ATTACHMENT 1 TO AEP:NRC:4520-01

SPECIFICATION DCC CE 107 QCS, REVISION 3
REINFORCING STEEL SPECIFICATIONS

FORM OC 19
REV. 6/70

INDIANA AND MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

SPECIFICATION COVER SHEET

Specification No.	Dated	Revision No.	Dated
DCC CE 107 QCS		3	March 26, 1969

	ATTACHMENTS
TITLE: Reinforcing Steel Specifications SYSTEM: All Class I and II Concrete SCOPE OF REVISION: General	

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INTERNAL APPROVAL SIGNATURES

	ORIGINAL ISSUE	Rev. 3	Rev.	Rev.
Author	J. C. Daragan			
Approved by				
Quality Assurance	George Lien			

Revision 3
March 26, 1969

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT
UNITS I & 2

REINFORCING STEEL SPECIFICATIONS

All reinforcing shall be deformed new billet open hearth steel conforming to ASTM Specification A-615-68 Grade 40.* Reinforcing is to be furnished and fabricated in accordance with the instructions contained herein, the abovementioned ASTM Specifications, and Buyer's detail drawings and bar bending schedule-Form SD-3 (Dr-45). All bars that are to be Cadweld spliced shall be so fabricated that both ends will freely fit through the proper Cadweld sleeve. Buyer will furnish the fabricator one complete set of all such sleeves for checking purposed. Buyer will also indicate on separate release sheets or by appropriate marking the bars to be Cadweld spliced. All reinforcing bars shall have U. S. standard markings for: (1) Producing Mill, (2) Bar size, (3) Type steel.

Bars to be spliced by the Cadweld splicing process may be sawed, sheared or flame cut providing that the Cadweld sleeve requirements are met.

CERTIFICATION TESTING AND ACCEPTANCE

Buyer will require certified mill tests reports for each heat of steel in accordance with ASTM A-615-68 Specification requirements. Mill tensile tests are to be made on the full section of bars as rolled. In addition Buyer will have independent tests taken to confirm compliance with ASTM A-615-68 for tensile strength, yield point, and percent elongation for each heat.

Fabricator will be required to tag for identification and segregate from other reinforcing steel Buyer's steel requirements, which have been accepted as meeting the specifications. All reinforcing steel requirements of Buyer must come from this tagged and segregated source and written certification to this effect shall be required for all fabricated steel delivered to the project site. In addition to the written certification each bundle of reinforcing delivered to the project shall be tagged showing the heat number of the steel manufacturer (Mill).

"CHECK" TEST REQUIREMENTS

Fabricator will be required to provide Buyer's job site testing laboratory at Bridgman, Michigan, with six (6) 3 feet long full size test specimens from each heat. The end 12" of any bar shall be excluded. These specimens will be tested in accordance with the pertinent provisions of ASTM A615-68 for tensile strength, yield point and percent elongation. With each new heat Buyer will provide fabricator approximate quantities and sizes about one (1) week prior to the receipt of the release for fabrication in order that Fabricator can immediately ship the required test specimens. It will be the Fabricator's responsibility to notify Buyer when new heats are to be used. Fabricator will be informed immediately when the test results are known.

If two (2) specimens from the same heat fail the required ASTM tests, the entire heat shall be rejected.

COLOR CODING AND BUNDLE MARKING

In addition to the tagging required for conformance to specifications Fabricator will be required to provide identification tagging on all steel shipped to the project site as set forth herein.

All reinforcing delivered to the project site requires two types of identification:

(1) A color tag designating the area in the plant where the steel is to be used.

(2) Metal tags identifying each Mark Number of fabricated steel.

COLOR TAGS

All releases for reinforcing requirements will bear a release number (RS-) each release will indicate the required color tag which is to be used to identify the area in the project where the material is to be used. No writing should appear on the color tag. Tags should be standard cardboard or heavy paper of the proper color securely fastened to each bundle of reinforcing. These tags should be strong enough and waterproofed enough to arrive at destination in a condition which will enable segragation of the bundles and their placement in the correct working area.

BUNDLE MARKING

Fabricator is to bundle the fabricated steel in bundles of identical members, and to each bundle securely tie a rust resistant metal tag stenciled or a substitute acceptable to Buyer in the following manner:

(1) First identification is the release number, i.e. a release identified as RS-25 will have as its first marking "RS-25".

(2) The following designation is to be the number of pieces in the bundle. A bundle of 19 pieces should therefore show as the second part of the identification the marking "19".

(3) The bar size need not appear on the tag.

(4) Straight bars should show the length of the bar as the third marking. A 15'-9" bar would show a third marking reading "159". A bar 15'-11" would show a marking of "1511".

(5) Formed bars are to bear as the last designation the mark number shown on the release sheets. Mark numbers usually appear as a combination of a letter and a numeral, i.e. "A-5".

An example of notations to appear on a bundle of straight bars, as detailed above, would therefore be RS25 (space) 19 (space) 159 or RS25 (space) 19 (space) 1511. A bundle of formed steel would bear a stenciled tag reading RS25 (space) 19 (space) A5.

INSPECTION

The Purchaser or Purchaser's representative shall have free access to the Fabricator's shop at all times while work on Purchaser's material is being performed.

SCHEDULING OF DELIVERIES

In all cases the delivery schedules called for indicate actual requirements. Delays in delivery of the reinforcing steel result in extension of the construction schedule and cannot be tolerated. It is therefore essential that Fabricator bear in mind that he must maintain deliveries as per the lead time schedule agreed to and which will become an essential part of any purchase order resulting from this inquiry.

ATTACHMENT 2 TO AEP:NRC:4520-01

CALCULATION SD-040303-001
UNIT 1 & 2 CONTROL ROD DRIVE MISSILE SHIELD REINFORCING
STEEL YIELD STRENGTH, REVISION 0

COOK NUCLEAR PLANT **CALCULATION COVER SHEET**	Page 1 Total pages including attachments - 140

CALCULATION NO. SD-040303-001		REVISION NO.	0
SAFETY RELATED:	☒ YES ☐ NO	UNIT NO.	1 & 2
SYSTEM FUNCTIONAL CALC:	☐ YES ☒ NO	SYSTEM Code:	CNTMT
AEPNG FUNCTIONAL AREA: DES			

TITLE:
UNIT 1 & 2 CONTROL ROD DRIVE MISSILE SHIELD REINFORCING STEEL YIELD STRENGTH

REASON FOR REVISION:
Initial Issue

Limitation: The value determined from this calculation may only be used without limitation following receipt of a Safety Evaluation from the Nuclear Regulatory Commission.

Do any assumptions require later verification? ☐ YES (check Calc status "Restricted Use") ☒ NO
If YES, specify tracking Condition Report:

Calculation Status (check one)	Document/Rev Superseded (replaced) by this Calculation
☒ Unrestricted Use (Approved in NDIS)	None
☐ Restricted Use (Hold in NDIS)	
☐ Void	
☐ Superseded (Specify superseding doc)	
By:	

Preparing Organization:	☒ AEPNG	☐ Other (specify)	
PREPARED BY: ☒ Multiple (see next sheets)	PRINT See pg. 2	SIGNATURE N/A	DATE N/A
REVIEW METHOD:	☒ Detailed Review	☐ Alternate Calculation	
REVIEWED BY: ☐ Multiple (see next sheets)	PRINT P. W. Leonard	SIGNATURE [signature]	DATE 3/25/04
APPROVED BY: (Manager or Designee)	PRINT P. G. Schoepf	SIGNATURE Paul G. Schoepf	DATE 3/26/04

Calculation Number:	SD-040303-001
Revision Number:	0
Page:	2

Multiple Preparers and Reviewers

Prepared By:	Print Name C. E. Shute	Signature	Date 3-25-04
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Reviewed By:	Print Name	Signature	Date
Pages:			
Prepared By:	Print Name	Signature	Date
Reviewed By:	Print Name	Signature	Date
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Reviewed By:	Print Name	Signature	Date
Pages:			

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2.0 List of Effective Pages

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3.0 Purpose /Objectives

The purpose of this calculation is to determine an appropriate/conservative yield strength value for reinforcing bar (rebar) used in the structural calculation for the Control Rod Drive Missile Shields (SD-010307-001, See Reference 1). Throughout this calculation, Control Rod Drive Missile Shields will be referred to as **missile shields.** The appropriate/ conservative yield strength value determined will be for the rebars used to resist the bending stresses in the missile shield concrete sections. Reference 1 indicates that the rebar yield point pertaining to bending stresses is the critical issue concerning the structural design of the missile shields. The rebars used to resist the bending stresses in the missile shields are the #8 and #11 rebars; therefore, the #8 and #11 rebars will be the only bars reviewed in this calculation. The #5 rebars that are in the missile shields to resist shearing stresses will not be reviewed in this calculation. The justification for excluding the #5 rebars will be given in Section 8.0, "Assumptions and Limitations", of this calculation.

The selection of the rebar yield strength value will be determined based on consideration of the Certified Mill Test Report (CMTR) data and I&M rebar site acceptance data. This will be accomplished by evaluating the appropriateness of the data, analyzing the data, and making a recommendation as to an appropriate/ conservative rebar yield strength value.

I&M had previously proposed using a yield strength value for rebar based on CMTR data only. Per NRC Letter N2003014 (See Reference 12), the NRC stated that the use of CMTR data only is insufficient for the determination of an appropriate yield strength value. Per Letter AEP:NRC:4520 (See Reference 13), I&M has informed the NRC that the I&M rebar site acceptance data is available and will now be included with the CMTR data for determination of an appropriate yield strength for the rebar. Once the appropriate yield strength value is determined, I&M will seek a license amendment for the acceptance of this yield strength value.

The yield strength value determined from this calculation is only applicable to the missile shields of Unit 1 and Unit 2. The value determined from this calculation may only be used without limitation following receipt of a Safety Evaluation from the Nuclear Regulatory Commission.

The missile shields are part of the containment internal structures (System Code CNTMT). The missile shields form part of the divider barrier, and are safety-related structures.

This calculation is an initial issue that does not supercede or supplement any previous calculation.

Note: AEP, I&M, Cook Plant, and site are used synonymously within this calculation.

4.0 Design Input

The design input includes the CMTRs from the rebar manufacturer that provide the yield points and the tensile strength for each individual heat of steel and the I&M acceptance tests performed at the Cook Plant for yield point and tensile strength on these same individual heats of steel for the #8 and #11 rebar that resist bending stresses in the missile shields.

4.1) CMTR values from the rebar manufacturer:

Heat No.	Bar Size	Unit	Yield Point (psi)	Tensile Strength (psi)
C34105	#11	1	53,205	89,423
B37160	#11	1	54,487	83,333
C35157	#8	1 & 2	57,468	85,316
B36171	#11	2	54,487	89,423
A37151	#11	2	50,641	84,615
B37340	#11	2	51,602	83,012
A36334	#11	2	55,769	85,576

4.2) I&M site acceptance tests for yield point and tensile strength of the rebar. Two individual tests were performed at the Cook Plant site for each individual heat of steel.

Heat No.	Bar Size	Unit	Yield Point Test #1 (psi)	YieldPoint Test #2 (psi)	Tensile Strength Test #1 (psi)	Tensile Strength Test #2 (psi)
C34105	#11	1	50,897	52,115	84,679	84,743
B37160	#11	1	51,025	50,833	85,320	82,948
C35157	#8	1 & 2	51,265	50,759	81,645	82,278
B36171	#11	2	52,115	52,692	88,717	91,730
A37151	#11	2	50,448	50,192	80,961	81,282
B37340	#11	2	52,179	49,487	87,948	80,256
A36334	#11	2	50,384	49,935	82,307	83,589

The above CMTR values for yield point and tensile strength were obtained from data sheets submitted by the rebar manufacturer when the CMTRs and test specimens were delivered to the Cook Plant site in 1972. I&M site acceptance test values for yield point and tensile strength were taken from Concrete Reinforcement Bar Test Reports. The CMTR and the I&M test data sheets are contained within DIT-B-02851-00 (Attachment 6). The plant material receipt packages for the rebar included in the missile shields are attached to this calculation as Attachment 7.

The traceability for the above CMTR values and the I&M site acceptance test values is shown in flow chart form as Attachment 1, "Chronological Events for the Unit 1 & 2 Missile Shields", attached to this calculation. Attachment 2 provides data sheets for the rebar for each heat number that supplements the data shown in the tables above. These data sheets provide a link for the rebar from the individual heats of steel to where the rebar is detailed on the reinforcement placement drawings (See Attachment 3, References 4 through 11). This information provides a link to the location of each individual rebar resisting bending stresses that is installed in the missile shields. Some of the data included on the Attachment 2 data sheets contain bar mark numbers. These bar mark numbers correspond to bar bending details contained in the drawings included as Attachment 3. Attachment 2 data sheets also contain data on unbent (straight) bars. Unbent bars are not assigned bar mark numbers.

The reinforcing steel bar lists received from the rebar manufacturer contained references linking all of the pieces of rebar to a respective heat of steel number. An extensive review of the reinforcing steel placement drawings (Reference Nos. 4 through 11) was made for both Units 1 & 2 to ensure that every piece of reinforcing steel resisting bending stresses in the missile shields was linked to a specific heat of steel number.

All of the reinforcing steel used in the missile shields was fabricated to the ASTM A615-68 standard and all of the reinforcing steel was specified to be Grade 40.

Reference 19 is the version of the reinforcing steel specification that was in effect during the construction of the missile shields. It is included to establish the requirements in effect at the time of construction.

5.0 References

Reference No.	Status	Document Number/Title	Rev, Edition, Date, etc	Doc in NDM	General Ref	Used for Input
1	App.	Calculation No. SD-010307-001, "Design Basis Analysis of Unit 1 and 2 Reactor Cavity Missile Shield Blocks"	Rev. 1, CS-02	☒	☐	☒
2	App.	DIT-B-02851-00, "Summary of Tensile Testing Results for Rebars Used in Control Rod Drive Missile Shields for Units 1 and 2"	02/23/04	☒	☐	☒
3	Ref.	"Applying Statistics" NUREG-1475	Feb., 1994	☐	☒	☐
4	App.	Drawing No. DC-110152, "Unit 1 Containment Bldg. Missile Shield, Rebar placement drawing" (Attachment #3)	Rev. 0	☒	☐	☒
5	App.	Drawing No. DC-123205, "Unit 1 Containment Bldg. Missile Shield, Standard rebar bending details" (Attachment #3)	Rev. 0	☒	☐	☒
6	App.	Drawing No. DC-123206, "Unit 1 Containment Bldg. Missile Shield, Bent rebar list" (Attachment #3)	Rev. 0	☒	☐	☒
7	App.	Drawing No. DC-123207, "Unit 1 Containment Bldg. Missile Shield, Straight rebar list" (Attachment #3)	Rev. 0	☒	☐	☒
8	App.	Drawing No. DC-110153, "Unit 2 Containment Bldg. Missile Shield, Rebar placement drawing" (Attachment #3)	Rev. 0	☒	☐	☒
9	App.	Drawing No. DC-123202, "Unit 2 Containment Bldg. Missile Shield, Standard rebar bending details" (Attachment #3)	Rev.0	☒	☐	☒
10	App.	Drawing No. DC-123203, "Unit 2 Containment Bldg. Missile Shield, Bent rebar list" (Attachment #3)	Rev. 0	☒	☐	☒
11	App.	Drawing No. DC-123204, "Unit 1 Containment Bldg. Missile Shield, Straight rebar list" (Attachment #3)	Rev. 0	☒	☐	☒
12	Ref.	NRC Letter N2003014, "Regarding Containment Structure Conformance to Design and Licensing Basis"	03/21/03	☒	☒	☐
13	Ref.	AEP Letter AEP:NRC:4520, "Withdrawal of License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shield"	03/02/04	☒	☒	☐
14	Ref.	ASCE Journal of the Structural Division "Variability of Mechanical Properties of Reinforcing Bars" (Attachment #4)	May, 1979	☐	☒	☐
15	App.	Drawing No. 1-2-3186C, Containment Building Missile Shield Plan & Sections Masonry"	Rev. 13	☒	☐	☒
16	App.	Drawing No. 1-2-3186N, "Containment Building Missile shield Cover Sections and Details Reinforcing"	Rev. 0	☒	☐	☒
17	App.	Drawing No. 1-2-3186P, "Containment Building Missile Shield Misc. Steel Frames & Details Masonry"	Rev. 8	☒	☐	☒
18	Ref.	ASTM A615-68, "Deformed Billet-Steel Bars for Concrete Reinforcment"	1968	☐	☒	☐
19	Ref.	DCC-CE-107-QCS, "Reinforcing Steel Specifications"	Rev. 3, 03/26/69	☒	☒	☐
20	Ref.	ACI Standard 318-99	1999		☒	

The above applicable references have been reviewed for pending changes in DOCUMENTUM and for pending condition reports in ECAP. Nothing was uncovered in these reviews that would impact this calculation.

6.0 Methodology

As shown in Section 4.0, there is available data for yield points on the rebar that was installed in the missile shields. This data includes the CMTR values from the rebar manufacturer and includes the I&M site acceptance tests. The CMTR values will not be used in this calculation. The justification for excluding the CMTR values is given in Section 8.0 of this calculation, "Assumptions and Limitations".

This calculation will consider the 14 data points from the I&M site acceptance tests. These 14 data points will first be tested for normality to determine if these data points approximate a normal distribution. The statistical test used for the testing for normality is listed below.

Following the statistical tests for normality, the I&M acceptance test data will be evaluated by performing either numerical review or statistical manipulations of the data and the results of this evaluation will determine a value for the rebar yield point that is both appropriate and conservative to be used in the structural calculation for the missile shields (SD-010307-001, See Reference 1). The numerical review of the data is listed below as Method 1 and the statistical manipulations of the data to be performed are listed below as Methods 2 and 3.

All statistical manipulations will be performed utilizing the statistical analysis tools available in Microsoft Excel (Office 97 and/or Office 2000).

6.1 Testing the data for Normality.

The I&M acceptance test data will be first tested for normality to determine if the 14 points of data approximate a normal distribution. Several textbook methods for goodness-of-fit tests such as the Chi Squared Test; the Least Squares Fit using the associated Correlation Coefficient, the Kolmogorav-Smirnov Test, and the Anderson-Darling Test were considered and ruled out because of the small sample size of 14 data points. The following goodness-of-fit test was identified to be appropriate for use in verifying the assumption that I&M test data points approximate a normal distribution. The goodness-of-fit test chosen was the W-Test. As a complementary check of the results obtained from the W-Test, the I&M acceptance test data was evaluated for goodness-of-fit to a beta distribution.

- W-Test

  The W-Test is a goodness-of-fit test that is described on Pages 7-9 through 7-12 of Reference 3 and is not repeated here.

- Beta Distribution

  Through a statistical software product, Crystal Ball 2000, the I&M acceptance test data was evaluated for goodness-of-fit to a beta distribution. Crystal Ball is not a QA approved software product for use at Cook Nuclear Plant. Therefore, the results from a Crystal Ball statistical analysis cannot be used in making a design basis or licensing basis decision. It can be used as a complementary check of the results obtained from the W-Test.

6.2 Evaluation of I&M Acceptable Test Data

Three methods will be considered in determining the appropriate rebar yield point.

Method 1

Method 1 will consist of a numerical review of the I&M acceptance test data and selection of the lowest yield strength value from any of the individual data points.

