of each welder, welding operator and tacker to make certain that the applicable requirements of section 4 are met." (Emphasis added)

C. Management Control Systems Utilized to Ensure Proper Material is Used

1. Procurement

Process Specification 7.M.1.1 and various Purchase Specifications (PF) are utilized to ensure that only material which meets the requirements of ASME SFA (and correspondingly AWS) and additional requirements of ASME, Section III, are procured.

2. Receipt Inspection

WBN Quality Control Procedure (QCP)-1.06 is used to verify that welding electrodes received meet contract specifications.

3. Warehouse Storage

WBN QCP-1.36 is used to verify acceptable warehouse storage conditions.

4. Storage in the Field

WBN Quality Control Instruction (QCI)-4.01 is used to specify/control field storage methods.

5. Field Weld Rod Center Issuance Controls

WBN QCI-4.01 specifies issuance controls to ensure that electrodes of the proper material are issued for each task. The craft foreman originates requisitions for issuance of materials on a welding material requisition (form TVA 10204) and specifies the appropriate material to be used. The control center attendant reviews the requisition for proper welding rod or wire notations and issues the material to the welder or welder helper. The welder retains a copy of the requisition as long as the issued welding materials are in his possession. The requisitions may be destroyed after a 24-hour retention period.

6. Verifications by the Welder and Welding Foreman

Process Specification O.C.1.1(a) requires that all welding be performed in accordance with the specification and applicable EN DES approved drawings. The welder and foreman are charged with assuring that filler material is correct, along with other variables. These determinations are also subject to a surveillance program conducted by welding inspectors as defined below.

7. Surveillance of Welding Activities

Process Specification O.C.1.1.(a) outlines the surveillance program and specifies the interval to be at least once every two weeks for each crew's work.

WBN QCI-4.03 requires a daily surveillance of welding activities to ensure a continuing high level of weld quality. These surveillances, conducted in shops and erection areas, are documented on a Daily Welding Surveillance Report. Use of proper filler material is one of various items verified during the daily surveillances. A weekly summary report is compiled on the Welding Surveillance Weekly Checklist. The weekly reports are maintained as quality records, while the daily surveillance reports are discarded after information is transferred to the weekly reports.

D. Summary

The code requires that the Inspector assures that only proper filler materials are used. It does not require individual records which demonstrate that proper material were used in every weld.

The following control systems assure that proper filler material is utilized in AWS welding applications:

1. Procurement controls
2. Receipt inspection
3. Storage and issuance controls
4. Verifications by the welder and foreman
5. Conduct and documentation of periodic surveillance

E. Conclusion

Although no individual records exist to prove conclusively that the filler material is of proper type, the controls above do give reasonable assurance that proper material is indeed used. Therefore, the requirements of the Code are met.

Regarding the question as to whether Criteria VIII and XVII of Appendix B to 10 CFR 50 are being met with respect to traceability of materials, ANSI N45.2-1971, which TVA is committed to, clarifies Appendix B. Paragraph 9, "Identification and Control of Materials, Parts, and Components," states, in part,

"[W]hen codes, standards, or specifications require traceability of materials, parts, or components to specific inspection or test records, the program shall be designed to provide such traceability."

AWS D.1.1-1972 does not require traceability of material, but only that proper materials are used; therefore, Appendix B is met.

INSPECTION RECORDS

NSRS CONCERN

- o That the WBN welding program did not provide inprocess inspection records necessary to satisfy AWS D1.1.-1972.

TVA PROGRAM

- o Designer requirements for structural welding, including inspection and records activities, are specified by EN DES via Construction Specification G-29C. G-29C incorporates the TVA licensing commitment to the NRC regarding AWS D1.1-1972, with any deviations from the Code specified in the specification.
- o OEDC management control systems relative to fitup and inspection records include:
  - o Verification by the welder and welding foreman
  - o Surveillance of welding activities
  - o Final weld inspections.
- o The surveillance program provides a weekly record of the results of daily surveillance activities, which include verification of fitup. The final weld inspection provides a record of the visual examination of the completed weld by the independent QC inspector.

OQA CONCLUSION

- o The OEDC program satisfies regulatory requirements and TVA commitments to the NRC and provides adequate confidence inprocess welding activities are conducted in accordance with specified requirements.