The following Methods 2 & 3 will consider combinations of the I&M site acceptance data points. As determined in Section 9.0, these values approximate a normal distribution. Following on Page 11 is a graphic illustration of a normal distribution. The mean and standard deviations will be calculated per Reference 3 and, per Page 5-20 of Reference 3, (n-1) will be used in the formula for standard deviation since the mean value is not known and has to be calculated. Table T-11b of Reference 3 will be used to determine the lower interval that contains 95% of the population with 95% confidence. Refer to Section 8.3 of Assumptions and Limitations for the justification for use of the 95/95 tolerance limit.

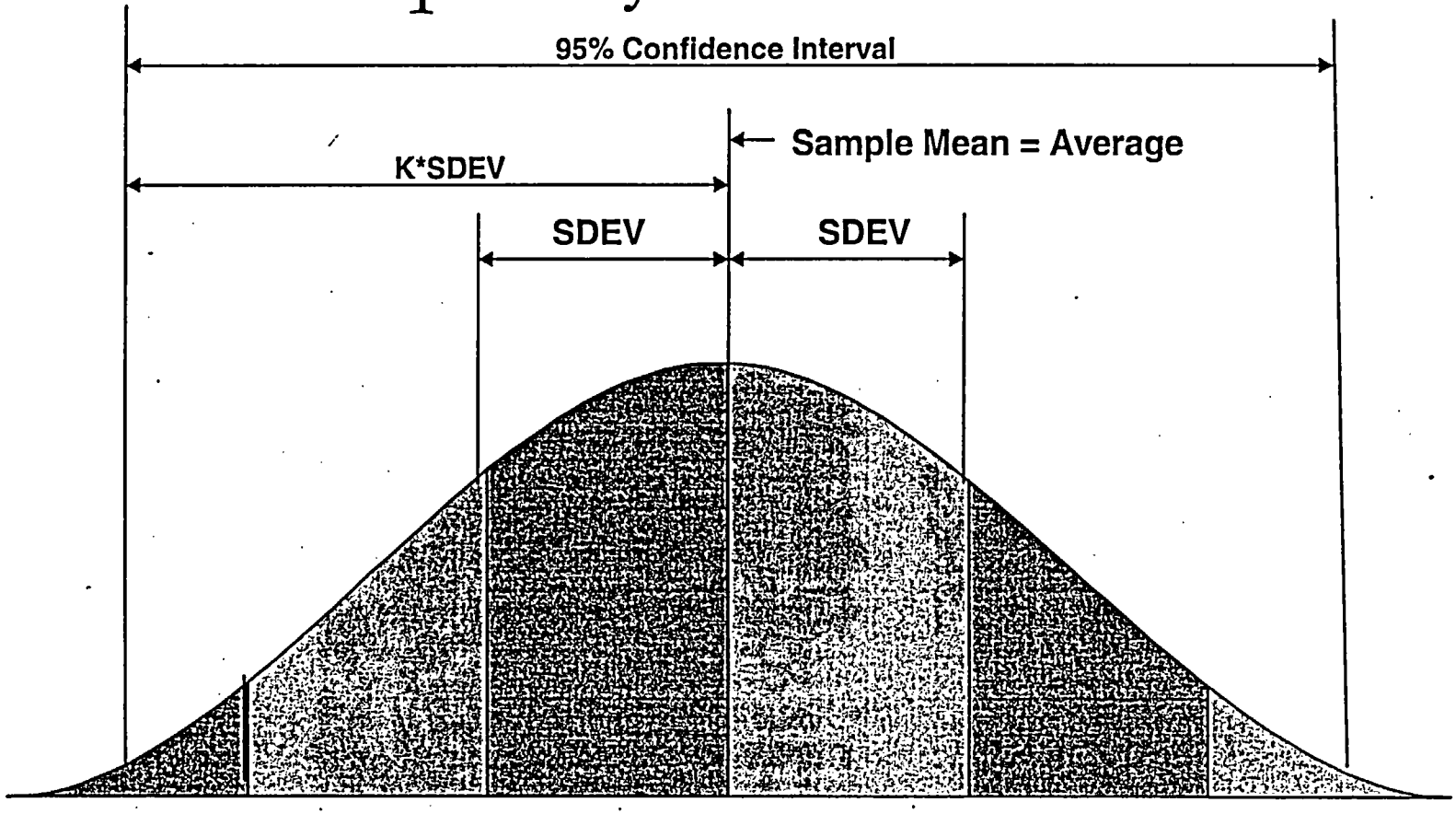
Following is a list of the definition of terms and of the formulas to be used in Methods 2 & 3 to calculate average value, standard deviation, and the lower rebar yield strength of the rebar population.

n = number of samples involved in the calculation
Average = X = the sample mean = (summation of all samples)/n
(Reference 3, Page 5-4)

$$SDEV = \sqrt{\frac{\sum (\text{Each Sample} - X)^2}{n-1}}$$

(Reference 3, Page 5-20)
K = A One-sided tolerance limit factor for a normal distribution given in Table T-11b of Reference 3). Values will be used for 0.95 confidence level for 0.95 of the population.
The lower interval of a population = X – (K*SDEV)

Normal Frequency Distribution Curve



SDEV = Standard Deviation

Method 2

Method 2 considers the 14 I&M site acceptance test data points. Using the formulas listed above, the mean (average) and standard deviation is calculated for the 14 data points and one-sided tolerance limits are developed using Table T-11b of Reference 3 to determine the lower interval rebar yield point that contains 95% of the population with 95% confidence.

Method 3

Method 3 will split the I&M site acceptance test data points between Unit 1 & 2. Since two points of the 14 data points are common to both Units 1 & 2, Unit 1 will consider 6 data points and Unit 2 will consider 10 data points. Each of the Unit 1 & 2 data points will be analyzed as outlined in Method 2 using the formulas listed above.

7.0 Acceptance Criteria

There are no acceptance criteria associated with this calculation since its purpose is to determine an appropriate/conservative rebar yield strength value from rebar test data.

8.0 Assumptions and Limitations

8.1 Justification for excluding the #5 missile shield rebar from consideration.

As stated in Section 3.0, the #5 missile shield rebar will not be considered in this calculation per the following:

i) The #5 rebar in the missile shield concrete structure resists shearing stresses. The Reference 1 structural calculation has evaluated all shearing stresses satisfactorily with the #5 rebar yield point taken at 40,000 psi.

ii) Refer to the ASCE paper that is included with this calculation as Attachment 4. The discussion beginning on Page 8 of 17 concerning "Effect of Bar Diameter" along with the graph plotted in Fig. 3a lead to the conclusion that smaller #5 bars tend to have higher yield strengths than the larger #8 and #11 bars. This is true for rebars manufactured before this paper was written in 1979.

Per the above bases, the #5 rebar yield strength(s) **will not** be considered for the determination of an appropriate/conservative rebar yield point value to be used in the structural calculation for the missile shields.

8.2 Justification for Excluding CMTR Test Values

Following are the findings of the comparison between the CMTR and the I&M Site Acceptance test values for rebar yield point:

i) Refer to the ASCE paper in Attachment 4. The discussion beginning on Page 7 of 17 concerning "Effect of Rate of Loading" states that mill tests on steel specimens are generally carried out at much greater strain rates than the steel will encounter in a structure subjected to static loads. For this reason, mill tests tend to overestimate the yield strength.

Table 2 on Page 10 of 17 of Attachment 4 demonstrates that the mill yield strengths are higher than those yield strengths produced by laboratory tests. In all cases shown on this Table 2 for various sizes of rebar, the mill tests are higher.

The CMTR test values and the I&M acceptance test values for yield point given in Sections 4.1 and 4.2 on Page 5 shows that for each individual heat number, the CMTR test value for yield point is higher that the I&M value in all cases except one. For Heat No. B37340, one of the I&M test values was higher than the CMTR test value. The other I&M test value for Heat No. B37340 was less than the CMTR value. Therefore, thirteen out of the fourteen I&M test values for the various heat numbers were lower than the CMTR values. This finding agrees with the statement in Attachment 4 which is the mill tests for rebar yield strength are generally higher than lab test values for rebars manufactured before 1979.

ii) A review of the CMTR test results and the I&M site acceptance test results for yield point on Page 5 shows the following information:

CMTR tests
Maximum Value = 57,468 psi
Minimum Value = 50,641 psi
Range = 6,827 psi

I&M site acceptance tests
Maximum Value = 52,692 psi
Minimum Value = 49,487 psi
Range = 3,205 psi

The above review indicates that the I&M site acceptance test values with a narrower range are grouped closer to the mean or average value of the test values. Therefore, the I&M test values consisting of 14 data points have less scatter than do the CMTR test values.

Summary of comparison of CMTR Test Values and I&M Site Acceptance Test Values for Rebar Yield Point.

CMTR values tend to be an overestimation of the yield point according to the ASCE paper in Attachment 4. The 14 I&M site test values for yield point tend to be grouped closer to the mean or average value of the test values. Therefore, per engineering judgement, the 14 I&M site acceptance test values are judged as being more representative test values to be used in the determination of an appropriate/conservative value for the yield point of rebar to be used in the structural calculation for the missile shields.

Therefore, the 14 I&M site acceptance test values for yield point will be used in this calculation and the CMTR test values for yield point will be discounted.

This is also consistent with later editions of ACI-318 code (e.g. ACI 318-99) that provides for evaluation of existing structures utilizing material test properties and values, i.e., as-built information.

8.3 The use of a 95/95 tolerance limit is reasonable since structures inherently transfer load internally, and it is not absolutely critical that any specific rebar have greater than a specified strength. The Unit 1 & 2 missile shields have 269-#8 and #11 rebars in each unit that resist bending stresses. With a 95/95 tolerance limit, 255 of these rebars will have a greater than specified strength and 14 rebars will have a lesser than specified strength. Collectively, the rebar will act together and a 95/95 tolerance limit provides reasonable assurance that collective rebar strength is above a determined value.

Page 3-20 of Reference 3 states that many federal agencies have adopted the 5% level of significance in risk analysis. This agrees with 95% confidence level that is being used in this calculation.

8.4 The limitation associated with this calculation is that the output cannot be utilized for design basis uses until approval is obtained from the NRC and then it can only be used for the missile shields.

9.0 Calculations

9.1 Perform Statistical Test to Demonstrate that the Results Obtained During the Two I&M Site Acceptance Tests for Yield Point Provide Data that Approximates a Normal Distribution, Taking into Consideration the Individual Heat Numbers.

An inherent assumption concerning the data obtained during I&M site acceptance tests for yield point (also referred to in this section as sample data) was whether or not the data approximated a normal distribution with reasonable confidence that the sample data is representative of the population. Verification of this assumption was essential in order to have assurance that the results obtained by methods 2 and 3 were reasonable. This section provides verification of this assumption.

Attachment 4, ASCE Journal of the Structural Division, "Variability of Mechanical Properties of Reinforcing Bars", suggests that yield test strength data is representative of a normal distribution (pages 4 and 5 attachment 4). Based on this recommendation, it was decided that Unit 1 & 2 sample data was evaluated for goodness-of-fit to a normal distribution.

There are several textbook methods (i.e., goodness-of-fit tests) for establishing whether or not a set of sample data approximates a given distribution. The most commonly used method is the Chi Squared test. However, there was not enough sample data to accurately perform and use the results of this test. Other goodness-of-fit tests such as, the Least Squares Fit using the associated Correlation Coefficient, Kolmogorov-Smirnov and Anderson-Darling were also ruled out for the same reasons. A literature search on goodness-of-fit tests was performed and the following tests were identified to be appropriate considering the sample size of the data and the simplicity of the goodness-of-fit techniques. The goodness-of-fit test selected to verify the assumption that the sample data approximates a normal distribution is the W- Test.

An observation concerning the I&M site acceptance test sample data. Although the sample data is small, the data has been determined to be representative of the heat and the manufacturing process used to fabricate the rebar. Additionally, the sample data is believed to be a random, unbiased sample of the rebar due to the requirements placed on the manufacturer in providing rebar for the I&M acceptance tests and the methods used to select samples of rebar and perform the I&M site acceptance tests.

W-Test

The W-test is a goodness-of-fit test described in reference 3 ("Applying Statistics", NUREG-1475). NUREG-1475 provides a step-by-step approach for performing this test. This step-by-step approach was applied using the data obtained during I&M site acceptance tests for yield point. The results obtained by using this technique substantiate that the data obtained from the I&M site acceptance tests for yield point for both Units 1 & 2 and for each of the Units, individually, approximate a normal distribution. The results are shown on pages 2 thru 4 of Attachment 10. The W-test is described in detail in NUREG-1475, therefore, a description of the test is not provided.

Beta Distribution

Attachment 4, ASCE Journal of the Structural Division, "Variability of Mechanical Properties of Reinforcing Bars", suggests that yield test strength data is also representative of a beta distribution (pages 4 and 5 attachment 4). Based on this recommendation, the Unit 1 & 2 sample data was evaluated for goodness-of-fit to a beta distribution. If the results of the goodness-of-fit tests are satisfactory, then the 95% lower confidence bound could be used to provide a complementary check on the results of methods 2 and 3.

However, it is difficult to ascertain appropriate alpha and beta parameters to analyze the sample data with respect to the Beta distribution. This is especially true of small sample sizes. Therefore, a statistical software product, Crystal Ball 2000, was used for these analyses. Although the primary purpose of Crystal Ball 2000 is to perform Monte Carlo simulations, it also provides for distribution fitting and a host of other common statistical functions and methods. Crystal Ball 2000 is a commercial software application and the software is classified under CNP software control process as "No Risk" (formerly "exempt"). The results obtained by using the software cannot be used for making a design basis or licensing basis decision, but the results can be used to provide a complementary check of the methods and results that are used for making these decisions.

The methods employed by the software are documented in the user manual, and a step-by-step process for performing statistical goodness-of-fit tests, along with explanations and acceptance criteria are also provided in the manual. This allows for independent verification of the results obtained by Crystal Ball 2000. Given the caveats and understanding of the discussion above, the process to determine a goodness-of-fit to a beta distribution using the sample data and the results obtained using Crystal Ball 2000 are described below.

Chapter 3 of the Crystal Ball 2000 software manual provides an easy to follow process for using the distribution fitting feature. A summary of that process, the sample data used, and the results are provided below.

The 14 data points obtained during I&M site acceptance tests for yield point strength for Units 1 and 2 and used in this analysis are listed below.

Unit 1 & 2 Yield Point Strength
49,487
49,935
50,192
50,384
50,448
50,759
50,833
50,897
51,025
51,265
52,115
52,115
52,179
52,692

The average of the sample data was computed to use as a surrogate assumption. This is not used in this process; however, a separate value is required by Crystal Ball 2000 for defining an assumption.

CELL was selected in Crystal Ball 2000 menu and *DEFINE ASSUMPTION* was selected from the pull down menu. The *Beta distribution* was then selected from the Distribution Gallery provided in Crystal Ball 2000. *FIT* was then selected from the Distribution Gallery to get the Fit Distribution menu.

Active Worksheet was selected in the Fit Distribution menu and the cell ranges from the worksheet containing the above sample data were entered into the Range.

Beta Distribution was chosen in the Fit Distribution 2 menu and *Chi-Square Test* was also selected. The check box for *Show Comparison Chart and Goodness-of-Fit Statistics* was checked.

The *OK* button was selected and the results of the Chi-Square goodness-of-fit test were displayed. The results indicated, ** *Insufficient Data for Chi-Square Test***.

This process was repeated for the Kolmogorov-Smirnov test and the Anderson Darling Test. The results for the Kolmogorov-Smirnov test indicated that the data was not a good fit. According to the Crystal Ball 2000 manual a value less than 0.03 indicates a close fit, the result using the sample data was 0.1614. The results for the Anderson-Darling test did indicate a close goodness-of-fit, again using the criteria provided in the Crystal Ball manual. The criteria provided states, "Generally a value less then 1.5 indicates a close fit. The value obtained for the Anderson-Darling test using the sample data was 0.3389.

Since the Anderson-Darling is more appropriate for goodness-of-fit tests at the extreme tails of the distribution and since this calculation is attempting to determine a minimum value, it was believed to be appropriate to consider the results of the Anderson-Darling test as reasonable evidence of the goodness-of-fit of the sample data to a beta distribution.

The ACCEPT button in Crystal Ball 2000 menu was then selected. Crystal Ball 2000 then presents a window of the frequency chart depicting the sample data in a beta distribution and several parameters of the distribution.

To correspond with the 95/95 confidence intervals used in methods 2 and 3, the PARM button in the window was selected and the parameters displayed were changed to match the 95% confidence interval. The three parameters input into the Choose Custom Parameters window were, 2.5, 50 and 95 for the 1st, 2nd and 3rd parameters, respectively. The 1st parameter, 2.5, represents the lower bound of the 95 percent confidence interval, the 3rd parameter. For the second parameter, a value of 50 was chosen since this represents the median value.

The results provided in Crystal Ball 2000 for the 95% confidence intervals and the median values are provided below.

Crystal Ball Results of Beta Distribution for the Sample Data	
95% lower	49156
Median (50%)	51027
95% upper	52574

The results obtained correspond very closely to the results obtained by methods 1, 2 and 3. Although the results do not provide for a definitive design basis conclusion, the results do provide a complementary validation of the results obtained by methods 2 and 3.

Based on the results obtained by the W-Test discussed above, the sample data representing the results of the I&M site acceptance tests for yield point were confirmed to approximate a normal distribution.

9.2 Perform the numerical review and/or the statistical manipulations of the 14 points of I&M Site Acceptance Data to Determine an appropriate/conservative rebar yield point value for the missile shields.

Method 1

Method 1 consists of a numerical review of the I&M acceptance data and selection of the lowest yield strength value from any of the individual data points. The individual data points for yield strength for I&M site acceptance tests are summarized below:

I&M site acceptance tests for yield point and tensile strength of the rebar. Two individual tests were performed at the Cook Plant site for each individual heat of steel.

Heat No.	Bar Size	Unit	Yield Point Test #1 (psi)	YieldPoint Test #2 (psi)	Tensile Strength Test #1 (psi)	Tensile Strength Test #2 (psi)
C34105	#11	1	50,897	52,115	84,679	84,743
B37160	#11	1	51,025	50,833	85,320	82,948
C35157	#8	1 & 2	51,265	50,759	81,645	82,278
B36171	#11	2	52,115	52,692	88,717	91,730
A37151	#11	2	50,448	50,192	80,961	81,282
B37340	#11	2	52,179	49,487	87,948	80,256
A36334	#11	2	50,384	49,935	82,307	83,589

By inspection, the lowest value from any yield point test is **49,487 psi.** Therefore, Method 1 suggests using a rebar strength value of **49,487 psi.**

Method 2

Method 2 considers I&M site acceptance data for both Unit 1 & 2. There will be a total of 14 data points for both units. As determined previously, this data approximates a normal distribution. The mean and standard deviation for each population will be calculated per Excel spreadsheets. The Excel spreadsheets and cell formulas will be attached to this calculation as Attachment 9.

The list of the definition of terms and of the formulas to be used in Methods 2 & 3 to calculate average value, standard deviation, and the lower rebar yield strength of the rebar population is shown in Section 6.2 on Page 10. For convenience, these terms and formulas are repeated below.
n = number of samples involved in the calculation
Average = X = the sample mean = (summation of all samples)/n
(Reference 3, Page 5-4)

$$\text{SDEV} = \sqrt{\frac{\sum (\text{Each Sample} - X)^2}{n-1}}$$

(Reference 3, Page 5-20)
K = A One-sided tolerance limit factor for a normal distribution given in Table T-11b of Reference 3). Values will be used for 0.95 confidence level for 0.95 of the population.