NSRS POSTITION

- o NSRS agrees with the OQA conclusions regarding the adequacy of the OEDC program.

## INSPECTION RECORDS

AWS D1.1-72

TVA MANAGEMENT CONTROL SYSTEM

Paragraph 6.1.1 states, "The Inspector designated by the Engineer shall ascertain that all fabrication by welding is performed in accordance with the requirements of this code."

Section 6.5 contains requirements for inspection of work and records maintenance. Paragraphs 6.5.1 through 6.5.5 specify the types of inspections to be conducted.

Paragraph 6.5.6 states, "The Inspector shall identify with a distinguishing mark all parts or joints that he has inspected and accepted."

Paragraph 6.5.7 states, "The Inspector shall keep a record of qualification of all welders, welding operators, and tackers, all procedures qualifications or other tests that are made, and such other information as may be required."

Paragraph 6.5.4 states, "The Inspector shall, at suitable intervals, observe the technique and performance of each welder, welding operator, and tacker to make certain that the applicable requirements of Section 4 are met." [Emphasis added]

Verifications by the Welders and Welding Foremen

Process Specification (PS) O.C.1.1(a), Section 5, provides for qualification of welders participating in the program. This is implemented at the site through WBN QCI-4.02.

Section 6 of PS O.C.1.1(a) requires that weldments and variables associated with them be verified correct before, during, and after welding operations. The responsibilities for assuring that these variables are correct are shared among the welder, the welding foreman, and an independent quality control inspector. As specified in paragraph 6.2, the welder and foreman are responsible for ensuring proper material, fitup, alignment, procedure adherence, etc., during preweld and actual welding phases. The welder and foreman activities are subject to a surveillance program defined in paragraph 6.3 to help ensure continued high quality. Note that EN DES has designated the "Inspector" in accordance with paragraph 6.1.1 of the Code via PS O.C.1.1(a).

Surveillance of Welding Activities

As noted above, PS O.C.1.1(a) provides for a sampling surveillance program to ensure adequacy of activities. Paragraph 6.3 specifies that each welder's work be monitored at least every two weeks and that both work in progress and completed work be checked. This program is implemented by WBN QCI-4.03, which requires a daily surveillance of activities. These surveillances are documented on a Daily Welding Surveillance Report and cover all aspects of the welding operation on a sampling basis. A weekly summary report is compiled on the welding Surveillance Weekly Checklist. The weekly reports are retained as quality records whereas the daily surveillance reports are discarded after information is transferred to the weekly reports.

Paragraph 6.5 of PS O.C.1.1(a) requires that a monthly report be sent to EN DES providing results of the surveillance program. The report lists the plant features examined, major problems, and corrective actions taken.

Final Weld Inspections

PS 3.C.5.4 and PS O.C.1.1(a) also provide for an independent, recorded inspection of all Category I welds after completion. PS O.C.1.1(a) requires that a record of inspection be retained. It stipulates that the record may be the inspector's unique identifying mark on the weldment, marked drawings, individual inspection records, or as required by a quality assurance program. PS 3.C.5.4 contains similar provisions.

This inspection is implemented and recorded by WBN QCP-4.13-VTC. Included in the inspection are examinations for weld defects, weld contour, size, weld cleanliness, arc strikes, welder's identification, and drawing requirements. The responsible quality control (QC) inspection unit (previously engineering unit) performs and documents these inspections.

## WELD INSPECTION RECORDS REQUIREMENTS

### A. Statement of Concern

Responses from EN DES and OQA do not define where the requirements relating to records dealing with fitup, in process inspection, or final inspection are contained in the TVA Quality Assurance Program. It is not clear whether it is intended that the weld inspection program be governed by the program through G-29C (peer inspection) or through the quality verifying program (QC inspection) (GNS 83 0811 050).

A periodic surveillance with no documentation of specifically what was surveilled is not adequate for QC records. Periodic surveilling if well documented is not adequate for meeting requirements since it does not provide inspection of all the activities involved (OQA 83 1118 425).

### B. AWS Code Requirements

Paragraph 6.1.1 states, "The Inspector designated by the Engineer shall ascertain that all fabrication by welding is performed in accordance with the requirements of this code."