The lower interval of a population = X – (K*SDEV)

Table M2 (Units 1 & 2)

Heat No.	Bar Size	Yield Point Test #1 (psi)	Yield Point Test #2 (psi)
C34105	#11	50,897	52,115
B37160	#11	51,025	50,833
C35157	#8	51,265	50,759
B36171	#11	52,115	52,692
A37151	#11	50,448	50,192
B37340	#11	52,179	49,487
A36334	#11	50,384	49,935
		Average	**51,023**
	Standard Deviation		**947.04**

K = 2.614
Min Yield Stress = 51,023 –(2.614*947.04) = 48,547 psi

With 95% confidence, the interval of **48,547 psi** to infinity contains 95% of the population.

Therefore, Method 2 suggests using a rebar strength of **48,547 psi.**

Method 3

Method 3 will split the I&M site acceptance test data between Unit 1 & 2. Since two points of data are points common to both Units 1 & 2, Unit 1 will consider 6 data points and Unit 2 will consider 10 data points. Each of the Unit 1 & 2 data points will be analyzed as outlined in Method 2.

Unit 1 Data

Table M3-1

Heat	Bar Size	I&M Determined Yield Point, psi	I&M Determined Yield Point, psi
C34105	#11	50,897	52,115
B37160	#11	51,025	50,833
C35157	#8	51,265	50,759
		AVG	51,149
		SDEV	505.46

Average = X = 51,149 psi
SDEV = 505.46
K = 3.708
Min Yield Stress = 51,149 –(3.708*505.46) = 49,275 psi

With 95% confidence, the interval of **49,275 psi** to infinity contains 95% of the population.

Unit 2 Data

Table M3-2

Heat	Bar Size	I&M Determined Yield Point, psi	I&M Determined Yield Point, psi
C35157	#8	51,265	50,759
B36171	#11	52,115	52,692
A37151	#11	50,448	50,192
B37340	#11	52,179	49,487
A36334	#11	50,384	49,935
		AVG	50,946
		SDEV	1072.65

Average = X = 50,946 psi
SDEV = 1072.65
K = 2.911
Min Yield Stress = 50,946 –(2.911*1,072.65) = 47,824 psi

With 95% confidence, the interval of **47,824 psi** to infinity contains 95% of the population.

Therefore, Method 3 suggests using a rebar strength of **47,824 psi.**

10. Conclusions and Recommendations

Summarize the results obtained in Section 9.0, Calculations.

Method 1- low value rebar yield point number = **49,487 psi**

Method 2 – contained 14 data points for both Units 1 & 2
Sample Mean = Average = **51,023 psi**
Standard Deviation = SDEV = **947.07 psi**
Minimum Rebar Yield Point = **48,547 psi** (at 95/95)

Method 3 – considered Unit 1 & 2 separately. It considered 6 data points from Unit 1 and 10 data points from Unit 2.

Unit 1 Data
Sample Mean = Average = **51,149 psi**
Standard Deviation = SDEV = **505.46 psi**
Minimum Rebar Yield Point = **49,275 psi** (at 95/95)

Unit 2 Data
Sample Mean = Average = **50,946 psi**
Standard Deviation = SDEV = **1,072.65**
Minimum Rebar Yield Stress = **47,824 psi** (at 95/95)

Based on the three methods examined by this calculation, the lowest rebar strength value determined was **47,824 psi.** This calculation concludes that **47,800 psi** is an appropriate/conservative rebar yield strength value to use for the #8 and #11 bars in the structural calculation (SD-010307-001, See Reference 1) for the missile shields.

The outcome of this calculation aligns with the Purpose/Objective previously stated.

Initial Structural Engineering Design was performed in 1972 for the missile shields. The size of rebar, the number of rebar, and the rebar configuration was determined for the missile shields. The rebar yield strength was specified to be 40,000 psi.

The Structural Engineering Drawing was prepared showing all information that was determined in the Structural Engineering Design.

I&M retained the reinforcing steel detailing contractor, United Detailers, Inc. From the I&M supplied engineering drawing, the detailer prepared a reinforcing steel placement drawing. On this placement drawing, each individual rebar has an associated mark number. This allows each rebar to be identified as to its size and as to whether it is a straight bar or whether it exists in a detailed bent bar configuration. The placement drawing also shows where each individual rebar is located in the missile shields.

I&M provided the reinforcing steel placement drawing prepared by United Detailers, Inc. and the applicable rebar procurement specification to the reinforcing steel fabricator, The Ceco Corporation. The procurement specification, DCC-CE-107-QCS, required Ceco to perform mill tests per ASTM A615-68 for each heat of steel. Ceco was also required to provide I&M six (6) test specimens from each heat of steel. The Ceco Corporation fabricated all of the reinforcing steel for the missile shields.

After manufacturing the reinforcing steel, The Ceco Corporation performed certified mill test reports for each heat of steel. These certified mill test reports complied with the ASTM A-615-68 specification. The mill tests were satisfactory.

Prior to delivery of the rebar, Ceco Corporation provided the Cook Plant with 6 sections of rebar 3'-0" long from each heat of steel along with the CMTRs to allow Cook to perform independent tests for tensile strength, yield strength, and elongation. The Cook Plant performed these tests on two of the specimens for each heat of steel per ASTM A615-68. This was done prior to the rebar being bent.
The test results were satisfactory. The Ceco Corporation then fabricated the rebar to the sizes and configurations given on the detail drawings.

Ceco Corporation delivered the reinforcing steel to the Cook Plant. Each piece of reinforcing steel was delivered having two tags attached. One color tag specified which area of the plant in which the piece of rebar is to be used.
A metal second tag designates the mark number of the rebar piece as it is called out on either the straight or bent rebar list.

The carpenters built the formwork for each of the missile shields. The iron workers placed and secured the reinforcing steel within the formwork per the placement drawing prepared by United Detailers, Inc.

After the reinforcing steel placement had been completed,the rebar placement was verified by a QC inspector. Each rebar was verified to be in the right location by comparing its mark number to the location specified on the placement drawing. Once the final QC inspection for rebar placement was completed, the concrete was then placed. Concrete was placed in 1972. This ended the construction phase for the missile shields.

CHRONOLOGICAL EVENTS FOR THE UNIT 1 & 2 MISSILE SHIELDS

UNIT NO. 1 REACTOR MISSILE SHIELDS

HEAT NO. C34105

Test Data for Heat No. C34105
Steel Manufacturer's CMTR data:
Yield Point = 53,205 psi
Tensile Strength = 89,423 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 50,897 psi
Tensile Strength = 84,679 psi

Test No. 2
Yield Point = 52,115 psi
Tensile strength = 84,743 psi

Drawing Nos. DC-110152 and DC-123206

Reinforcing Steel Included in Heat No. C34105

Rebar Size	No. of Rebars	Rebar Mark	Rebar Function
#11	57	11B10	Double 180 degree hook bar, top and bottom, resisting bending stresses
#11	12	11B11	Double 180 degree hook bar, top, resisting bending stresses
#11	32	11B1	Double 180 degree hook bar, top and bottom, resisting bending stresses
#11	8	11B2	Double 180 degree hook bar, top, resisting bending stresses
#11	2	11B21	Double 180 degree hook bar, top, resisting bending stresses

UNIT NO. 1 REACTOR MISSILE SHIELDS

HEAT NO. B37160

Test Data for Heat No. B37160
Steel Manufacturer's CMTR data:
Yield Point = 54,487 psi
Tensile Strength = 83,333 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 51,025 psi
Tensile Strength = 85,320 psi

Test No. 2
Yield Point = 50,833 psi
Tensile strength = 82,948 psi

Drawing Nos. DC-110152 and DC-123207

Reinforcing Steel Included in Heat No. B37160

Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#11	64	Straight Bar, 28'-3" Long	Top and bottom bars, resisting bending stresses
#11	16	Straight Bar, 26'-6" Long	Top bars, resisting bending stresses
#11	4	Straight Bar, 7'-6" Long	Top bars, resisting bending stresses
#11	41	Straight Bar, 24'-0" Long	Top and bottom bars, resisting bending stresses
#11	8	Straight Bar, 22'-3" Long	Top bars, resisting bending stresses

* Rebar mark numbers are not assigned to straight bars.

UNIT NO. 1 REACTOR MISSILE SHIELDS

HEAT NO. C35157

Test Data for Heat No. C35157
Steel Manufacturer's CMTR data:
Yield Point = 57,468 psi
Tensile Strength = 85,316 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 51,265 psi
Tensile Strength = 81,645 psi

Test No. 2
Yield Point = 50,759 psi
Tensile strength = 82,278 psi

Drawing Nos. DC-110152 and DC-123207

Reinforcing Steel Included in Heat No. C35157			
Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#8	13	Straight Bar, 28'-3" Long	Side face bars resisting torsional shear and shrinkage & temperature stresses
#8	12	Straight Bar, 24'-0" Long	Side face bars resisting torsional shear and shrinkage & temperature stresses

* Rebar mark numbers are not assigned to straight bars.

UNIT NO. 2 REACTOR MISSILE SHIELDS

HEAT NO. B37340

Test Data for Heat No. B37340
Steel Manufacturer's CMTR data:
Yield Point = 51,602 psi
Tensile Strength = 83,012 psi

I&M Site Bar Test Report:

Test No. 1	Test No. 2
Yield Point = 52,179 psi	Yield Point = 49,487 psi
Tensile Strength = 87,948 psi	Tensile strength = 80,256 psi

Drawing Nos. DC-110153, DC-123203, and DC-123204

Reinforcing Steel Included in Heat No. B37340

Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#11	57	11B10	Double 180 degree hook bar, top and bottom, resisting bending stresses
#11	64	Straight Bar, 28'-3" Long	Top and bottom bars, resisting bending stresses

* Rebar mark numbers are not assigned to straight bars.

UNIT NO. 2 REACTOR MISSILE SHIELDS

HEAT NO. A37151

Test Data for Heat No. A37151
Steel Manufacturer's CMTR data:
Yield Point = 50,641 psi
Tensile Strength = 84,615 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 50,448 psi
Tensile Strength = 80,961 psi

Test No. 2
Yield Point = 50,192 psi
Tensile strength = 81,282 psi

Drawing Nos. DC-110153, DC-123203, and DC-123204

Reinforcing Steel Included in Heat No. A37151			
Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#11	12	11B11	Double 180 degree hook bar, top, resisting bending stresses
#11	16	Straight Bar, 26'-6" Long	Top bars, resisting bending stresses

* Rebar mark numbers are not assigned to straight bars.

UNIT NO. 2 REACTOR MISSILE SHIELDS

HEAT NO. A36334

Test Data for Heat No. A36334
Steel Manufacturer's CMTR data:
Yield Point = 55,769 psi
Tensile Strength = 85,576 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 50,384 psi
Tensile Strength = 82,307 psi

Test No. 2
Yield Point = 49,935 psi
Tensile strength = 83,589 psi

Drawing Nos. DC-110153, DC-123203, and DC-123204

Reinforcing Steel Included in Heat No. A36334

Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#11	32	11B1	Double 180 degree hook bar, top, resisting bending stresses
#11	41	Straight Bars, 24'-0" Long	Side face bars resisting torsional shear and shrinkage & temperature stresses

* Rebar mark numbers are not assigned to straight bars.

UNIT NO. 2 REACTOR MISSILE SHIELDS

HEAT NO. B36171

Test Data for Heat No. B36171
Steel Manufacturer's CMTR data:
Yield Point = 54,487 psi
Tensile Strength = 89,423 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 52,115 psi
Tensile Strength = 88,717 psi

Test No. 2
Yield Point = 52,692 psi
Tensile strength = 91,730 psi

Drawing Nos. DC-110153, DC-123203, and DC-123204

Reinforcing Steel Included in Heat No. B36171			
Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#11	8	11B2	Double 180 degree hook bar, top, resisting bending stresses
#11	2	11B21	Double 180 degree hook bar, top, resisting bending stresses
#11	4	Straight Bar, 7'-6" long	Top bars, resisting bending stresses
#11	8	Straight Bar, 22'-3" Long	Top bars, resisting bending stresses

- Rebar mark numbers are not assigned to straight bars.

UNIT NO. 2 REACTOR MISSILE SHIELDS

HEAT NO. C35157

Test Data for Heat No. C35157
Steel Manufacturer's CMTR data:
Yield Point = 57,468 psi
Tensile Strength = 85,316 psi

I&M Site Bar Test Report:

Test No. 1
Yield Point = 51,265 psi
Tensile Strength = 81,645 psi

Test No. 2
Yield Point = 50,759 psi
Tensile strength = 82,278 psi

Drawing Nos. DC-110153 and DC-123204

Reinforcing Steel Included in Heat No. C35157			
Rebar Size	No. of Rebars	Rebar Mark*	Rebar Function
#8	13	Straight Bar, 28'-3" Long	Side face bars resisting torsional shear and shrinkage & temperature stresses
#8	12	Straight Bar, 24'-0" Long	Side face bars resisting torsional shear and shrinkage & temperature stresses

* Rebar mark numbers are not assigned to straight bars.

Reinforcing Steel Placement Drawings

1.) Drawing No. DC-110152, "Unit 1 Containment Bldg. Missile Shield, Rebar placement drawing"
2.) Drawing No. DC-123205, "Unit 1 Containment Bldg. Missile Shield, Standard rebar bending details"
3.) Drawing No. DC-123206, "Unit 1 Containment Bldg. Missile Shield, Bent rebar list"
4.) Drawing No. DC-123207, "Unit 1 Containment Bldg. Missile Shield, Straight rebar list"
5.) Drawing No. DC-110153, "Unit 2 Containment Bldg. Missile Shield, Rebar placement drawing"
6.) Drawing No. DC-123202, "Unit 2 Containment Bldg. Missile Shield, Standard rebar bending details"
7.) Drawing No. DC-123203, "Unit 2 Containment Bldg. Missile Shield, Bent rebar list"
8.) Drawing No. DC-123204, "Unit 1 Containment Bldg. Missile Shield, Straight rebar list"

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
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D-01

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2. DIMENSIONS OMITTED ARE ZERO
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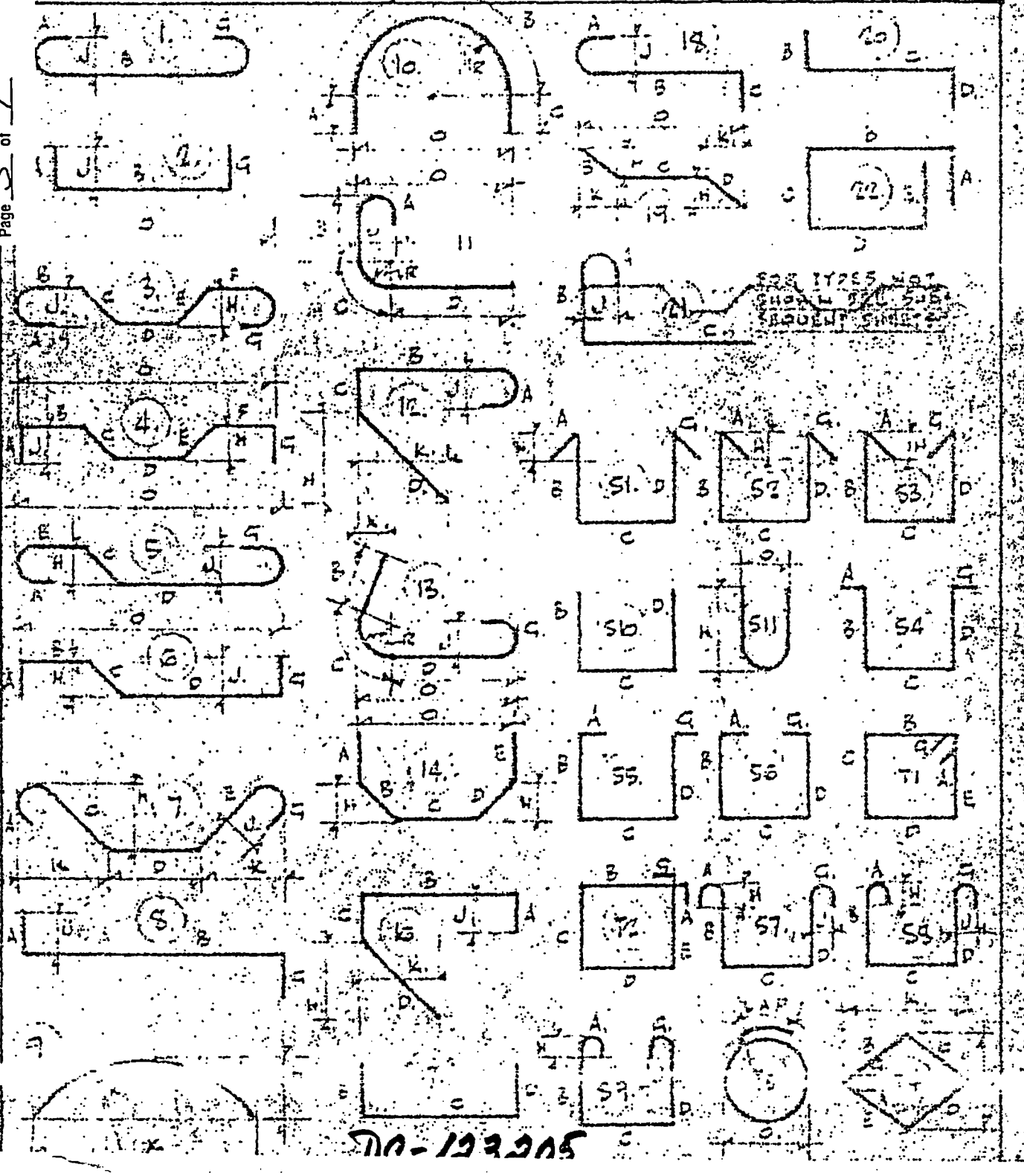

Calc No.: SD-040303-001, Rev. 0
Attachment 3
Page 3 of 9

American Electric Power Corp. Donald C. Cook Nuclear Plant.
Unit 1 APPROVED IN GENERAL Per VDR-04-0008
BY C.E. Shute/C.E. Shute DATE 3-10-04

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DC-193905

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UNIT NO. 1 CONTAINMENT BLDG. MISCELL SHIELD

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK PLANT, BRIDGMAN, MICH.

DWG. 12825.1093

REV. 9.5.72

1161	32	11	29.7	1	1.7	24.5					1.7			1.24
1162	8	11	25.11	1	1.7	22.9					1.7			1.24
553	30	5	6.1	510		10	4.5	10						
584	304	5	5.3	510		10	3.7	10						
585	30	5	9.5	56	10	4.9	1.7	2.6						
586	1344	5	4.9	1	1.7	3.7					1.7			1.42
587	112	5	6.4	510		2.9	10	2.9						
588	12	5	5.6	510		10	1.10	10						
589	6	5	3.4	510		10	1.8	10						
1812	57	11	31.12	1	1.7	28.8					1.7			1.24
1811	12	11	30.2	1	1.7	27.0					1.7			1.24
512	64	5	13.4	56	10	9.6	1.6	1.6						
513	80	5	13.5	56	10	9.6	1.7	1.6						
514	4	5	5.4	56	10	1.0	1.6	1.6						
515	8	5	6.0	510		10	4.4	10						
516	4	5	2.10	510		10	1.2	10						
517	256	5	6.0	510		2.9	1.0	2.9						
518	30	5	8.0	56	10	4.8	1.0	1.6						
519	30	5	6.0	510		10	4.42	10						
520	8	5	10.10	510		10	9.23	10						
1521	2	11	9.4	1	1.7	7.9								1.24
522	6	5	5.9	56	10	1.17	1.6	1.6						

Calc No.: SD-040303-001, Rev. 0

Attachment 3

Page 4 of 9

American Electric Power Corp. Donald C. Cook Nuclear Plant.
Unit 1 APPROVED IN GENERAL Per VDR-04-0008
BY C.E. Shute/C.E. Shute DATE 3-10-04

DC-123206

REFER TO BAR DETAILED DWG. H5,1093

STRAIGHT BARS

AVAILABLE COPY

ALL SIZES GRADE AGIS 60 REV. 9-5-72

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF RECLAMATION
LITTLE ROCK, ARKANSAS

UNIT NO. 1 CONTAINMENT BLDG. MISSILE SHIELD

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK PLANT, BRIDGMAN, MICH.