Section 6.5 contains requirements for inspection of work and records maintenance. Paragraphs 6.5.1 through 6.5.5. specify the types of inspections to be conducted.

Paragraph 6.5.6 states, "The Inspector shall identify with a distinguishing mark all parts or joints that he has inspected and accepted."

Paragraph 6.5.7 states, "The Inspector shall keep a record of qualification of all welders, welding operators, and tackers, all procedures qualifications or other tests that are made, and such other information as may be required."

Paragraph 6.5.4 states, "The Inspector shall, at suitable intervals, observe the technique and performance of each welder, welding operator, and tacker to make certain that the applicable requirements of Section 4 are met." (emphasis added)

C. Management Control Systems for Conduct and Documentation of Inspections

1. Verifications by Welders and Foremen

Process Specification (PS) O.C.1.1(a), Section 5, provides for qualification of welders participating in the program. This is implemented at the site through WBN QCI-4.02.

Section 6 of PS O.C.1.1(a) requires that weldments and variables associated with them be verified correct before, during, and after welding operations. The responsibilities for assuring that these variables are correct are shared among the welder, the welding foreman, and an independent quality control inspector. As specified in paragraph 6.2, the welder and foreman are responsible

for ensuring proper material, fitup, alignment, procedure adherence, etc., during preweld and actual welding phases. The welder and foreman activities are subject to a surveillance program defined in paragraph 6.3 to help ensure continued high quality. Note that EN DES has designated the "Inspector" in accordance with paragraph 6.1.1 of the Code via PS O.C.1.1(a).

2. Surveillance of Welding Activities

As noted above, PS O.C.1.1(a) provides for a sampling surveillance program to ensure adequacy of activities. Paragraph 6.3 specifies that each welder's work be monitored at least every two weeks and that both work in progress and completed work be checked. This program is implemented by WBN QCI-4.03, which requires a daily surveillance of activities. These surveillances are documented on a Daily Welding Surveillance Report and cover all aspects of the welding operation on a sampling basis. A weekly summary report is compiled on the welding Surveillance Weekly Checklist. The weekly reports are retained as quality records whereas the daily surveillance reports are discarded after information is transferred to the weekly reports.

Paragraph 6.5 of PS O.C.1.1(a) requires that a monthly report be sent to EN DES providing results of the surveillance program. The report lists the plant features examined, major problems, and corrective actions taken.

3. Final Weld Inspections

PS 3.C.5.4 and PS O.C.1.1(a) also provide for an independent, recorded inspection of all Category I welds after completion.. PS O.C.1.1(a) requires that a record of inspection be retained. It stipulates that the record may be the inspector's unique identifying mark on the weldment, marked drawings, individual inspection records, or as required by a quality assurance program. PS 3.C.5.4 contains similar provisions.

This inspection is implemented and recorded by WBN QCP-4.13-VTC. Included in the inspection are examinations for weld defects, weld contour, size, weld cleanliness, arc strikes, welder's identification, and drawing requirements. The responsible quality control (QC) inspection unit (previously engineering unit) performs and documents these inspections.

4. Summary

The Engineer (EN DES) has specified that inspection responsibilities are to be shared by the welder, welding foreman, and QC inspector. Preweld and in process activities are confirmed to be per procedure by the welder when his stencil is placed on the joint. Activities conducted by the welder and welding foreman are surveilled on a sampling basis by an independent inspector. These surveillance results are compiled in weekly and monthly reports. Finally, independent examinations are conducted and documented on all completed Category I welds.

5. Conclusions

The welding verification program as implemented meets the intent of AWS D.1.1-1972. The Code does not require independent inspection of all process variables and activities. The programmatic controls being implemented provide reasonable assurance that welds are of acceptable quality and that required records are retained.

Regarding the issue of whether records requirements of Criterion XVII of Appendix B to 10 CFR 50 are being met, it should be noted that the only true inspection as defined by Criterion X, in this case is the final visual weld examination, the documentation of which meets the intent of Criterion XVII.

INSPECTION THROUGH CARBO-ZINC

- CONCERN      o NSRS review of WBN weld program indicated that inspections had been performed through carbo-zinc primer.
- PURPOSE      o CONST requested approval from EN DES to inspect through carbo-zinc primer as a part of a series of sample programs in which welds were being reinspected to determine their adequacy and the adequacy of previous inspections.
- BOUNDS      o Inspection through carbo-zinc authorized for:  
                  - Welds made prior to November 2, 1981  
                  - Inspections made after November 2, 1981  
                  - Carbo-zinc  $\leq$  5 mils and sprayed in accordance with the applicable specification.
- o All welds inspected for weld quality (porosity, lack-of-fusion, cracks, etc.) as a part of an EN DES directed sampling program to be cleaned.
- o Acceptance criteria for weld defects to be in accordance with G-29C.

SAMPLE PROGRAM RESULTS:

<u>Scope</u>	<u>Sample</u>	<u>Results</u>
Cable tray supports	8,000 linear inches (configuration) 3,500 linear inches (quality)(note 1)	100% acceptable
Duct hangers	5,000 linear inches (configuration) 2,100 linear inches (quality)	100% acceptable
Misc. struc. steel	18,000 linear inches (both)	100% acceptable for quality 667 inches unacceptable for configuration (3.63%)
Conduit supports	4,000 linear inches (configuration) (note 2)	100% acceptable

NOTE 1: All sample program inspections upon which the determination of acceptability of weld quality were based were conducted with primer removed.

NOTE 2: Weld quality accepted based on cable tray support sample program.

Based on these sample programs, the primary area of uncertainty with respect to weld acceptability is related to weld configuration (i.e. overlap, undercut, size, etc.).

## QUALIFICATION PROGRAM RESULTS

- o Inspection through carbo-zinc acceptable for:
  - weld configuration (overlap, undercut, size, location)
  - large cracks
  - coarse porosity.
- o Inspection through carbo-zinc unacceptable for:
  - small cracks
  - fine porosity.

Based on this qualification program, the area of concern for any inspection conducted through carbo-zinc is limited to small cracks and fine porosity.

## SUMMARY

1. Welds at Watts Bar were inspected through carbo-zinc as a part of the weld sample program.
2. Inspection through carbo-zinc was not authorized by EN DES for determination of acceptability of weld quality (porosity, lack-of-fusion, cracks, etc.).
3. Results of sample programs indicate weld quality was not an area of uncertainty for samples.
4. Results of weld qualification program indicates that weld quality can be determined through carbo-zinc, with the exception of small cracks and fine porosity.
5. Available data, including NSRS evaluation notes, indicates that the extent to which inspection through carbo-zinc may have been conducted outside the sample program was relatively small.

## OQA CONCLUSION

Based on the information provided above regarding the area of uncertainty from the weld sample programs (weld configuration), the area of concern for any inspections through carbo-zinc primer (weld quality), and the extent to which inspections may have been conducted through carbo-zinc, the integrity of the welds at Watts Bar Nuclear Plant are not in question.

## NSRS POSITION

NSRS agrees with the OQA conclusions regarding the adequacy of the OEDC program.

Inspection through Carbo-zinc

Key Dates and Events (A=Approximate)

- Fall 1981 (A) CONST verbally requested that EN DES evaluate the acceptability of visual examination of welds in accordance with G-29C after coating with carbo-zinc.
- Note: Involved OEDC personnel have stated that the purpose of this request was to facilitate the performance of a series of weld sample programs underway at WBN to verify the acceptability of welds. These sample programs were to evaluate both weld configuration (location, size, undercut, and overlap) and weld quality (porosity, cracks, lack-of-fusion, etc.) for welds which had been previously inspected and accepted.
- November 2, 1981 SWP 811102-056 authorized visual examination of welds in accordance with G-29C after coating with carbo-zinc, provided (quote):
1. Carbon zinc thickness is 5 mils maximum.
  2. All work after this date is examined prior to priming with carbo zinc.
  3. Welds inspected for weld quality as part of an EN DES directed sampling program are to be cleaned.
- December 1, 1981(A) CONST provided verbal authorization to inspectors. Note: This authorization may have been limited to one inspection unit.
- December 2, 1981(A) NSRS, during conduct of mini-management review, expressed concern with issue of inspection through carbo-zinc.
- December 15, 1981(A) CONST verbally informed inspectors not to inspect through carbo-zinc.
- January 14, 1982 NEB 820114 253 clarified condition under which inspections through carbo-zinc is authorized (superseded SWP 811102 056) (quote):
1. The Acceptance criteria for weld defects is in accordance with G-29C.
  2. The carbo-zinc was sprayed in accordance with the applicable coating application specification.