DATE	FORM	CKD.	DWG. NO.
8-30-72	MD	GR	H5-1093

SHEET NO. 3 OF 3

FOR LISTS SEE DRAWING H5-1093 SHEET NO. 1 FOR COOL BLUE

NOS	SIZE	LENGTH	NOS	SIZE	LENGTH	NOS	SIZE	LENGTH
64	11	28.3						
16	11	26.6						
41	11	24.0						
5	11	22.3						
4	11	7.6						
13	8	28.3						
12	8	24.0						
						11		18192
						15		1750
						TOTAL SHT. NO. 3		19942
						SUMMARY		
						TOTAL SHT. NO. 2		31852
						TOTAL SHT. NO. 3		19942
						TOTAL RS. 1093		51794

American Electric Power Corp. Donald C. Cook Nuclear Plant.
Unit 1 APPROVED IN GENERAL Per VDR-04-0008
BY C.E. Shute/C.E. Shute DATE 3/10-04

Calc No.: SD-040303-001, Rev. 0
Attachment 3
Page 5 of 9

DC-123207

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
DWG.2C93
" UNIT NO.2 CONTAINMENT BLDG MISSILE SHIELD."

WITHIN THIS PACKAGE.. OR BY SEARCHING USING DWG. NO. 2C93.

D-02

REFER TO BAR DETAILED DWG. No. 2C93

TYPICAL BAR BENDING TYPES

NOTES:

1. ALL DIMENSIONS ARE OUT TO OUT.
2. DIMENSIONS OMITTED ARE ZERO
3. FIGURES IN CIRCLES SHOW TYPES
4. COLOR CODE: BLUE.
5. ALL STEEL GRADE A615-60

REV. 9.5.72

FOR DETAIL DIMENSIONS SEE DWG. RS-2C93 SH. 1 THRU 3 INCL.

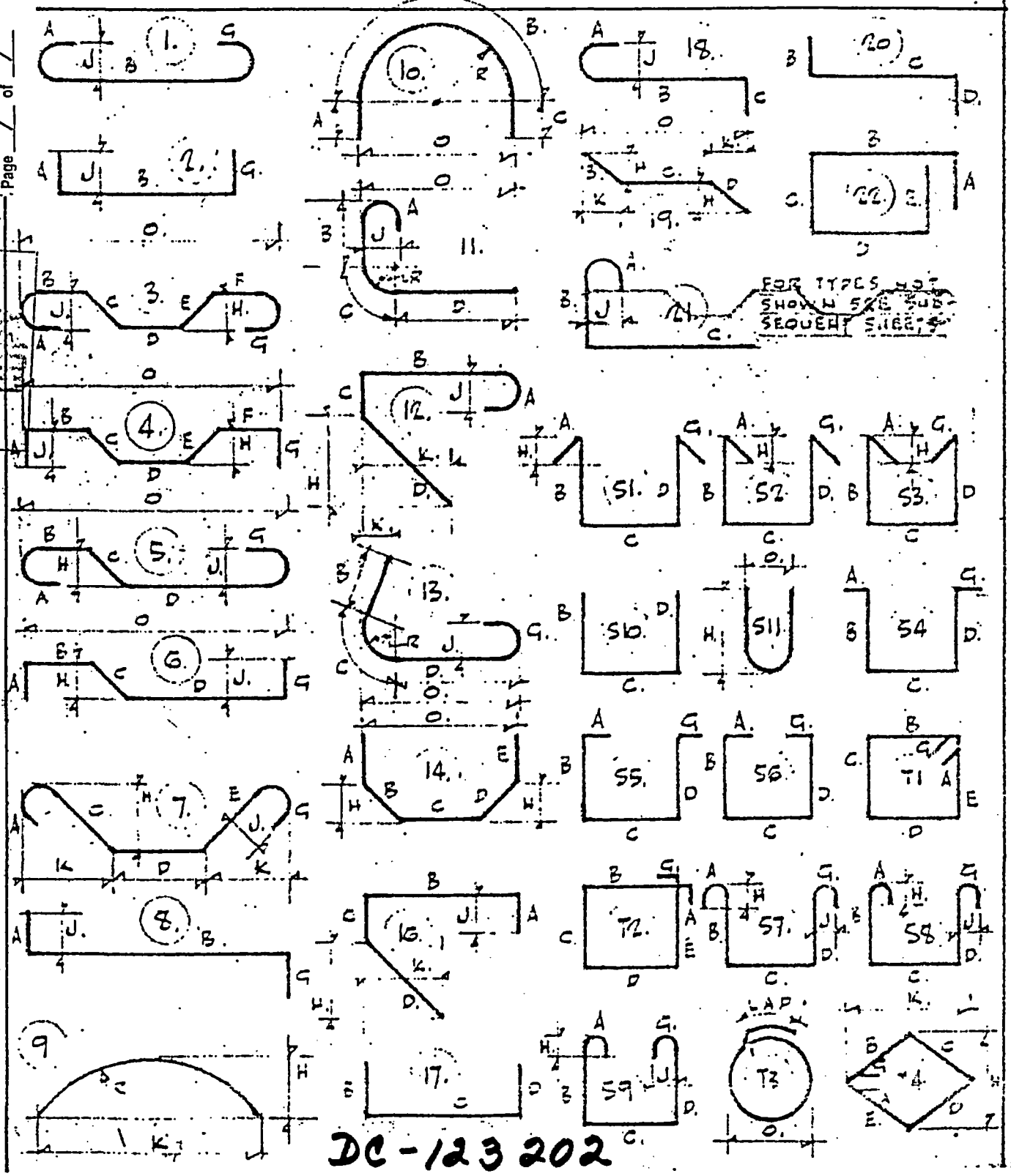
UNITED DETAILERS INC.
266 NORTH BROAD STREET
ELIZABETH N.J. 07208

UNIT NO. 2 CONTAINMENT BLDG. MISSILE SHIELD

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C COOK PLANT, BRIDGMAN, MICH.

DATE	DRN	CKD	DWG. NO. RS-2C93
5.30.72	MD	GR	

ORDER TO: CECO CORP. 9-7-72 SHEET NO. 1 OF 3



DC-123202

Calc No.: SD-040303-001, Rev. 0
Attachment 3
Page 7 of 9

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American Electric Power Corp. Donald C. Cook Nuclear Plant.
Unit 2 APPROVED IN GENERAL Per VDR-04-0008
BY C.E. Shute/C.E. Smith DATE 3-10-04

REFER TO BAR DETAILED DWG. NO. 7C93 FOR BENDING TYPES SEE DRAWING NO. RS-1C93 SHEET NO. 1

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ALL STEEL GRADE AGIS-60 REV. 9-5-72

UNITED DETAILERS INC. 150 NORTH BROAD STREET ELIZABETH, N.J. 07208

UNIT NO. 2 CONTAINMENT BLDG. MISSILE SHIELD

INDIANA & MICHIGAN ELECTRIC COMPANY DONALD C. COOK PLANT - BRIDGMAN, MICH.

DATE	DRN	CKD	DWG. NO. RS-7C93
8-30-78	MD	GR	

SHEET NO. 2 OF 3

FOR NOTES SEE DRAWING NO. RS-7C93 SHEET NO. 1 COLOR CODE: BLUE

MARK	NO	SIZE	LGTH.	TYPE	A	B	C	D	E	F	G	H	K	J
11B1	32	11	27-7	1	1-7	24-5					1-7			1-24
11B2	8	11	25-11	1	1-7	22-9					1-7			1-24
5B3	30	5	6-1	S10		10	4-5	10						
5B4	304	5	5-3	S10		10	3-7	10						
5B5	36	5	9-8	S6	10	4-9	1-7	2-6						
5B6	1392	5	4-9	1	7	3-7					7			4½
5B7	112	5	6-4	S10		2-9	10	2-9						
5B8	12	5	3-6	S10		10	1-10	10						
5B9	6	5	3-4	S10		10	1-8	10						
11B10	57	11	31-10	1	1-7	28-8					1-7			1-24
11B11	12	11	30-2	1	1-7	27-0					1-7			1-24
5B12	64	5	13-4	S6	10	9-6½	1-6	1-6						
5B13	80	5	13-5	S6	10	9-6½	1-7	1-6						
5B14	8	5	5-4	S6	10	1-0	1-6	1-6						
5B15	8	5	6-0	S10		10	4-4	10						
5B16	8	5	2-10	S10		10	1-2	10						
5B17	256	5	6-0	S10		2-9	1-0	2-9						
5B18	36	5	8-6	S6	10	4-8½	1-6	1-6						
5B19	36	5	6-0	S10		10	4-4½	10						
5B20	8	5	10-10	S10		10	9-2½	10						
11B21	2	11	9-4	1	1-7	9-9								1-24
5B22	6	5	5-9	S6	10	1-11½	1-6	1-6						
												11	17	453
												5	14	399
											TOTAL SHT. NO. 2			

American Electric Power Corp. Donald C. Cook Nuclear Plant. Unit 2 APPROVED IN GENERAL Per VDR-04-0008 BY G.E. Shute/L.E. Shute DATE 3-10-04

Calc No.: SD-040303-001, Rev. 0

Attachment 3

Page 8 of 9

DC-123203

REFER TO BAR DETAILED DWG. NO. 2C93

STRAIGHT BARS

ALL STEEL GRADE AGIS 60 REV. 9-5-72

UNITED DETAILERS INC.
256 NORTH BROAD STREET
ELIZABETH N. J. 07208

UNIT NO. 2 CONTAINMENT BLDG. MISSILE SHIELD

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK PLANT, BRIDGMAN MICH.

DATE	DRN	CKD	DWG. NO. RS.2C93
8-30-72	MD.	GR	

ORDER TO:

SHEET NO. 3 OF 3

FOR NOTES SEE DRAWING NO. RS-2C93 SHEET NO 1

COLOR CODE: BLUE

NO.	SIZE	LENGTH	NO.	SIZE	LENGTH	NO	SIZE	LENGTH
64	11	28.3						
16	11	26.6						
41	11	24.0						
8	11	22.3						
4	11	7.6						
13	8	28.3						
12	8	24.0						
							#11 =	18192
							#8 =	1750
						TOTAL SHT. NO. 3 =		19942
						SUMMARY		
						TOTAL SHT. NO. 2 =		31852
						TOTAL SHT. NO. 3 =		19942
						TOTAL RS. 1C93 =		51794

Calc No.: SD-040303-001, Rev. 0

Attachment 3

Page 9 of 9

BEST AVAILABLE COPY

American Electric Power Corp. Donald C. Cook Nuclear Plant.
Unit 2 APPROVED IN GENERAL Per VDR-04-0008
BY G.E. Shute DATE 3-10-04

DC-123204

SUBSTITUTE ATTACHMENT 4
CALCULATION SD-040303-001, REVISION 0
(Replaces a 17 page copyrighted article)

Civil Engineering Database

Variability of Mechanical Properties of Reinforcing Bars

by **Sher Ali Mirza**, (Professional Research Assoc., Dept. of Civ. Engrg., Univ. of Alberta, Edmonton, Canada) and **James G. MacGregor**, Fellow, ASCE, (Prof., Dept. of Civ. Engrg., Univ. of Texas at Austin, Austin, Austin, Tex.; on leave as Prof. of Civ. Engrg., University of Alberta, Edmonton, Canada)

Journal of the Structural Division, Vol. 105, No. 5, May 1979, pp. 921-937

Document type: Journal Paper

Errata: ST May 1980, pg. 1232

Abstract: The results of approximately 4000 published and unpublished tensile tests on deformed reinforcing bars are studied to obtain statistical relationships for various mechanical properties. The sample included No.3 through No.18, Grades 40 and 60, bars. The means and coefficients of variation of the mill test yield strengths were found to be 48.8 ksi (337 MN/m²) and 10.7% for Grade 40 and 71 ksi (MN/m²) and 9.3% for Grade 60 bars. Beta distributions were used to represent both of these sets of data. The static yield strength was found to be 3.5 ksi (24 MN/m²)) lower on the average than the mill test yield strength in both cases, with a coefficient of variation of 13.4%. The trend to lower yield strengths with increased bar sizes observed early in the 1970's was not present in more recent test data, apparently due to more stringent production control in recent years.

CONFIGURATION DOCUMENT IMPACT ASSESSMENT

CDI Number: CDI - - N/A

INITIATION

Description of Change Activity:
(Describe the reason for the changes. Identify a primary change driver, and include a brief description of the activity.)

The primary change driver is calculation SD-040303-001 (Reactor Missile Blocks Reinforcing Steel Yield Strength), Rev. 0 This calculation determines an appropriate yield strength from rebar CMTR and rebar site acceptance test data, for use in the structural calculation for the control rod drive missile shields (SD-010377-001).

Condition Report 03085024 documents that the NRC (letter dated March 23, 2003) did not accept use of actual rebar yield strength in the structural calculation (SD-010307-001) for the Control Rod Drive Missile Shield. I&M subsequently submitted a LAR (letter dated November 12, 2003, AEP:NRC:3520-01) to request the use of yield strength from measured material properties, based on CMTR (mill test) data. I&M subsequently withdrew this LAR, via letter dated March 2, 2003,AEP:NRC:, citing the existence of additional supporting data (I&M rebar site acceptance test data). Calculation SD-040303-001 uses both CMTR and site acceptance test data to determine an appropriate yield strength value for use in the missile shields and will support a new license amendment request based on consideration of both sets of rebar test data.

CDI Number: CDI – YYYY-NNNNN Rev NN./

☒ N/A – CDI is to be issued closed and attached to a controlled or record document.

	Print Name	Signature	Date
Preparer:	Paul G. Schoepf	Paul G. Schoepf	3/12/04
Reviewer: Qualification ☒50.59 ☐ CDI PSG	Paul W. Leonard	Paul W. Leonard	3/13/04

CLOSEOUT

All requirements of the implementation plan have been met, and all impacted documents have either been updated or reference to an appropriate tracking mechanism has been noted. This CDI may be closed out.

	Print Name	Signature	Date
Closeout Reviewer:	Paul W. Leonard	Paul W. Leonard	3/13/04

PART 1 – Functional Area (FA) Impacts

Check 1 and/or 2 as applicable:

1. ☐ Impacts and interfaces are sufficiently addressed and documented in the associated change driver procedure and are not documented here – see Part 2 for Document Impacts.

2. ☒ The following Functional Areas were assessed, and the results are documented below.

Design Engineering	Plant Engineering		
☐ Config Mgmt	☐ Production	☐ Fuel, Safety and Analysis and Reactor Eng	☐ Maintenance
☐ Mod Admin	☐ Programs	☐ Regulatory Affairs	☐ Testing
☐ I&C	☐ System	☐ Information Technology	☐ Rad/Chem/Env
☐ Electrical	Site Protection	☐ Training	☐ Material Management
☐ Mechanical	☐ Fire Protection	☐ Operations	☐ Other (See Below)
☒ Structural	☐ Security	☐ Performance Assurance	
	☐ E-Plan		

FA	Assessed By	Impacts	Comments
Structural	☒ Preparer ☐ FA _____ (Name)	☒ Yes ☐ No	Calculation SD-010307-001 for the structural qualification of the CRDM missile blocks will require revision, following NRC issuance of a Safety Evaluation Report, to incorporate the use of measured rebar material properties into the calculation. Specification ES-CIVIL-0432 (containment design criteria) also requires revision. See below for further discussion and tracking vehicles. There are no other specific impacts for the structural area.

This form is derived from information found in PMP-5043-CDI-001. It or a similar form may be used provided the content is consistent with the requirements of that procedure.

PART 2 – Document Impacts

Review configuration documents to determine impacts from the activity being performed. NOTE: All impacts must be found acceptable and either updated concurrently with the impacting activity execution or a tracking mechanism initiated to ensure later update.

List Specific Documents/Programs Reviewed/Impacted Refer to Figure 2 of PMP-5043-CCD-001 for list of configuration documents. Identify specific sections impacted.		Indicate: FA Owner to Notify OR via Document Distribution	Impacted Document Update		
			Concurrent Update?	Date Complete or Tracking Number	Check if Pending rev
1a. Drawings	☒ N/A				
None reviewed.			☐		☐
			☐		☐
1b. Vendor Manuals	☒ N/A				
None reviewed.			☐		☐
			☐		☐
2. Databases	☒ N/A				
None reviewed.			☐		☐
			☐		☐
3. Software	☒ N/A				
None reviewed.			☐		☐
			☐		☐
4a. Procedures	☒ N/A				
None reviewed.			☐		☐
			☐		☐
4b. Programs (See Department Websites to help identify program owners)	☒ N/A				
None reviewed.			☐		☐
			☐		☐
4c. Calculations	☐ N/A				
SD-010307-001		Via Document Distribution	☐	03085024-2	☐
			☐		☐
4d. Design Standards	☒ N/A				
None reviewed.			☐		☐
			☐		☐
4e. Emergency Plan Info	☒ N/A				
None reviewed.			☐		☐
			☐		☐
4f. Specifications	☐ N/A				
ES-CIVIL-0432-QCN		Via Document Distribution	☐	03085024-2	☐

This form is derived from information found in PMP-5043-CDI-001. It or a similar form may be used provided the content is consistent with the requirements of that procedure.

CONFIGURATION DOCUMENT IMPACT ASSESSMENT

List Specific Documents/Programs Reviewed/Impacted Refer to Figure 2 of PMP-5043-CCD-001 for list of configuration documents. Identify specific sections impacted.	Indicate: FA Owner to Notify OR via Document Distribution	Impacted Document Update		
		Concurrent Update?	Date Complete or Tracking Number	Check if Pending rev
		☐		☐
Other ☒ N/A				
None reviewed.		☐		☐
		☐		☐
		☐		☐
4g. Licensing Documents (list sections/paragraphs reviewed, and impact – **if not reviewed or no impact, indicate such, and explain in Part 3.)** NOTE: Impacts must be resolved before the change document is issued for use.				
Operating License No impacts (see discussion below).		☐		
Technical Specifications No impacts (see discussion below).		☐		
UFSAR UFSAR Table 5.2-8, Section 5.2.2.5	Via Document Distribution	☐	03085024-2	
SERs No impacts (see discussion below).		☐		
Commitments #8280 – Submit a revised License Amendment Request to resolve the missile shield reinforcing bar yield strength issue. This calculation supports this commitment. There is no impact.		☐		
Environmental Protection Plan Not reviewed (see discussion below).		☐		
Security Plan – Safeguards Not reviewed (see discussion below).		☐		

Part 3 – For 4g: Identify all electronic files searched, the search parameters used, and discuss the results.

This form is derived from information found in PMP-5043-CDI-001. It or a similar form may be used provided the content is consistent with the requirements of that procedure.