3. The carbo-zinc thickness is not greater than 5 mils as documented in coating inspection records and/or log books or as measured adjacent to the weld. Coating thickness measurement techniques shall be in accordance with the specification for coating application. All work performed after this date shall be examined before it is primed.

January 25, 1982

PS 3.C.4.5(a) issued. Authorizes inspection through carbo-zinc with same restrictions as NEB 820114 253 for welds made prior to November-2, 1981.

June 23, 1982

NSRS Special Investigation R-82-07-WBN (GNS 820623 050) issued. Review conducted March 29 through April 2, 1982. Results included:

R-82-07-WBN-02, Improper Inspection of Structural Support Welds

Based on interviews with QC inspectors, it was concluded that 100 to 150 structural support welds had been inspected through carbo-zinc primer without approved procedures.

Recommendations

Due to the uncertainty of the outcome on the question of the site-approved procedures for inspecting welds through carbo-zinc primer, the NSRS proposes two recommendations:

1. If this type of inspection is acceptable through implementation of the EN DES-approved process specification, then the welds should be used "as is."
2. If this type of inspection is unacceptable, then the welds should be reinspected in accordance with existing site approved procedures.

R-82-07-WBN-06, Documentation of Weld Sampling Program

Insufficient documentation exists to substantiate the weld sampling program conducted to verify that visual weld inspections could be made through carbo-zinc primer.

Recommendation

Prepare a report that describes the weld sampling program and that provides the technical justification for inspection through carbo-zinc primer. This report should identify the welds in the sampling program, the specific welds primed with carbo-zinc, the thickness of the primer, how the primer thickness was measured, and the results of the sampling program.

July 22, 1982

EDC 820722 006 - Initial OEDC response to R-82-07-WBN includes (in part) (quote):

Inspection records from the Record Storage Vault signed by inspectors who stated to NSRS that they made inspections through carbo-zinc have been examined. There is no entry on the record that the inspections were made through carbo-zinc. All records examined identified the applicable approved procedure (WBN-QCP-4.13) as the inspection document. Therefore, as previously stated, we conclude that the inspections were made using an approved procedure.

It has been determined that the reported inspections of structural welds involved were confined to the work of one engineering unit. As stated in the response to Item 01, Construction cannot find any record of inspections which were performed without an approved procedure.

September 13, 1982

WBN QCP 4.13, Revision 6, issued to authorize inspection through carbo-zinc with restrictions of PS 3.C.5.4(a).

March 10, 1983

CONST identified three (3) conduit supports which they could determine were inspected through carbo-zinc. An IRN was prepared, the supports were later reinspected, and the welds were determined to be acceptable.

May 19, 1983

OQA responded to OEDC that OQA had conducted follow-up actions associated with R-82-07-WBN-02 and that the item was closed (OQA 830519 004).

June 21, 1983

EDC 830621 004 - OEDC follow-up response to R-82-07-WBN-06 provided the following results of the OEDC qualification program designed to ascertain the acceptability of inspection through carbo-zinc (quote):

1. The qualification tests did substantiate the ability to perform visual inspection of welds through primer for size, location, undercut, and overlap as permitted in G-29C. (OEDC has not interpreted G-29C as permitting acceptance of weld quality based on an inspection through primer.)
2. The qualification tests did not substantiate a practical method of visual inspection of weld quality through primer in a construction environment.

August 24, 1983

PS 3.C.5.4(a), Addenda 2, issued to limit scope of visual inspection through carbo-zinc to weld configuration as follows (quote):

Revise paragraph 5.2.1 to read as follows:

5.2.1 Welds made prior to November 2, 1981, which are coated with carbo-zinc primer may be visually examined for weld size, undercut, overlap, and arc strikes in accordance with this process specification without removing the primer provided:

- (a) The carbo-zinc was sprayed in accordance with the applicable coating application specification.
- (b) The carbo-zinc thickness is not greater than 5 mils as documented in coating inspection records and/or log books or as measured adjacent to the weld. Coating thickness measurement techniques shall be in accordance with the specification for coating application.

August 24, 1983

OQA responded to OEDC that OQA had conducted necessary follow-up actions associated with R-82-07-WBN-06 and that the item was closed (OQA 830824 002).

October 28, 1983

WBN QCP-4.13 revised to delete provisions for inspection through carbo-zinc.

October 28, 1983

NSRS met with OQA and requested that OQA reconsider our actions to close R-82-02-WBN-02. The NSRS provided the following statements (quote):

- 1A. We disagree that this is closed for the following reasons:
1. Inspectors within the electrical, instrumentation, and civil welding groups stated they did inspections.
  2. OQA closure is based upon only the electrical group.
  3. OQA has documentation that only three welds, inspected by the electrical group, had primer on them and those three have not been inspected yet. No other welds were identified by OQA; therefore, the statement in 1A, second section is incorrect.
  4. Six of twenty inspection personnel interviewed by NSRS stated they inspected through primer but could not remember which welds. OQA obtained at a later date a list of welds inspected or not inspected through primer from three inspectors.
- 1B. 1. The inprocess specifications G-29C, P.S.3.C.5.4(a), dated March 9, 1983, which allows inspection through primer has not been revised. An addendum to G-29C dated August 12, 1983, which provides the revision has not been issued.
2. WBN denied in a memorandum from Kimmons to Culver dated July 22, 1982, that personnel were told to inspect through primer using only a memorandum. In a memorandum from the electrical supervisor to an OQA employee received by NSRS on October 25, 1983, states that he told his inspectors to inspect through primer.

Inspection through Carbo-zinc

Data Relative to Bounding Area of Concern

The following information and data is provided to define, to the extent possible, the area of concern with respect to inspection of welds through carbo-zinc at WBN.

1. Types of welds - Structural welds governed by G-29C PS.3.C.5.4(a), including pipe hangers, cable tray supports, conduit supports, miscellaneous structural steel, duct hangers and instrument supports.
2. Date of welds - PS.3.C.5.4(a) authorized CONST to inspect welds made before November 2, 1981, through carbo-zinc. Separate from that specification, a number of sampling programs at WBN have verified the acceptability of the seven types of welds identified in (a) above up to the effective dates of the sampling programs. The combination of the data is provided on Figure 1 to characterize the timeframe within which welds could have been made and subsequently inspected through carbo-zinc. Note that this does not imply that these welds were actually inspected through carbo-zinc.
3. Date of Weld Inspections - Inspection through carbo-zinc was initially authorized by EN DES on November 2, 1981 (SWP 811102 056). CONST verbally authorized the WBN inspectors to inspect through carbo-zinc approximately December 1, 1981. This verbal authorization was rescinded on approximately December 15, 1981. PS.3.C.5.4(a) authorized inspection through carbo-zinc from January 25, 1982, to August 12, 1983. WBN QCP-4.13 authorized the inspection through carbo-zinc from September 13, 1982, to October 28, 1983.
4. Location of welds - There is no data available which would bound the location of welds which may have been inspected through carbo-zinc.
5. Inspection Units Involved - The NSRS review notes indicate that inspectors within the electrical, instrumentation, and civil welding groups had stated that they had performed inspections through carbo-zinc.
6. General -
  - a. The NSRS report indicated:
    - (1) that of 24 inspectors interviewed, 9 believed inspection through carbo-zinc had been permitted and 4 indicated they had actually performed inspection through carbo-zinc,

- (2) it appeared that 100 to 150 structural support welds had been inspected through carbo-zinc primer without approved procedures, and
- (3) that this could not be substantiated by a review of the records nor was it possible to specifically determine which welds were inspected in this manner.

Note: The OEDC response to R-82-07-WBN-02 verified that the inspection records did not indicate that the inspections had been made through carbo-zinc.

- b. In March 1983, CONST questioned their inspectors to determine if they could identify any welds which had been inspected through carbo-zinc. Three (3) conduit supports were identified and were documented under an IRN. These supports were later cleaned and reinspected and were found to be acceptable.