Operating License and Technical Specifications were reviewed (Unit 1 Rev. 64, Amendment 280 and Unit 2 Rev. 68, Amendment 264 in Documentum) using key words "rebar", "reinforcing", "reinforcement", "yield strength", "ACI" and "concrete". There were no hits on "rebar", "reinforcing", "reinforcement" or "yield strength". Hits on "ACI" had nothing to do with concrete and rebar, and hits on "concrete" had no implications for rebar yield strength.

UFSAR was searched using keywords words "rebar", "reinforcing", "reinforcement", "yield strength", "ACI" and "concrete"

UFSAR Table 5.2-8 (Containment Internal Structures Element Design Pressures) shows a design pressure capability for the missile shield of 53.9 psi based on the 2001 reanalysis (which used measured material properties of 50.6 ksi for rebar strength). This value will change depending on the final rebar strength determined from calculation SD-0403030-001 and its impact on structural calculation SD-010307-001.

UFSAR Section 5.2.2.5 discusses Structural Materials for the containment, and notes that reinforcement steel has a minimum strength of 40,000 psi. This section also notes that stresses in rebar was generally kept to grade 40 values. This statement is literally not impacted, however, it should be clarified (once NRC approval is obtained) to note that stresses above 40,000 psi are only allowed for the missile shields, based on the SER received. Section 5.2.2.3 discusses use of capacity reduction or "phi" (ϕ)factors, which reduce capacity to account for small adverse variations in material strengths (e.g., $\phi = 0.90$ for flexure). The use of phi factors in structural calculations is not impacted.

Searched SERs for "rebar" and "reinforcement". SER N69031 (1/14/69) includes the text, ""no steel reinforcement will experience average strains beyond the yield point at the factored load." This statement suggests that the response of the containment structure, even under the load combination involving the Design Basis Earthquake, will remain elastic and below the yield level." The calculation SD-040303-001 will define a yield strength based on test data and the related LAR will request NRC approval for the use of measured material properties in structural calculations for the missile shield. There is no intent to have rebar experience strain beyond yield point. Approval to use measured (vice specified) yield point will be solicited and obtained from the NRC. Therefore, this statement is not impacted.

SER N85078 (2/25/85) regarding Containment Ultimate Capacity includes the text, "The D. C. Cook containment ultimate capacity was initially evaluated by staff's consultant, Gunnar Harsted. The evaluation was based on the code specified design strengths for concrete, reinforcing steel, liner steel and structural steel, and on simple hand calculation. On the basis of this evaluation it was identified that the containment capacity is limited by the strength of the equipment hatch closure plate and equipment hatch door, and the limiting internal pressure is 23.5 psig. An independent evaluation was made by Structural Mechanics Associates (SMA), the D. C. Cook licensee's consultant, and is contained in the two referenced reports. The SMA analyses were based on the "as built" strengths as well as the code specified values and more detailed computer analyses were employed. The "as built" strengths consisted of the lowest sample value and the mean sample value of the materials. Containment internal pressures corresponding to the code specified and "as built" values were calculated for different limiting sections of the containment. In order to measure the anticipated degree of dispersion in the calculated results, a probabilistic description of the ultimate internal pressure capacity of the containment was developed. The evaluation identified four limiting modes of failure. They are shear failure in base mat, membrane hoop tension failure of containment cylinder, bending failure of equipment hatch, and bending failure of personnel hatch." This SER acknowledged the use of "as-built" strength for determination of containment ultimate capacity, and based on its results, the missile blocks were not limiting components. Since NRC approval is being sought to use "as-built" rebar strength, and the noted SER already acknowledges the use of as-built material properties, this SER is not impacted.

This form is derived from information found in PMP-5043-CDI-001. It or a similar form may be used provided the content is consistent with the requirements of that procedure.

CMS was searched using key words "rebar", "reinforcing", "reinforcement" and "yield strength". Five commitments of some relevance were identified.

8161 – This commitment described that I&M will revise the ice condenser endwall calculation (SD-010307-003) with respect to required rebar yield strength. This commitment was closed (calculation revised and no longer relies on as-built rebar yield strength). This commitment is closed.

4530 – This commitment discusses containment analysis related to hydrogen burn, and discussed consideration of rebar yielding. There is no specific discussion of rebar yield strength. This commitment is closed/outdated.

4386 and 4566 – These early commitments were for I&M to supply mill test reports of materials and design details used for the containment liner and reinforcing bars to Dr. Harstead (Containment Ultimate Capacity analysis). These commitments are closed/outdated.

8202 – This commitment (4/23/03) was for I&M to submit a LAR for use of missile shield reinforcing bar strength based on material test data. This commitment was closed based on AEP submitting a LAR on 11/12/03. This commitment needs to be reopened based on I&M's withdrawal of the LAR, or a new commitment generated.

8280 – This commitment is for I&M to submit a revised LAR to resolve the missile shield reinforcing bar yield strength issue. This calculation supports this commitment.

Final consideration of impacts based on what NRA does regarding commitment 8202. Others are not impacted.

The Environmental Protection Plan and Security Plan were not reviewed. These plans would not contain any discussion of rebar strength values used in structural calculations.

Constraints and Implementation Plan: (describe sequence of events for document changes and any restrictions or milestones that apply)

Calculation SD-0403030-001 is being developed to determine an appropriate rebar yield strength value based on measured material properties, for use in the structural calculation for the missile shields (SD-010307-001). The value determined in calculation SD-040303-001 will be the basis for a License Amendment Request (LAR) to request NRC approval to use this value. This LAR is scheduled to be submitted to the NRC by 4/20/04.

Following receipt of an SER from the NRC, the structural calculation SD-010307-001 will be revised to incorporate the yield strength value. The UFSAR will also be changed to note that measured rebar strength properties are used for the missile shield only, and the resulting capacity of the missile shield will be added to UFSAR Table 5.2-8. Finally, specification ES-CIVIL-0432-QCN will also be changed to note that measured rebar strength properties are used for the missile shield only.

In the event the NRC elects NOT to issue an SER allowing the use of measured material properties, an alternate resolution path will be developed. This may include alternate submittal to allow use of a reduced load factor on pressure, or to re-pour new missile blocks.

This form is derived from information found in PMP-5043-CDI-001. It or a similar form may be used provided the content is consistent with the requirements of that procedure.

AEP DESIGN INFORMATION TRANSMITTAL (DIT)

DIT Form, Part 1

☒ SAFETY-RELATED ☐ NON-SAFETY-RELATED	Originating Organization ☒ AEP ☐ Other (specify)	DIT No DIT-B-02851-00
D.C. Cook Unit (Circle applicable): BOTH		Page 1 of 31
System Designation CNTMT		To Paul G. Schoepf

Subject: Summary of Tensile Testing Results for Rebars Used in Control Rod Drive Missile Shields for Units 1 and 2

Satyananda Chakrabarti	Staff Engineer		2/22/04
Preparer	Position	Preparer's Signature	Date
Paul W. Leonard	Principal Nuclear Specialist		2/23/04
Reviewer	Position	Reviewer's Signature	Date
Paul G. Schoepf	Manager, Struct./Mech. Design	Paul G. Schoepf	2/23/04
Approver	Position	Approver's Signature	Date

Status of Information: ☒ Approved for Use ☐ Unverified

Method and Schedule of Verification for Unverified DITs N/A.

CR#

Holds Associated with Unverified DITs: N/A.

Description of Information: The information contained in this DIT collates the relevant rebar test data and backup documents. For details, see Part 2 of this document.

Purpose of Issuance (Including any Precautions or Limitations): To support license amendment request to the Nuclear Regulatory Commission on the use of CMTR data in the analyses of the Control Rod Drive Missile Shields in the Containment.

Source of Information: The material bar strengths are taken from Concrete-Reinforcement Bar Test Reports prepared at the time of initial construction. The copies of test data are attached.

Engineering Judgement Used? ☒ Yes ☐ No

Controlled Reference / Document No.:

1. Calc SD-010307-001, Rev. 1, CS-01 (Approved)
2. NTS-2002-021-REP, Rev.0 (Approved)
3. DIT-B-01954-00 (Approved)
4. UFSAR, Ch. 5, Rev. 18.1 (Approved)

Uncontrolled Reference / Document No.:

Distribution: Copy to Requestor P.G. Schoepf
Copy to DIT Administrator File
Original to NDM (Transmitted by DIT Administrator)

Calc No.: SD-040303-001, Rev. 0

Attachment 6

Page 1 of 31

This form is derived from the information in 12-EHP-5040-DES-001, Rev. 3, Control of Design Input, Data Sheet 3, AEP Design Information Transmittals (DIT) – DIT Form

Description of Information(Continued):

The Collation of material test data is presented in Table 1 below and contains the following information:

1. Unit No.
2. Heat No.
3. Bar Size
4. Yield Point from Manufacturer Test, psi
5. Tensile Strength from Manufacturer Test, psi
6. Yield Point from I&M Site Bar Test Report, psi
7. Tensile Strength from I&M Site Bar Test Report, psi
8. Reference

Calc No.: SD-040303-001, Rev. 0

Attachment 6

Page 2 of 31

Ref. 1

The analysis for the Control Rod Drive Missile Shields is contained in Calculation no. SD-010307-001, CS-01 (Reference 1). Copies of backup documentation for Items 1 through 5 are included in Report No. NTS-2002-021-REP (References 2 and 3). Copies of backup documentation for Items 6 and 7 are attached herewith with references to the attachment numbers. Note that the data contained under Items 4 and 5 are generally designated as Certified Mill Test Report (CMTR) data.

Also note that the Method of Inspection of Testing of rebars used at the time of construction was as follows (reference 4):

"Certified reports of chemical and physical test performed on the reinforcing steel were submitted to the Engineer by the supplier. These tests conform to the requirements of "Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement" ASTM Designation A615-68.

In order to assure that reinforcing steel met appropriate specifications, samples of rebar delivered to the job site were selected and tested to confirm compliance with the specified physical requirements and for certification of mill test reports.

The selection of the specimens was as follows:

Two specimens were taken for each heat of material. No samples selected included the end 12 inches of any bar delivered.

Prior to fabrication and/or delivery of the reinforcing to the job site, specimens were tested for ultimate strength, yield strength and elongation by Indiana & Michigan Electric Company. If any of these specimens failed to meet the requirements of the applicable specification for ultimate strength, yield strength or elongation, the heat of steel was resampled, this time selecting four specimens instead of two as were required originally. If any of these specimens failed to meet the requirements of the applicable specification for ultimate strength, yield strength or elongation, the entire heat was rejected.

All reinforcing was kept separated by size and heat and tagged with the manufacturer's identification number. This identification was maintained at least until the heat of steel met the aforementioned requirements.

To insure that only the specified reinforcing steel was received, the mill test reports for each shipment were checked against the mill test reports sent to the job site with the test specimens."

At the time of construction, only the tensile capacities obtained from testing were tabulated. In preparing Table 1, the bar test data is presented in terms of stress for a direct comparison of CMTR data with the tensile stress data. These stresses are calculated by dividing the tabulated capacities by their corresponding standard bar areas.

Also, note that in Attachment 2 and in DIT-B-01954-00 duplication of numbers for heat number A36448 exists. The CMTR yield and tensile stresses available from Attachment 2 data are slightly higher than that of the material test data provided with DIT-B-01954-00. In reviewing the two sets of data noting that specific corrections were made to the material sheets attached to DIT-B-01954-00, and that the material sheets clearly designate the steel to be part of the missile shield, the lower of the two values are selected by engineering judgment and tabulated below.

Table 1

Summary of Tensile Testing for Rebar Used in Control Rod Drive Missile Shields

Unit 1 Test Data						
Heat No.	Bar Size	Yield Point from Manufacturer Test, psi	Tensile Strength from Manufacturer Test, psi	Yield Point from I&M Site Bar Test Report, psi	Tensile Strength from I&M Site Bar Test Report, psi	Attach. No.
C34105	#11	53,205	89,423	50,897 52,115	84,679 84,743	1
B37160	#11	54,487	83,333	51,025 50,833	85,320 82,948	1
C35157	#8	57,468	85,316	51,265 50,759	81,645 82,278	2
A36448	#5	54,193	79,677	53,225 55,483	75,483 78,709	2
Lowest Yield Strength Value for Unit 1, psi		53,205		50,759		
Unit 2 Test Data						
Heat No.	Bar Size	Yield Point from Manufacturer Test, psi	Tensile Strength from Manufacturer Test, psi	Yield Point from I&M Site Bar Test Report, psi	Tensile Strength from I&M Site Bar Test Report, psi	Attach. No.
B36171	#11	54,487	89,423	52,115 52,692	88,717 91,730	1
A37151	#11	50,641	84,615	50,448 50,192	80,961 81,282	3
B37340	#11	51,602	83,012	52,179 49,487	87,948 80,256	1
A36334	#11	55,769	85,576	50,384 49,935	82,307 83,589	4
C35157	#8	57,468	85,316	51,265 50,759	81,645 82,278	2
C34982	#5	57,741	79,354	52,580 55,806	76,129 78,064	2
Lowest Yield Strength Value for Unit 2, psi		50,641		49,487		

FORM QC-12
REV. 2/70

file

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No. _____

P.O. or Contract No. _____ ASTM Designation A-615-GRADE 40 Date 8/3/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B36171	1	#11	81.3	138.4	9.3	PASS	
"	2	#11	82.2	143.1	9.2	PASS	
C34117	3	#11	78.9	141.3	9.6	PASS	
"	4	#11	77.4	129.2	9.7	PASS	
B37160	5	#11	79.6	133.1	9.4	PASS	
"	6	#11	79.3	129.4	9.5	PASS	
C31760	7	#11	83.4	139.4	9.3	PASS	
"	8	#11	84.5	140.3	9.4	PASS	
C34105	9	#11	79.4	132.1	9.2	PASS	
"	10	#11	81.3	132.2	9.5	PASS	

AEP QA AUDIT
SCOPE Heat tested and approved by I&M per ASTM A615-40
SIG. Rick Shell
DATE 8-28-72

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE = 1/2 IN./MIN.

Calc No.: SD-040303-001, Rev. 0

Attachment 6

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Date Samples Were Received 8/2/72

Tested By Bill Fruisette

Approved By Willis McKinney Date 8-3-72

Copies To:

FORM CC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No.

P.O. or Contract No. ASTM Designation A-615 - GRADE 40 Date 8/3/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B37340	11	#11	81.4	132.2	9.6	PASS	
"	12	#11	77.2	125.2	9.7	PASS	
A37636	13	#11	80.3	127.3	9.5	PASS	
"	14	#11	79.2	127.4	9.4	PASS	

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE → 1/2 KSI/MIN

Calc No.: SD-040303-001, Rev. 0

Attachment 6

Page 5 of 31

Date Samples Were Received 8/2/72

Tested By Bill Fuisette

Approved By William McKinney Date 8-3-72

Copies To:

Form L14

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-418

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC-FURNACE STEEL #11 REBAR MAY 31 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168480

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. in 8" %	Red. of Area %	Bend Test
T		A37636	#11	37	73	022	045					50320	85897	18		OK
	✓	A37672		34	73	020	044					51923	82051	20		OK
	✓	A36838		37	70	021	047					50320	82692	22		OK

Rec'd. 8/2/72

Bill Fischetti

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Form L14

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 71-158

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR AUG 27 19 71

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168252 & 168303

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A35728	#11	36	78	023	052					49358	84294	16		OK
		C34132		36	76	017	040					50320	81730	17		OK
T	✓	C34105		36	75	023	048					53205	89423	16		OK
	✓	A35433		39	66	030	058					52564	82371	17		OK
T	✓	C34117		38	74	015	030					49038	83012	17		OK
	✓	A35737		38	65	019	042					54166	84615	17		OK

Calc No.: SD-040303-001, Rev. 0

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Attachment 1

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

Gerald J. Adams

We hereby certify that the above figures are correct as contained in the records of the company

Form L14

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-49

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 14 19 72

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168522

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. in 8" %	Red. of Area %	Bend Test
		A33509	#11	38	87	018	038					55128	80769	18		OK
T		B37340		37	79	025	049					51602	83012	20		OK
T		B37160		38	73	025	058					54487	83333	17		OK

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Form L14

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-50

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR. 14 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168620

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A36016	#11	37	73	020	037					57371	88461	16		OK
		C34513		40	75	025	757					56089	81730	18		OK
T	V	C31760		39	83	022	046					57371	89743	17		OK
		A33509		38	87	018	038					55128	80769	18		OK
T	V	B36171		40	75	024	054					54487	89423	16		OK

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Attachment 1

FORM QC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier: Cleco Steel Corp. Report No.:

P.O. or Contract No.: ASTM Designation: A-615-Grade 40 Date: 2/16/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B36789	21	#5	16.8	24.3	9.3	Pass	
"	22	#5	16.3	24.4	9.6	Pass	
B36745	23	#5	16.4	23.8	9.9	Pass	
"	24	#5	16.0	23.4	10.0	Pass	
C34982	25	#5	16.3	23.6	9.6	Pass	
"	26	#5	17.3	24.2	9.7	Pass	
A36448	27	#5	16.5	23.4	9.7	Pass	
"	28	#5	17.2	24.4	9.5	Pass	

AEP QA AUDIT
SCOPE: Verify tested and approved
SIG. Rick Shell
DATE 2-18-72

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks: Loading Rate = 1/2 in./min.

Calc No.: SD-040303-001, Rev. 0

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Date Samples Were Received: 2/14/72

Tested By: Bill Fuskette

Approved By: J. Gauer Date: 2-16-72

Copies To:

FORM QC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC AEP POWER SYSTEM

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No. _____

P.O. or Contract No. _____ ASTM Designation A615 – GRADE 40 Date 2/16/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B35501	11	#8	38.8	65.5	9.5	PASS	
"	12	#8	39.0	63.9	9.6	PASS	
C35085	13	#7	34.0	53.6	9.3	PASS	
"	14	#7	34.3	53.3	9.3	PASS	
B37049	15	#7	32.5	51.6	9.3	PASS	
"	16	#7	33.1	51.4	9.3	PASS	
C34540	17	#6	22.8	37.2	9.3	PASS	
"	18	#6	22.7	36.6	9.4	PASS	
B37100	19	#6	22.0	36.0	9.8	PASS	
"	20	#6	22.4	36.0	9.3	PASS	

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE → 1/2 W./MIN.

Calc No.: SD-040303-001, Rev. 0

Attachment 6

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Date Samples Were Received 2/14/72

Tested By Bill Fishette

Approved By J. L. Gauer Date 2-16-72

Copies To:

FORM QC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC AEP POWER SYSTEM

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No. _____

P.O. or Contract No. _____ ASTM Designation A-615-GRADE 40 Date 2/16/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B36144	1	#10	64.7	108.9	9.7	PASS	
"	2	#10	67.4	108.9	9.5	PASS	
B35810	3	#10	60.9	95.7	9.6	PASS	
"	4	#10	62.5	98.0	9.6	PASS	
C35157	5	#8	40.5	64.5	9.7	PASS	
"	6	#8	40.1	65.0	9.5	PASS	
A36688	7	#8	40.2	65.3	9.6	PASS	
"	8	#8	40.7	64.7	9.5	PASS	
C35020	9	#8	38.8	63.6	9.5	PASS	
"	10	#8	40.4	63.3	9.9	PASS	

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE → 1/2 IN./MIN.

Calc No.: SD-040303-001, Rev. 0

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Date Samples Were Received 2/14/72

Tested By Bill Frisbette

Approved By J. F. Gauer Date 2-16-72

Copies To:

Form L14

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-76.

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #5 REBAR JAN 14 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168336

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		C34930	#5	27	76	019	040					58709	79677	22		OK
		C34982		34	63	019	035					57741	79354	21		OK
		A36538		33	70N	020	044					59032	90322	18		OK
		A36448		30	65	023	045					55806	78709	21		OK

Calc No.: SD-040303-001, Rev. 0

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CONTENT QUALITY IS EQUAL TO THE ORIGINAL

We hereby certify that the above figures are correct as contained in the records of the company

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Attachment 2

Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-7-70

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #5 REBAR JAN 28 19 77

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168551

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A36438	#5	34	69	025	050					54193	79677	22		OK
		B36789		34	68	023	045					56151	82580	20		OK
		B36745		34	70	026	050					54516	85806	19		OK

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Calc No.: SD-040303-001, Rev. 0

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Attachment 2

We hereby certify that the above figures are correct as contained in the records of the company

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LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

FILE NO. 7

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #6 REBAR JAN 19 19 72

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT ILL.

Car Number ATSF 168535

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
1	1	B37100	#6	36	68	015	029					55681 ~~55800~~	82500	20		OK
		B36765		36	67	020	043					56818	84545	17		OK
		C35198		32	70	022	050					53636	80681	21		OK
		C35196		34	63	014	026					51363 ~~XXX~~	81363	22		OK

B-7

Attachment 6
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Calc No.: SD-040303-001, Rev. 0

DIT-B-02851-00
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Attachment 2

We hereby certify that the above figures are correct as contained in the records of the co...

Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #6 REBAR OCT 5 19 71

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168657

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. in 8" %	Red. of Area %	Bend Test
		A36018	#6	35	65	023	051					51818	84318	19		OK
		C34542		34	74	021	045					56136 XXXXX	85000	18		OK
1/		C34540		36	60	015	032					48636	77727	21		OK
		C34538		35	70	020	039					52222	80000	22		OK
		A36033		33	75	015	028					53863	80454	19		OK

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Calc No.: SD-040303-001, Rev. 0

DIT-B-02851-00 Page 16 of 31 Attachment 2

Gerald J. Coleman

We hereby certify that the above is a true and correct as contained in the records of the company.

Form L-14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #7 REBAR JAN. 22 19 72

Charged to

Shipping Notice ATSF 168223

Shipped to CECO CORP., LEMONT, ILL.

Car Number

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		B37049	#7	35	70	022	045					57666	87666	18		OK
		A36598		34	66	028	064					59166	87500	20		OK
		B37104		35	70	021	039					60000	90000	16		OK

We hereby certify that the above figures are correct as contained in the records of the company.

Calc No.: SD-040303-001, Rev. 0

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Attachment 2

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LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #7 REBAR JAN 28 19

Charged to

Shipping Notice ATSF 168551

Shipped to CECO CORP., LEMONT, ILL.

Car Number

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		C35085	#7	33	77	026	055					59333	89333	16		OK

Calc No.: SD-040303-001, Rev. 0

Attachment 6

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DIT-B-02851-00

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Attachment 2

We hereby certify that the above figures are correct as contained in the records of this company

Form 614

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #8 REBAR JUN 4 19 71

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF #168149

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. in 8" %	Red. of Area %	Bend Test
		B35501	#8	35	73	020	045					56075	86455	18		OK
		C33682		33	69	018	037					48481	80126	20		OK
		A34967		35	66	019	040					48987	80631	19		OK
		A34988		36	67	018	032					44936	76202	21		OK
		C33685		35	64	012 02	025					46582	79240	20		OK

We hereby certify that the above figures are correct as contained in the records of the company.

Calc No.: SD-040303-001, Rev. 0

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Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7>/

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #8 REBAR JAN. 27 19

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168252

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8 %	Red. of Area %	Bend Test
		B37072	#8	34	70	016	035					53544	86835	17		OK
		C35020		34	79	024	049					53164	85063	17		OK

We hereby certify that the above figures are correct as contained in the records of this company.

Calc No.: SD-040303-001, Rev. 3

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Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7318

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #8 REBAR JAN 25 19 72

Charged to CECO. CORP., LEMONT, IL.

Shipping Notice ATSF 168311

Shipped to

Car Number

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		C35150	#8	35	73	027	053					60759	91772	15		OK
		C35157		36	68	020	044					57468	85316	16		OK
		A36688		36	66	029	060					53797	85569	17		OK

B.F.

Calc No.: SD-040303-001, Rev. 0

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I hereby certify that the above figures are correct as contained in the records of the company.

Form L14

LEMONT MANUFACTURING CORPORATION

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT, ILLINOIS

FILE NO. 72-17

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #10 REBAR AUG 30 71

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number AT&SF 168333

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		B36144	#10	37	78	019	033					50787	83858	20		OK
		E88														
		C34206		37	73	015	030					50787	81889	20		OK
	1A	A35615		36	72	020	044					51968	86614	18		OK
		B36131		37	70	020	045					51574	86614	18		OK
		B35810		35	73	024	053					47637	81102	19		OK

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Calc No.: SD-040303-001, Rev. 0

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We hereby certify that the above [illegible] are [illegible] as contained in the records of [illegible]

[illegible] Adams

Rebar tests

FORM QC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No. _____

P.O. or Contract No. _____ ASTM Designation A-615 - GRADE 40 Date 7/26/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
A37672	1	#11	81.1	127.9	9.5	PASS	
"	2	#11	81.4	128.0	9.5	PASS	
A36838	3	#11	81.3	127.5	9.9	PASS	
"	4	#11	81.0	127.1	9.9	PASS	
A37151	5	#11	78.7	126.3	9.7	PASS	
"	6	#11	78.3	126.8	9.7	PASS	
A37168	7	#11	79.8	131.1	9.5	PASS	
"	8	#11	80.7	131.5	9.7	PASS	
B37097	9	#11	79.0	129.5	9.5	PASS	
"	10	#11	78.0	130.9	9.1	PASS	BROKE IN GRIPS

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD. Gage Length 8.00"

Remarks LOADING RATE → 1/2 in./min.

Date Samples Were Received 7/26/72

Tested By Bill Fiaiolette

Approved By [signature] Date 7-27-72

Copies To

Calc No.: SD-040303-001, Rev. 0

Attachment 6

Form 1 14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-48

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAY 31 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168480

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A37636	#11	37	73	022	045					50320	85897	18		OK
T	✓	A37672		34	73	020	044					51923	82051	20		OK
T	✓	A36838		37	70	021	047					50320	82692	22		OK

Rec'd 7/26/72
Bill Fruchette

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7r-417

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAY 31 19 72

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168675

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
	WISC	A36838	#11	37	70	021	047					50320	82692	22		OK
VT	WISC	A37151		37	70	023	048					50641	84615	17		OK
	1A	B37706		37	70	014	028					53525	88301P	17		OK
VT		A37168		35	73	016	037					53525 88282X	84615	18		OK
		A37636		37	73	022	045					50320	85897	18		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-45

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 13 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168649

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. in 8" %	Red. of Area %	Bend Test
		B37097	#11	39	72	018	042					54807	89102	21		OK
		A36334		38	76	019	045					55769	85576	19		OK
		A36682		37	78	021	041					52884	84935	16		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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FORM CC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No.

P.O. or Contract No. ASTM Designation A-615-GRADE 40 Date 7/19/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
A36334	1	#11	78.6	128.4	9.7	PASS	
"	2	#11	77.9	130.4	9.7	PASS	
A36682	3	#11	76.8	130.3	9.6	PASS	
"	4	#11	78.2	129.3	9.3	PASS	
B35236	5	#11	77.6	129.2	9.8	PASS	
"	6	#11	78.9	130.1	9.5	PASS	
A36782	7	#11	78.3	131.2	9.8	PASS	
"	8	#11	76.4	130.2	9.6	PASS	

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE = 1/2 in./min.

AEP QA AUDIT
SCOPE Material Tested by I&M per ASTM A615-40.
SIG. [illegible]
DATE 7-26-72

Date Samples Were Received 7/19/72

Tested By Bill Fiselette

Approved By [illegible] Date 7-21-72

Copies To

Calc No.: SD-040303-001, Rev. 0

Attachment 6

Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-45

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 13 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168649

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8 %	Red. of Area %	Bend Test
		B37097	#11	39	72	018	042					54807	89102	21		OK
		A36334		38	76	019	045					55769	85576	19		OK
		A36682		37	78	021	041					52884	84935	16		OK

7/19/72

Received Franchette

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Form L 14

LEMONT MANUFACTURING CORPORATION

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT, ILLINOIS

FILE NO. 71-87

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR APR 26 19 71

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168297

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
	✓	B35248	#11	39	79	018	039					52243	87820	15		OK
	✓	C33048		40	70	020	044					51923	81730	16		OK
TA	✓	B35236		38	79	023	050					54487	83974	15		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: S3-040303-001, Rev. 0

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Attachment 4

Form L14

CONTENT QUALITY IS EQUAL TO THE ORIGINAL

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-76

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 13 19 72

Charged to _____ Shipping Notice _____

Shipped to CECO CORP., LEMONT, ILL. Car Number ATSF 168159

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		B37097	#11	39	72	018	042					54807	89102	21		OK
		B37276		39	75	022	053					55448	89423	15		OK
		B37247		40	73	024	050					51923	88461	17		OK
		A96782		37	75 78	021	034					52243	81730	18		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

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Attachment 4

FORM QC-12
REV. 2/70

INDIANA & MICHIGAN ELECTRIC COMPANY
DONALD C. COOK NUCLEAR PLANT

AMERICAN ELECTRIC POWER SYSTEM AEP

CONCRETE-REINFORCEMENT BAR TEST REPORT

Name of Supplier CECO STEEL CORP. Report No. _____

P.O. or Contract No. _____ ASTM Designation A-615-GRADE 40 Date 6/12/72

HEAT NUMBER	TEST No.	BAR SIZE	YIELD POINT KIPS	TENSILE LOAD KIPS	ELONG GAGE LENGTH	PASS REJECT	REMARKS
B37058	11	#10	68.8	109.3	9.3	PASS	
"	12	#10	69.3	110.4	9.3	PASS	
C35144	13	#10	70.5	111.5	9.6	PASS	
"	14	#10	70.4	111.7	9.3	PASS	
B38100	15	#10	68.4	109.0	9.4	PASS	
"	16	#10	67.2	109.1	9.6	PASS	

AEP QA AUDIT
SCOPE Heat Treated
Approved by
Tamper Celis
DCNA ASTM A615-
40.
SIG. Rd Stell
DATE 6-20-72

ASTM A615 GR 40, Y-40 KSI, T-70 KSI				
BAR SIZE	AREA SQ. IN.	SPEC YIELD KIPS	SPEC TENSILE KIPS	MIN. ELONG. GAGE LENGTH IN. (1)
3	0.11	4.4	7.7	8.86
4	0.20	8.0	14.0	8.95
5	0.31	12.4	21.7	8.95
6	0.44	17.6	30.8	8.95
7	0.60	24.0	42.0	8.86
8	0.79	31.6	55.3	8.80
9	1.00	40.0	70.0	8.72
10	1.27	50.8	88.9	8.64
11	1.56	62.4	109.2	8.55
14	2.25	90.0	157.5	8.55
18	4.00	160.0	280	8.55

Note (1) STD Gage Length 8.00"

Remarks LOADING RATE → 1/2 KSI/min.

Calc No.: SD-040303-001, Rev. 0

Attachment 6

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Date Samples Were Received 6/15/72

Tested By Bill Fischetto

Approved By J.F. Irwin Date 6-19-72

Copies To:

PURCHASE ORDER

MATERIAL RECEIPT

DATE 10-11-72

The Ceco Corp.

RECEIVED AT

Indiana & Michigan Power Co.
Donald C. Cook Nuclear Plant Const. Dept.
P. O. Box 458
Bridgman, Michigan 49106

PREPAID (X) COLLECT ( )

Bags	Barrels	Boxes	Bundles	Cartons	Coils	Crates	Pkges.	Pieces
			6					

MATERIAL RECEIPT—To Main Acct'g Office

ORDER No. 4565CX9 REQ. No.

STORES BIN NO.	QUANTITY RECEIVED	ITEMS
		Reinf. Steel Bars
		RS-1C-93

UNLOADED BY Jones

LOCATION STORED Q-47

HOW TO BE USED Unit #1 Cont. Bldg. Missle Shield

831 | PART | Final-Shipment

Date Material Rec'd 10-5-72 | Date Passed 10-11-72

Carrier Vendor	Express	Parcel Post	F.O.B. Destination Deduct from Invoice
Freight Pro. No.		Weight 35,645 Lbs.	$
FREIGHT	U.P.S.		

Storekeeper Material Receipt No. 11304

Calc No.: SD-040303-001, Rev. 0

Attachment 7

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FORM 476 REV. 4

THE CECO CORPORATION-PU OR DELY. ORDER

Company Charged*

Stop No. Ceco 367 [0] 0-Coco Steel [ ] 4-Coco Erection

Date* 10/5/7

Per TP

FROM Name Lomont 53R
Address
City State

TO Name Indiana & Michigan Electric Company
Address Exit #16 (D.C. Cook Nuclear Plant)
City Bridgman State Mich.

DESCRIPTION						COSTING DATA			
NO. KGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
6	Bdls	Bars reinforcing steel.	1			9-3-870-R577 Rev	3		
						PART 1		802	35645
		Job phone: 616-465-5901							

C. O. D.

$ _____

(NOT C.O.D. unless amount is shown)

Remarks [redacted]

MxxL: 29-0

Tagged: Blue

Material Received By 10-5-72
J. M. Powell Co. Mr. Green

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Company Charged*

Step No. CECO 367 [0] 0-Coco Steel [ ] 4-Coco Erection

Date * 10/5/7

Per TP

FROM Name Lomont 53R

Address

City State

TO Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						*COSTING DATA			
NO. KGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
	Bdls	Bars reinforcing steel.	1			9-3-870-B577 Rev	3		
						PART 1		802	35645
		Job phone: 616-465-5901							

C. O. D.

$

(NOT C.O.D. unless amount is shown)

Remarks

MarL: 29-0

Tagged: BLUE

Material Received By 10-5-72

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Sheet 1 of 3 As Shown

Sheet 2 of 3

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Coco Order # B577Rev

Release # 1C-93

Calc No.: SD-040303-001, Rev. 0

Attachment 7

THE CECO CORPORATION

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO.

LOCATION BRIDGMAN, MICH.

NAME OF JOB DONALD C. COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #1 CONT. BLDG ON DRWG 1093

MISSLE SHIELD STRAIGHT BARS

ORDER # B577R

CONT. NO. 9-3-372

SHEET 1 OF 3

DATE 9-3-72

LISTED BY

CHECKED BY

	COLUMN #1 NO. PCS.	SIZE	LENGTH	COLUMN #2 NO. PCS.	SIZE	LENGTH
1.	64	#11	28-3			
2.	164		26-6			
3.	41		24-0			
4.	8		22-3			
5.	4	#11	7-6			
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
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23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						

837160 OK

18192

RS-1093

HEATS LISTED HAVE BEEN APPROVED FOR USE ON THIS PROJECT

10-5-72 3:15

Robert Craig

GRADE REINF. 40

TAG COLOR BLUE

MAXIMUM BNDL'S _____ TON

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER, HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

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THE CECO CORPORATION

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO.

LOCATION BRIDGMAN, MICH

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #1 CONT. BLDG ON DRWG.

ORDER # 1577 REV

CONT. NO. 72-370

SHEET 2 OF 3

DATE 9-5-72

LISTED BY

RS 1C93

ALL DIMENSIONS OUT TO OUT — DIMENSIONS OMITTED ARE ZERO

NO PCS	SIZE	LENGTH	MARK		A	B	C	D	E	F	G	H	J	K	R	O
57	#11	31-10	11B10	1	1-7	23-3					1-7	–	1-2¼			
12		30-2	11B11	1	1-7	27-0	C34105				1-7		1-2¼			
32		27-7	11B1	1	1-7	24-5			OK		1-7	–	1-2¼			
8		25-1	11B2	1	1-7	22-1					1-7	–	1-2¼			
2	#11	9-4	11B1	1	1-7	7-9						–	1-2¼			

1745#

[redacted]

LOC Q-47

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 5 of 32

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. 40

TAG BUNDLES BLUE

_____ TON MAXIMUM BNDLS

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 71-158

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR AUG 27 19 71

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168252 & 168303

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A35728	#11	36	78	023	052					49358	84294	16		OK
		C34132		36	76	017	040					50320	81730	17		OK
	✓	C34105		36	75	023	048					53205	89423	16		OK
	✓	A35433		39	66	030	058					52564	82371	17		OK
	✓	C34117		38	74	015	030					49038	83012	1[illegible]		OK
	✓	A35737		38	65	019	042					54166	84615	17		OK

Page 6 of 32

Attachment 7

Calc No.: SD-040303-001, Rev. 0

Gerald L. Adams

We hereby certify that the above figures are correct as contained in the records of the company

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-49

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 14 19 72

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168522

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A33509	#11	38	87	018	038					55128	80769	18		OK
	✓	B37340	✓	37	79	025	049					51602	83012	20		OK
	✓	B37160	OK	38	73	025	058					54487	83333	17		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 7 of 32

PURCHASE ORDER

MATERIAL RECEIPT

DATE 10-11-72

The Ceco Corp.

RECEIVED AT

Indiana & Michigan Power Co.
Donald C. Cook Nuclear Plant Const. Dept.
P. O. Box 458
Bridgman, Michigan 49106

PREPAID (X) COLLECT ( )

Bags	Barrels	Boxes	Bundles	Cartons	Coils	Crates	Pkges.	Pieces

MATERIAL RECEIPT—To Main Acct'g Office

REQ. No.

ORDER No. 45L5CX9

STORES BIN NO.	QUANTITY RECEIVED	ITEMS
		Reinf. Steel Bars
		RS-1C-93

UNLOADED BY Jones

LOCATION STORED Q-44

HOW TO BE USED Unit #1 Cont. Bldg. Missle Shield

PART | Final-Shipment

Date Material Rec'd 10-6-72

Date Passed 10-11-72

Carrier Vendor	Express	Parcel Post	F.O.B. Destination Deduct from Invoice
Freight Pro. No.		Weight 16,159 Lbs.	$
FREIGHT	U.P.S.		