Figure 1

	1979	1980	1981	1982	1983
1. Pipe Hangers					
2. Cable Tray Supports					
3. Conduit Supports					
4. Miscellaneous Structural Steel					
5. Duct Hangers					
6. Instruments Supports					

1

Notes:

1. Inspection through carbo-zinc was authorized by EN DES for welds made prior to November 2, 1981. (Reference SWP 811102 056; NEB 820114 253; PS.3.C.5.4; WBN QCP-4.03)
2. NCR 2019 CONST conducted a 100 percent reinspection of pipe changers and associated welds installed prior to January 21, 1980.
3. NCR 2375R - The corrective action for this NCR included a sample program which evaluated the integrity of welds made prior to February 6, 1981, for cable tray supports; and prior to June 11, 1980, for miscellaneous structural steel and conduit supports. The results of these sample programs were acceptable. Thus, welds prior to this date are acceptable regardless of the carbo-zinc issue.
4. NCR 2654R - The corrective action sample program for this NCR established the integrity of welds made prior to March 27, 1980, regardless of the carbo-zinc issue.

ACCEPTANCE CRITERIA COMPARISON

CRITERIA	P.S.3.C.5.2 AWS D1.1-72	P.S.3.C.5.4 PRIOR TO 2/13/81	P.S.3.C.5.4 AFTER 2/13/81
Convexity.	.15 in. + .03 in.	.15 in. + .06 in.	.15 in. + .06 in.
Undercut	.01 in. deep transverse to stress  1/32 in. deep parallel to stress	Pipe hangers - 1/32 in. deep on stressed members  Other components - 1/32 in. deep on stressed members except an additional 1/32 in. deep and 1/4 in. length not to exceed 10% of the run. Undercut in non-stressed members is not cause for rejection.	1/32 in. deep on stressed member. Undercut on non-stressed member shall not be cause for rejection.
Undersize	1/16 in. underrun for 10% of length	Cable tray supports - ECN 2688 showed minimum size.  Duct supports - 3/16 in. is minimum size. 1/16 in. underrun for entire length on welds larger than 3/16 in.	1/16 in. underrun for 10% of length
Arc strikes and weld spatter	No arc strikes or weld spatter allowed	Random arc strikes and weld spatter are acceptable if cleaned by wire brushing	No arc strikes allowed. No weld spatter allowed except nonexcess weld spatter is acceptable on steel surfaces being painted.

Technical Basis for Changes

- Convexity - Allowed by AWS D1.1-1980.
- Undercut - No Code addressed non-stressed members, new tolerances allowed by ASME NAVSHIPS 0900-005-9010 and NAVSHIPS 0900-000-1000.
- Undersize - EN DES calculations support the changes (SWP 821022013 and SWP 82012704)
- Arc strikes and Weld spatter - Not normally considered defects. Brittle and fatigue failure frequently initiate from arc strikes. These components are not subject to nor des for fatigue failure. These materials would not fail from brittle fracture but from ductile fracture.

UNITED STATES GOVERNMENT

## Memorandum

TENNESSEE VALLEY AUTHORITY

GNS '840203 054

TO : J. W. Anderson, Manager of Quality Assurance, M155 MIB-K

FROM : H. N. Culver, Director of Nuclear Safety Review Staff, 249A HBB-K

DATE : February 3, 1984 840209F0014 (1)

SUBJECT: WATTS BAR NUCLEAR PLANT - CLOSURE OF NSRS ITEM R-82-02-WBN-24

- Reference:
1. My memorandum to you dated August 10, 1983, "Closure of NSRS Item R-82-02-WBN-24 - Comparison of G-29C to AWS D1.1" (GNS 830811 050)
  2. Your memorandum to W. F. Willis dated January 19, 1984, "Key Topics Report No. 20" (OQA 840119 001)
  3. Your memorandum to me dated January 30, 1984, "AWS Welding Program" (OQA 840130 002)

NSRS concurs with the conclusions that the AWS welding program for WBN satisfies regulatory requirements and TVA commitments to the NRC as expressed in reference 2 and 3. It is NSRS's position that the concerns expressed in items R-82-02-WBN-24, R-82-07-WBN-02, and R-82-07-WBN-06 have been satisfactorily resolved. These items are closed.

JW  
JCJ:LML

cc: G. F. Dilworth, E12D46 C-K  
MEDS. W5R63 C-K

*H. N. Culver*  
H. N. Culver

Principally prepared by J. C. Jones



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