Storekeeper

Material Receipt No. 11305

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 8 of 32

FORM 476 REV. 4

THE CECO CORPORATION-PU OR DELY. ORDER

Company Charged*

Stop No. CECO 313 [0] 0-Ceco Steel [ ] 4-Ceco Erection

Date* 10/5/72

Per TP

Name Lomont 53R

Address

City State

TO

Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						*COSTING DATA			
NO. KGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	DET. N.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
	Bdls	Bars reinforcing steel.	1			9-3-870-B577 REV	3		
						BAL. 2		802	16157
		Job phone: 616-465-5901							

C. O. D.

$

(NOT C.O.D. unless amount is shown)

Remarks

Mark: 29-0

Tagged: Blue

Material Received By

J&M Power Co. R. White 10/6/72

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Company Charged*

Ship No. CECO 313 [0] 0-Coco Steel [ ] 4-Coco Erection

Date* 10/5/72

Per TP

Name Lemont 53R

Address

City State

TO Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						COSTING DATA			
NO. KGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	DETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
	Bdls	Bars reinforcing steel.	1			9-3-870-B577 Rev	3		
						BAL. 2		802	16157
		Job phone: 616-465-5901							

C. O. D.

$

(NOT C.O.D. unless amount is shown)

Remarks

Mark: 29-0

Tagged: Blue

Material Received By

Ind Power Co. J. White 10/6/72

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Sheet 1 of 3 As Shown

Sheet 2 of 3 ↓ ↓

Sheet 3 of 3 Complete

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Coco Order # B577 Rev

Release # 1C-93

THE CECO CORPORATION

(2)

ORDER # B577RA
CONT. NO. 9-3-372
SHEET 1 OF 3
DATE 9-3-72
LISTED BY
CHECKED BY

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO
LOCATION BRIDGMAN, MICH.
NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT
MATERIAL FOR UNIT #1 CONT. BLDG. ON DRWG 1C93
MISSLE SHIELD STRAIGHT BARS

	COLUMN #1				COLUMN #2		
	NO PCS	SIZE	LENGTH		NO PCS	SIZE	LENGTH
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.	13	#3	25-3	C35157			
10.	12	#3	24-0	OK			
11.				1750			
12.							
13.				17942			
14.							
15.							
16.				RS-1C93			
17.							
18.							
19.							
20.	HEATS LISTED HAVE BEEN						
21.	APPROVED FOR USE ON						
22.	THIS PROJECT						
23.				10-6-72			
24.				8:00 AM			
25.				Robert Craig			
26.							
27.				out 10:10 AM			
28.							
29.							
30.							
31.							
32.							
33.							

GRADE REINF. 40
TAG COLOR BLUE
MAXIMUM BNDL'S _____ TON
MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER, HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 11 of 32

THE CECO CORPORATION

(2)

ORDER # 65177 PE

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO.

CONT. NO 43-570

LOCATION BRIDGMAN MICH.

SHEET 2 OF 3

DATE 9-3-72

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

LISTED BY

MATERIAL FOR UNIT #1 CONT. BLDG ON DRWG.

RS 1C93

ALL DIMENSIONS OUT TO OUT

DIMENSIONS OMITTED ARE ZERO

ITEM NO.	SIZE	LENGTH	MARK	A	B	C	D	E	F	G	H	J	K	R	O
1392	#5	4-9 5/8	6	0-7 3-7			~~A36458~~ A36448			0-7		0-4½		6876	
														2434	

OK R.J.C.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 12 of 32

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. 40

TAG BUNDLES BLUE

_____ TON MAXIMUM BNDLS

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

THE CECO CORPORATION

CONTRACTOR: INDIANA & MICHIGAN ELECTRIC CO. (2)

LOCATION: BRIDGMAN, MICH.

NAME OF JOB: DONALD C COOK NUCLEAR POWER PLANT UNIT #1 CONT. BLDG

MATERIAL FOR: MISSLE SHIELD ON DRWG. 1C93

ORDER # 037722

CONT. NO. 1 70

SHEET 3 OF 3

DATE 9-8-72

LISTED BY

RS-1C93

ALL DIMENSIONS OUT TO OUT — DIMENSIONS OMITTED ARE ZER

	NO. PCS	SIZE	LENGTH	MARK		A	B	C	D	E	F	G	H	J	K	R	O
1	80	#5	13-2	SB13	S6	0-10	9-6½	1-7	1-6								
2	64		13-4½	SB12	S6	0-10	9-6½	1-6	1-6								
3	8		10-10	SB22	S10	—	0-10	1-2½	0-10								
4	36		3-8	SB5	S6	0-10	1-9	1-7	2-6								
5	30		8-6½	SB13	S6	0-10	4-8½	1-6	1-6								
6	256		6	SB17	S10	—	2-9	1-0	2-9								
7	112		6-4	SB7	S10	—	2-9	0-10	2-9		A36438						
8	30		6-1	SB3	S10	—	0-10	4-5	0-10		A36448						
9	8		6-0	SB15	S10	—	0-10	4-4	0-10								
10	36		6-0½	SB19	S10	—	0-10	4-4½	0-10								
11	6		5-9½	SB22	S6	0-10	1-11½	1-6	1-6								
12	2		5-4	SB14	S6	0-10	1-6	1-6	1-6								
13	304		5-3	SB4	S10	—	0-10	3-7	0-10								
14	12		3-6	SB8	S10	—	0-10	1-10	0-10								
15	6		3-4	SB9	S10	—	0-10	1-8	0-10								
16	8	#5	2-10	SB16	S10	—	0-10	1-2	0-10							7-13	
17																	
18																	
19																	
20																	
21																	

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 13 of 32

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. do

TAG BUNDLES (BLUE)

_____ TON MAXIMUM BNDLS

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-18

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #8 REBAR JAN 25 19 72

Charged to CECO CORP., LEMONT, IL. Shipping Notice ATSF 168311

Shipped to Car Number

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		C35150	#8	35	73	027	053					60759	91772	15		OK
		C35157		36	68	020	044					57468	85316	16		OK
		A36688		36	66	029	060					53797	85569	17		OK

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 14 of 32

We hereby certify that the above figures are correct as contained in the records of the company

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-2-5

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #5 REBAR JAN 28 19 72

Charged to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168551

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		~~A36438~~	#5	34	69	025	050					54193	79677	22		OK
		B36789		34	68	023	045					56451	82580	20		OK
		B36745		34	70	026	050					54516	85806	19		OK
		A364481														
			OK R.J.C.													

We hereby certify that the above figures are correct as contained in the records of the company.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 15 of 32

PURCHASE ORDER

MATERIAL RECEIPT

DATE 10-11-72

The Ceco Corp.

RECEIVED AT

Indiana & Michigan Power Co.
Donald C. Cook Nuclear Plant Const. Dept.
P. O. Box 458
Bridgman, Michigan 49106

MATERIAL RECEIPT—To Main Acct'g Office

ORDER No. 45605CX9 REQ. No.

PREPAID (X) COLLECT ( )

Bags	Barrels	Boxes	Bundles	Cartons	Coils	Crates	Pkges.	Pieces
			8					

STORES BIN NO.	QUANTITY RECEIVED	ITEMS
		Reinf Steel Bars
		RS-2C-93

UNLOADED BY Jones

LOCATION STORED Q-45

HOW TO BE USED Unit #2 Cont. Bldg. Missle Shield 833

PART | Final-Shipment

Date Material Rec'd 10-10-72 | Date Passed 10-11-72

Carrier Vendor	Express	Parcel Post	F.O.B. Destination Deduct from Invoice
Freight Pro. No.		Weight 35,645 Lbs.	$
FREIGHT	U.P.S.		

Storekeeper Material Receipt No. 113062

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 16 of 32

THE COCO CORPORATION-PU OR DELY. ORDER

FORM 476 REV. A

Company Charged*

Ship No. Coco 367 [0] 0-Coco Steel [ ] 4-Coco Erection

Date* 10/9/7

Per TP

FROM: Name Lemont 53R

Address

City State

TO: Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						*COSTING DATA			
NO. PKGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
8	Bdls	Bars reinforcing steel.	1			9-3-870-B578 Rev.	3		
						PART 1		802	35645
		Job phone: 616-465-5901							

C. O. D.

$ _____

(NOT C.O.D. unless amount is shown)

Remarks Bdl #

Mark: 29-0

Tagged: BLUE GREEN

Material Received By John Brown Co. Y. White/c/o

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Calc No.: SD-040303-001, Rev. 0

Attachment 7

FORM 476 REV. 3

THE COCO CORPORATION-PU OR DELY. ORDER

Company Charged*

Step No. Coco 367 [0] 0 - Coco Steel [ ] 4 - Coco Erection

Date * 10/9/72

Per TP

Name Iomont 53R

Address

City State

TO Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						*COSTING DATA			
NO. PKGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT.
	Bdls	Bars reinforcing steel.	1			9-3-870-B578 Rev.	3		
						PART 1		802	35645
		Job phone: 616-465-5901							

C. O. D.

$ _____

(NOT C.O.D. unless amount is shown)

Remarks Bill #

Mark: 29-0

Tagged: Blue

Material Received By

Ill Power Co. Y. White 10/10/72

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Sheet 1 of 3 As Shown

Sheet 2 of 3 ↓ ↓

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Coco Order # B578 Rev.

Release # 2C-93

X

Calc No.: SD-040303-001, Rev. 0

Attachment 7

REV. F. 1150

THE CECO CORPORATION

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO

LOCATION BRIDGMAN, MICH.

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #2 CONST. BLDG ON DRWG. 2C-93

ORDER # [illegible]

CONT. NO. 9-3-21

SHEET 1 OF 3

DATE 9-3-72

LISTED BY [illegible]

CHECKED BY

MISSLE SHIELD STRAIGHT BARS

ITEM	COLUMN #1 NO. PCS.	SIZE	LENGTH		COLUMN #2 NO PCS	SIZE	LENGTH
1.	64	#11	23-3	B37340 ✓			
2.	16		26-6	A37151 ✓			
3.	41		24-0	A36334 ✓			
4.	8		22-3	B36171			
5.	1	#11	7-6				
6.				18192			
7.							
8.							
9.	[redacted]						
0.							
1.				[redacted]			
2.							
3.				[redacted]			
4.							
5.							
6.							
7.							
8.				RS 2C-93			
9							
0.				HEATS LISTED HAVE BEEN			
1.				APPROVED FOR USE ON			
2.				THIS PROJECT			
3.				10/10/72			
4.							
5.				R.D. Cay			
6.							
7.				in 10:07 AM			
8.				out 10:49 A.M.			
9.							
0.							
1.							
2.							
3.							

OK

GRADE REINF. 40

TAG COLOR BLUE

MAXIMUM BNDL'S _____ TO

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER, HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO

LOCATION BRIDGMAN, MICH.

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #2 CONT BLDG ON DRWG. 2C93

MISSLE SHIELD

ORDER # [illegible]

CONT. NO. 72-570

SHEET 3 OF 3

DATE 1-3-72

LISTED BY [illegible]

R5 2C-93

ALL DIMENSIONS OUT TO OUT — DIMENSIONS OMITTED ARE ZER

NO. PCS	SIZE	LENGTH	MARK		A	B	C	D	E	F	G	H	J	K	R	O
1. 57	#11	31-10	11B104		1-7	23-3		B37340			1-7	-	1-2 1/4			
2. 12		30-2	11B114		1-7	27-0		A37151			1-7		1-2 1/4			
3. 32		27-7	11B11		1-7	24-5		A36334			1-7	-	1-2 1/4			
4. 8		25-11	11B24		1-7	22-9		B36171			1-7	-	1-2 1/4			
5. 4	#11	9-4	11B21		1-7	7-9							1-2 1/4			
															17453	

OK

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 20 of 32

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. 40

TAG BUNDLES BLUE

_____ TON MAXIMUM BNDLS

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

[illegible] CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-50

[illegible] of CHEMICAL and PHYSICAL Tests of ENGERRG [illegible] #11 REBAR MAR 14, 72

[illegible] to _____ Shipping Notice _____

[illegible] to CECO CORP., LEMONT, ILL. Certificate ATSF 168620

[illegible] No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A36016 [illegible]	#11	37	73	020	037					57371	88461	16		OK
		C34513		40	75	025	757					56089	81730	18		OK
	✓	C31760		39	83	022	046					57371	89743	17		OK
		A33509	✓	38	87	018	038					55128	80769	18		OK
	✓	B36171	✓ OK	40	75	024	054					54487	89423	16		OK

Calc No.: SD-040303-001, Rev. 0
Attachment 17
Page 21 of 32

We hereby certify that the above figures are correct as contained in the records of the company.

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-6/72

...of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAY 31 19 72

...ed to Shipping Notice

...ed to CECO CORP., LEMONT, ILL. Car Number ATSF 168675

...ler No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8", %	Red. of Area %	Bend Test
	WISC	A36838	#11	37	70	021	047					50320	82692	22		OK
✓	WISC	A37151		37	70	023	048					50641	84615	17		OK
	IA	B37706	✓ OK	37	70	014	028					53525	83012	17		OK
✓		A37168		35	73	016	037					53525 53252X	84615	18		OK
		A37636		37	73	022	045					50320	85897	18		OK

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Calc No.: SD-040303-001, Rev. 0

We hereby certify that the above figures are correct as contained in the records of the company.

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-49

of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 14 19 72

ed to CECO CORP., LEMONT, ILL. Shipping Notice ATSF 168522

ed to Car Number

er No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		A33509	#11	38	87	018	038					55128	80769	18		OK
	✓	B37340	✓ OK	37	79	025	049					51602	83012	20		OK
	✓	B37160		38	73	025	058					54487	83333	17		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

Attachment 17

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LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-45

...of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #11 REBAR MAR 13 19 72

...ged to _____ Shipping Notice _____

...ped to CECO CORP., LEMONT, ILL. Car Number ATSF 168649

...der No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8", %	Red. of Area %	Bend Test
		B37097	#11	39	72	018	042					54807	89102	21		OK
		A36334	✓	38	76	019	045					55769	85576	19		OK
		A36682	OK	37	78	021	041					52884	84935	16		OK

We hereby certify that the above figures are correct as contained in the records of the company

Calc No.: SD-040303-001, Rev. 0

Attachment 7

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PURCHASE ORDER

MATERIAL RECEIPT

DATE 10-12-72

The Ceco Corp.

RECEIVED AT

Indiana & Michigan Power Co.
Donald C. Cook Nuclear Plant Const. Dept.
P. O. Box 458
Bridgman, Michigan 49106

PREPAID (X) COLLECT ( )

Bags	Barrels	Boxes	Bundles	Cartons	Coils	Crates	Pkges.	Pieces

MATERIAL RECEIPT—To Main Acct'g Office

ORDER No. 4565CX9 REQ. No.

STORES BIN NO.	QUANTITY RECEIVED	ITEMS
		Reinf. Steel Bars
		RS-2C-93

UNLOADED BY Jones

LOCATION STORED Y-48

HOW TO BE USED Unit #2 Cont. Bldg. Missle Shield 834

PART | Final-Shipment

Date Material Rec'd 10-11-72 | Date Passed 10-12-72

Carrier Vendor	Express	Parcel Post	F.O.B. Destination Deduct from Invoice
Freight Pro. No.		Weight 16,159 Lbs.	$
FREIGHT	U.P.S.		

Storekeeper

Material Receipt No. 11324

Calc No.: SD-040303-001, Rev. 0

Attachment 7

FORM 476 REV. 4

THE COCO CORPORATION PURCHASE ORDER

Company Charged* 313

Job No. Coco

[0] 0 - Coco Steel [ ] 4 - Coco Erection

Date * 10/9/72

Per TP

Name	Lomont 53R	TO Name	Indiana & Michigan Electric Company
Address		Address	Exit #16 (D.C. Cook Nuclear Plant)
City	State	City	Bridgman State Mich.

DESCRIPTION						COSTING DATA			
NO. PCS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
	Bdls	Bars reinforcing steel.	1			9-3-870-6578 REV.	3		
						-BAL 2		802	16159
		Job phone: 616-465-5901							

C. O. D.

(NOT C.O.D. unless ordered)

Remarks [ ] #

MarkL: 28-0

Material Received By Sym Power Co. G. White 10/11/72

[ ] Consignee accepted goods with ...

Calc No.: SD-040303-001, Rev. 0

Attachment 7

THE COCO CORPORATION-PU OR DELY. ORDER

FORM 476 REV. 4

Shop No. Coco 313 Company Charged* [0] 0-Coco Steel [ ] 4-Coco Erection

Date * 10/9/72

Per TP

Name Lomont 53R

Address

City State

TO Name Indiana & Michigan Electric Company

Address Exit #16 (D.C. Cook Nuclear Plant)

City Bridgman State Mich.

DESCRIPTION						*COSTING DATA			
NO. KGS.	CONTENTS	ARTICLES	DEL. (1)	P.U. (2)	RETN.	ORDER NO.	DISTRICT CHARGED TO	PRODUCT CODE	WEIGHT
	Bdls	Bars reinforcing steel.	1			9-3-870-8578 REV.	3		
						-BAL 2		802	16159
		Job phone: 616-465-5901							

C. O. D.

$

(DO NOT C.O.D. unless amount is shown)

Remarks [redacted] #

Mark: 28-0

Tagged: BLUE

Material Received By J. M. Power Co. J. White 10/11/

[ ] Consignee accepted goods without exception

[ ] Consignee took exception. See other side.

Sheet 1 of 3 As Shown

Sheet 2 of 3 ↓ ↓

Sheet 3 of 3 Complete

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Sheet ___ of ___

Coco Order # 8578 Rev.

Release # 2C-93

X

Calc No.: SD-040303-001, Rev. 0

Attachment 7

EV...F...ES : THE CECO CORPORATION

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO

LOCATION BRIDGMAN, MICH.

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

MATERIAL FOR CONT #2 CONST. BLDG ON DRWG 2C-93

ORDER #

CONT. NO. 9-3-3?

SHEET 1 OF 3

DATE 9-3-92

LISTED BY

CHECKED BY

MISSLE SHIELD STRAIGHT BARS

ITEM	COLUMN #1 NO PCS	SIZE	LENGTH		COLUMN #2 NO. PCS	SIZE	LENGTH
1							
2							
3							
4							
5							
6							
7							
8							
9	13	5	29-3	C35157			
10	12	5	24-0				
11				175#			
12						O/T	
13				19942			
14							
15							
16							
17							
18		RS	20-93				
19							
20							
21							
22				Bats listed have been			
23				approved for use on			
24				this project			
25							
26							
27				Greg Hettinger			
28							
29				10-7-92			
30							
31				In 10:05 A.M.			
32				OUT 12:00 p.M.			
33							

GRADE REINF. 40

TAG COLOR BLUE

MAXIMUM BNDL'S _____ TON

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER, HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

Calc No.: SD-040303-001, Rev. 0

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THE CECO CORPORATION

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO

LOCATION BRIDGMAN, MICH.

NAME OF JOB DONALD C COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #2 CONT BLDG ON DRWG. 2C93

MISSLE SHIELD

ORDER # [illegible]

CONT. NO. [illegible]

SHEET 2 OF 3

DATE 4-3-72

LISTED BY [illegible]

RS 2C-93

ALL DIMENSIONS OUT TO OUT

DIMENSIONS OMITTED ARE ZERO

NO. PCS	SIZE	LENGTH	MARK	TYPE	A	B	C	D	E	F	G	H	J	K	R	O
[illegible]																
1342	#5	12-9	5B6	1	0-7	3-7	C34982	-	-	-	0-7	—	0-4½		6816	
										OK					2713	4

Calc No.: SD-040303-001, Rev. 0

Attachment 7

Page 29 of 32

1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. 40

TAG BUNDLES [illegible]

_____ TON MAXIMUM BNDL

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

CONTRACTOR INDIANA & MICHIGAN ELECTRIC CO.

LOCATION BRIDGMAN, MICH.

NAME OF JOB D. C. COOK NUCLEAR POWER PLANT

MATERIAL FOR UNIT #2 CONT. BLDG. ON DRWG. 2C-93

MISSLE SHIELD

CONT. NO. 13-370-

SHEET 3 OF 3

DATE 9-8-12

LISTED BY

R5-2C-93

ALL DIMENSIONS OUT TO OUT — DIMENSIONS OMITTED ARE ZERO

NO. PCS	SIZE	LENGTH	MARK	TYPE	A	B	C	D	E	F	G	H	J	K	R	O
80	#5	13-5½	SB13	S6	0-10	9-6½	1-7	1-6								
64		13-4½	SB12	S6	0-10	9-6½	1-6	1-6								
8		15-10½	SB20	S10	—	0-10	1-2½	0-10								
36		9-3	SB5	S6	0-10	4-9	1-7	2-6								
30		8-6½	SB3	S6	0-10	4-3½	1-6	1-6		C34982						
25½		6-6	SB17	S10	—	2-9	1-0	2-9								
112		6-4	SB7	S10	—	2-9	0-10	2-9								
30		6-1	SB3	S10	—	0-10	4-5	0-10								
8		6-0	SB15	S10	—	0-10	4-4	0-10								
36		6-0½	SB19	S10	—	0-10	4-4½	0-10			OK					
6		5-9½	SB22	S6	0-10	1-11½	1-6	1-6								
2		5-4	SB14	S6	0-10	1-6	1-6	1-6								
304		5-3	SB4	S10	—	0-10	3-7	0-10		LOC.						
12		3-6	SB3	S10	—	0-10	1-10	0-10								
6	#7	3-4	SB9	S10	—	0-10	1-8	0-10		1-48						
8	#5	2-10	SB16	S10	—	0-10	1-2	0-10							7-5	3

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Attachment 7

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1) IT IS THE RESPONSIBILITY OF THE CONSIGNEE TO CHECK THIS MATERIAL AGAINST THE ATTACHED SHIPPING LIST.
2) NO CLAIMS FOR SHORTAGES WILL BE CONSIDERED UNLESS CECO IS NOTIFIED WITHIN 48 HOURS AFTER ARRIVAL AND GIVEN A REASONABLE OPPORTUNITY TO VERIFY THE ALLEGED SHORTAGE.
3) NO REPLACEMENTS WILL BE MADE UNLESS THE ABOVE PROCEDURE IS FOLLOWED EXCEPT UPON RECEIPT OF AN EXTRA ORDER.

GRADE REINF. 40

TAG BUNDLES BLUE

_____ TON MAXIMUM BND

MILL TEST REQ'D _____

FOR THE CONVENIENCE OF THE CARRIER HE IS REQUESTED TO CALL _____ AT _____ IN _____ 24 HOURS PRIOR TO DELIVERY TO ARRANGE FOR UNLOADING.

LEMONT MATERIALS CORPORATION

LEMONT, ILLINOIS

FILE NO. 7-18

of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #8 REBAR

JAN 25 19 72

Sold to CECO CORP., LEMONT, IL.

Shipping Notice ATSF 168311

Car Number

No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P.	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8" %	Red. of Area %	Bend Test
		C35150	#8	35	73	027	053					60759	91772	15		OK
		C35157		36	68	020	044					57468	85316	16		OK
		A36688		36	66	029	060					53797	85569	17		OK

OK 1-28-72

Attachment 7

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Calc No.: SD-040303-001, Rev. 0

We hereby certify that the above figures are correct as contained in the records of the company

LEMONT MANUFACTURING CORPORATION

LEMONT, ILLINOIS

FILE NO. 72-726.

Report of CHEMICAL and PHYSICAL Tests of ELECTRIC FURNACE STEEL #5 REBAR JAN 14 19 72

Sold to

Shipping Notice

Shipped to CECO CORP., LEMONT, ILL.

Car Number ATSF 168336

Order No.	Mill Order No.	Heat No.	Slab No.	ANALYSIS % C	Mn	P	S	Si			Test Piece Cut From	Yield Point lbs. per sq. in.	Tensile Strength lbs. per sq. in.	Elong. In 8", %	Red. of Area %	Bend Test
		C34930	#5	27	76	019	040					58709	79677	22		OK
		C34982		34	63	019	035					57741	79354	21		OK
		A36538		33	70	020	044					59032	90322	18		OK
		A36448		30	65	023	045					55806	78709	21		OK

OK 2/2/72

Calc No.: SD-040303-001, Rev. 0

Attachment 7

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Edward L. Adams

We hereby certify that the above figures are correct as contained in the records of the company.

Table T-11b: One-sided tolerance limit factors for a normal distribution*

γ = confidence, π = % of population

	γ = 0.90			γ = 0.95			γ = 0.99		
n	π = 0.90	π = 0.95	π = 0.99	π = 0.90	π = 0.95	π = 0.99	π = 0.90	π = 0.95	π = 0.99
2	10.253	13.090	18.500	20.581	26.260	37.094	103.029	131.426	185.617
3	4.258	5.311	7.340	6.155	7.656	10.553	13.995	17.370	23.896
4	3.188	3.957	5.438	4.162	5.144	7.042	7.380	9.083	12.387
5	2.742	3.400	4.666	3.407	4.203	5.741	5.362	6.578	8.939
6	2.494	3.092	4.243	3.006	3.708	5.062	4.411	5.406	7.335
7	2.333	2.894	3.972	2.755	3.399	4.642	3.859	4.728	6.412
8	2.219	2.754	3.783	2.582	3.187	4.354	3.497	4.285	5.812
9	2.133	2.650	3.641	2.454	3.031	4.143	3.240	3.972	5.389
10	2.066	2.568	3.532	2.355	2.911	3.981	3.048	3.738	5.074
12	1.966	2.448	3.371	2.210	2.736	3.747	2.777	3.410	4.633
14	1.895	2.363	3.257	2.109	2.614	3.585	2.596	3.189	4.337
16	1.842	2.299	3.172	2.033	2.524	3.464	2.459	3.028	4.123
18	1.800	2.249	3.105	1.974	2.453	3.370	2.357	2.905	3.960
20	1.765	2.208	3.052	1.926	2.396	3.295	2.276	2.808	3.832
22	1.737	2.174	3.007	1.886	2.349	3.233	2.209	2.729	3.727
24	1.712	2.145	2.969	1.853	2.309	3.181	2.154	2.662	3.640
26	1.691	2.120	2.937	1.824	2.275	3.136	2.106	2.606	3.566
28	1.673	2.099	2.909	1.799	2.246	3.098	2.065	2.558	3.502
30	1.657	2.080	2.884	1.777	2.220	3.064	2.030	2.515	3.447
35	1.624	2.041	2.833	1.732	2.167	2.995	1.957	2.430	3.334
40	1.598	2.010	2.793	1.697	2.125	2.941	1.902	2.364	3.249
45	1.577	1.986	2.761	1.669	2.092	2.898	1.857	2.312	3.180
50	1.559	1.965	2.735	1.646	2.065	2.862	1.821	2.269	3.125
60	1.532	1.933	2.694	1.609	2.022	2.807	1.764	2.202	3.038
70	1.511	1.909	2.662	1.581	1.990	2.765	1.722	2.153	2.974
80	1.495	1.890	2.638	1.559	1.964	2.733	1.688	2.114	2.924
90	1.481	1.874	2.618	1.542	1.944	2.706	1.661	2.082	2.883
100	1.470	1.861	2.601	1.527	1.927	2.684	1.639	2.056	2.850
150	1.433	1.818	2.546	1.478	1.870	2.611	1.566	1.971	2.740
200	1.411	1.793	2.514	1.450	1.837	2.570	1.524	1.923	2.679
250	1.397	1.777	2.493	1.431	1.815	2.542	1.496	1.891	2.638
300	1.386	1.765	2.477	1.417	1.800	2.522	1.475	1.868	2.608
350	1.378	1.755	2.466	1.406	1.787	2.506	1.461	1.850	2.585
400	1.372	1.748	2.456	1.398	1.778	2.494	1.448	1.836	2.567
500	1.362	1.736	2.442	1.385	1.763	2.475	1.430	1.814	2.540
1,000	1.338	1.709	2.407	1.354	1.727	2.430	1.385	1.762	2.475
∞	1.282	1.645	2.326	1.282	1.645	2.326	1.282	1.645	2.326

* Adapted from Odeh, R. E., and D. B. Owen, 1980, *Tables for Normal Tolerance Limits, Sampling Plans, and Screening*, Marcel Dekker, Inc., New York, NY, Table 1, pp. 17-69, courtesy of Marcel Dekker, Inc.

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Calc No.: SD-040303-001, Rev. 0

Attachment 8

Page 1 of 2

Table T-11b: One-sided tolerance limit factors for a normal distribution

Statistical tolerance limits are values derived from sample data in such a manner as to encompass a specified fraction of a population's values and to do so with a prescribed level of confidence. Table 11-b provides the factors needed to produce one-sided lower *or* upper bounds from samples of size n of normally distributed variables. Factors are given for three fractions—π = 0.90, 0.95, and 0.99—and for three levels of confidence—γ = 0.90, 0.95, and 0.99. For other combinations of n, π, and γ, refer to Odeh and Owen (1980, pp. 17-69).

Because statistical tolerance intervals are functions of the sample's mean and standard deviation, the intervals themselves are random variables: they change their calculated endpoints with each new sample. But, because of the nature of their construction, $100\gamma\%$ of them will contain $100\pi\%$ of the population from which their samples are drawn.

Example 1: Consider a sample of size $n = 10$ that yields $\bar{x} = 143.2$ and $s = 13.9$. To create a one-sided *upper* interval that contains 90% of the population with 95% confidence, turn to Table T-11b. From the three columns headed by $\gamma = 0.95$, find the column headed by $\pi = 0.90$. At the intersection of that column with the row labelled 10, note the value $k = 2.355$. The interval's upper endpoint is found by calculating $\bar{x} + ks = 143.2 + 2.355(13.9) = 143.2 + 32.7 = 175.9$. Thus, with 95% confidence, the interval $(-\infty, 175.9)$ contains 90% of the population.

Example 2: Consider a sample of size $n = 10$ that yields $\bar{x} = 143.2$ and $s = 13.9$. To create a one-sided *lower* interval that contains 90% of the population with 95% confidence, turn to Table T-11b. From the three columns headed by $\gamma = 0.95$, find the column headed by $\pi = 0.90$. At the intersection of that column with the row labelled 10, note the value $k = 2.355$. The interval's upper endpoint is found by calculating $\bar{x} - ks = 143.2 - 2.355(13.9) = 143.2 - 32.7 = 110.5$. Thus, with 95% confidence, the interval $(110.5, -\infty)$ contains 90% of the population.

95% POPULATION => π = 0.95
95% CONFIDENCE => γ = 0.95

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Attachment 8

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Attachment 9 – Excel Spreadsheets Used for Computations

Table M2 (Units 1 & 2)

Heat No.	Bar Size	Yield Point Test #1 (psi)	Yield Point Test #2 (psi)
C34105	#11	50,897	52,115
B37160	#11	51,025	50,833
C35157	#8	51,265	50,759
B36171	#11	52,115	52,692
A37151	#11	50,448	50,192
B37340	#11	52,179	49,487
A36334	#11	50,384	49,935
		Average	51,023
		Standard Deviation	947.04

	B	C	D	E
1				
2	Table M2 (Units 1 & 2)			
3				
4	Heat No.	Bar Size	Yield Point Test #1 (psi)	Yield Point Test #2 (psi)
5	C34105	#11	50897	52115
6	B37160	#11	51025	50833
7	C35157	#8	51265	50759
8	B36171	#11	52115	52692
9	A37151	#11	50448	50192
10	B37340	#11	52179	49487
11	A36334	#11	50384	49935
12				
13			Average	=AVERAGE(D5:E11)
14			Standard Deviation	=STDEV(D5:E11)
15				
16				
17				

Table M3-1 (Unit 1)		
Heat	Bar Size	I&M Determined Yield Point, psi
B37160	#11	51,025
B37160	#11	50,833
C34105	#11	50,897
C34105	#11	52,115
C35157	#8	51,265
C35157	#8	50,759
	AVG	51,149
	SDEV	505.46

Table M3-2 (Unit 2)		
Heat	Bar Size	I&M Determined Yield Point, psi
A36334	#11	50,384
A36334	#11	49,935
A37151	#11	50,448
A37151	#11	50,192
B36171	#11	52,115
B36171	#11	52,692
B37340	#11	52,179
B37340	#11	49,487
C35157	#8	51,265
C35157	#8	50,759
	AVG	50,946
	SDEV	1072.65

	A	B	D	E
1	Table M3-1 (Unit 1)			
2	Heat	Bar Size	I&M Determined Yield Point, psi	
3	B37160	#11	51025	
4	B37160	#11	50833	
5	C34105	#11	50897	
6	C34105	#11	52115	
7	C35157	#8	51265	
8	C35157	#8	50759	
9				
10				
11		AVG	=AVERAGE(D3:D8)	
12		SDEV	=STDEV(D3:D8)	
13				
14				
15				
16				
17				
18	Table M3-2 (Unit 2)			
19	Heat	Bar Size	I&M Determined Yield Point, psi	
20	A36334	#11	50384	
21	A36334	#11	49935	
22	A37151	#11	50448	
23	A37151	#11	50192	
24	B36171	#11	52115	
25	B36171	#11	52692	
26	B37340	#11	52179	
27	B37340	#11	49487	
28	C35157	#8	51265	
29	C35157	#8	50759	
30				
31				
33		AVG	=AVERAGE(D20:D29)	
34		SDEV	=STDEV(D20:D29)	

Attachment 10 – Normal Distribution Statistical Data Sheets

W Test for Normality – 14 I&M Test Results for Unit 1 & 2

Refer to Pages 7-9 through 7-12 of Reference 3
q = 0.05 = level of confidence (Refer to Page 11)

Rank i	Ascending Ordered Data y(i)	Descending Ordered Data y(n-i+1)	Difference [y(n-i+1) – y(i)]	Table T-6a Coefficients for K=7 a(i)	a(i)[y(n-i+1) – y(i)]
1	49487	52692	3205	0.5251	1682.9455
2	49935	52179	2244	0.3318	744.5592
3	50192	52115	1923	0.2460	473.0580
4	50384	52115	1731	0.1802	311.9262
5	50448	51265	817	0.1240	101.3080
6	50759	51025	266	0.0727	19.3382
7	50833	50897	64	0.0240	1.5360
8	50897				
9	51025				
10	51265				
11	52115				
12	52115				
13	52179				
14	52692				
				B =	3334.6711

Table T-6b from Ref. 3
Wq(n) = 0.874

S = 947.04
n = 14

W = (B2)/(n-1)*(S**2) = 0.9537**

W > Wq(n) , Result = Normal Distribution

W Test for Normality – 6 I&M Test Results for Unit 1

Rank i	Ascending Ordered Data y(i)	Descending Ordered Data y(n-i+1)	Difference [y(n-i+1) – y(i)]	Table T-6a Coefficients for K=3 a(i)	a(i)[y(n-i+1) – y(i)]
1	50759	52115	1356	0.6431	872.0436
2	50833	51265	432	0.2806	121.2192
3	50897	51025	128	0.0875	11.2000
4	51025				
5	51265				
6	52115				
				B =	1004.4628

Table T-6b from Ref. 3
Wq(n) = 0.788

S = 505.46
n = 6

W = (B2)/(n-1)*(S**2) = 0.7898**

W > Wq(n) , Result = Normal Distribution

W Test for Normality – 10 I&M Test Results for Unit 2

Rank i	Ascending Ordered Data y(i)	Descending Ordered Data y(n-i+1)	Difference [y(n-i+1) – y(i)]	Table T-6a Coefficients for K=5 a(i)	a(i)[y(n-i+1) – y(i)]
1	49487	52692	3205	0.5739	1839.3495
2	49935	52179	2244	0.3291	738.5004
3	50192	52115	1923	0.2141	411.7143
4	50384	51265	881	0.1224	107.8344
5	50448	50759	311	0.0399	12.4089
6	50759				
7	51265				
8	52115				
9	52179				
10	52692				
				B =	3109.8075

Table T-6b from Ref. 3
Wq(n) = 0.842

S = 1,072.65
n = 10

W = (B2)/(n-1)*(S**2) = 0.9339**

W > Wq(n) , Result = Normal Distribution

Calculation Review Comment Form

Calculation No.: SD-040303-001	Revision: 0	CS NO:
Title UNIT 1 & 2 CONTROL ROD DRIVE MISSILE SHIELD REINFORCING STEEL YIELD STRENGTH		Attachment: 11 Page: 1 of 1
This form was completed using the Calculation Review Checklist from 12 EHP 5040 DES.003		

☒ Attachment 3 Calculation Review Checklist	☐ Attachment 4, Restricted Use Calculation Review Checklist ☐ Full Scope Review ☐ Partial Scope Review (Describe scope in Comment #1)

Comment #	Attribute #	Comment	Resolution
1	4a	Provide an overview of the method/approach that will be used for the calculation.	The overview of the method/approach has been provided at the beginning of Section 6.0.
2	6b	The details currently provided in Sections 6.1 and 6.2 more correctly belong in Section 8, Assumptions and Limitations.	These sections have been moved to Section 8.0, "Assumptions & Limitations".
3	7d	The details for the tests for normality are an inherent part of the calculation and should be evaluated in Section 9, Calculations.	The tests for normality now appear in Section 9.0, "Calculations".
4	7c	For the information currently in Section 6.1 (see Comment 2), additional justification is needed for discounting the use of the CMTR data.	Additional justification for discounting the use of the CMTR data has been given in Section 8.0.
5	6a	In the current Section 6.2, an incorrect statement is made regarding CMTR data vs. I&M test data. Not all CMTR values exceed the companion I&M test values.	This incorrect statement has been corrected.
6	4b	In the current Section 6.2, the I&M test data for the individual tests from each heat are called out separately. There is no basis (or need?) for this approach. This also applies to Section 9.0, Method 2 (page 15).	All I&M tests are now considered together. The individual tests from each heat are now not called out separately.
7	6b	On Page 8, 6.2.i, the determined strain may not be correct. Elongation was determined over an 8 inch specimen, not a 36 inch specimen.	This section was removed from the calculation. The strain rate is no longer being used in the discussion.
8	11d	Attachment 10 graph needs to be reconfigured so that the unit specific information can be discerned when printed in black and white.	This has been completed. Graphs for Unit 1 and Unit 2 can now be discerned.
9	N/A	Various editorial comments provided via marked up pages.	These have all been reviewed and corrected.
Computations were checked by a combination of Microsoft Excel Statistical Analysis Tools and TI-86 calculator.			

Reviewed by:	Print Name P. W. Leonard	Signature [signature]	Date 3/25/04

Design Review Board Approval Form

☐ E-Mod, ☐ TM, ☒ CALC, ☐ Other Product No.: SD-040303-001 Rev. 0

Title of Product: Missile Block Rebar Calculation Date: March 22, 2004

The DRB will be responsible for providing an additional level of management oversight to assure the quality of products reviewed and endorsed by the DRB.

DRB members shall pay particular attention to the aspects of the products (i.e., design input, assumptions, equipment locations, etc) within their respective areas of expertise.

DRB comments have been satisfactorily resolved and incorporated or included as open item(s) as designated by membership signatures OR Chairperson signature below.

Approval by Membership

Area	Name (Printed)	Name (Signature)	Date
Regulatory Affairs			
Configuration Control	Donald Hafer	[signature]	3/25/04
NE Electrical			
NE I & C			
NE Mechanical			
NE Structural			
System Engineering			
Operations			
Nuclear Safety			
Projects			
MMS			
MET			
ENPI			
ENPV			
ESY			
Reactor Engineering			
ENPM			

OR

Approval by Chairperson

Name (Printed)	Name (Signature)	Date
Paul R. Donavin	[signature]	3-25-04

Calc No.: SD-040303-001, Rev. 0

Attachment 12

Page 1 of 1

This form is derived from Data Sheet 1 of 12-EHP-5040-DRB-001, Rev. 4, Design Review Board Expectations, Policies, and Practices.