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AUTHOR AFFILIATION

MCGAUGHY, R.W. RECIP. NAME

Iowa Electric Light & Power Co. RECIPIENT AFFILIATION

DENTON, H.R.

Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards response to 840222 request for add1 info re IE Bulletin 80-11, "Masonry Wall Design."

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AEDD 11

ENCL

Iowa Electric Light and Power Company

April 23, 1984 NG-84-1681

Mr. Harold Denton, Director Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555

Subject:

Duane Arnold Energy Center

Op. License No: DPR-49
Masonry Wall Design

Dear Mr. Denton:

This letter is submitted in response to Mr. D. B. Vassallo's letter dated February 22, 1984 regarding masonry block walls at the DAEC. The information contained in Attachments 1 and 2 provides our response to the information requested.

Please contact this office if there are additional questions regarding this subject.

Very truly yours,

K. W. Midaugh

Richard W. McGaughy Manager, Nuclear Division

RWM/BWR/dmb*

cc: B. Reid

L. Liu

S. Tuthill

M. Thadani

NRC Resident Office

Commitment Control No. 84-0041

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8404260150 840423 PDR ADDCK 05000331 Q PDR 50-331

MASONRY WALL DESIGN

Docket # 50-53/
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Date 4.23.84of Document
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Response to Request for Additional Information Masonry Wall Design, IE Bulletin 80-11 (dated February 22, 1984) Duane Arnold Energy Center Docket No. 50-331

1.a Question:

With reference to the reinforcement in masonry walls, the ACI 531-79 Code (1) specifies that the minimum area of reinforcement in a wall in each direction, vertical or horizontal, shall be 0.0007 (0.07%) times the gross cross-sectional area of the wall and that the minimum total area of steel, combined vertical and horizontal, shall not be less than 0.002 (0.2%) times the gross cross-sectional area. Clarify whether the reinforced walls at this plant meet the above requirements. It should be noted that the horizontal reinforcement is installed to satisfy the minimum reinforcement requirement for a reinforced wall.

Response:

The masonry walls reviewed at DAEC for Bulletin 80-11 meet the reinforcing requirements of ACI 531-79 for reinforced masonry walls. This is based on a review of design drawings for masonry walls at DAEC (See Reference 3, Attachment 5, Design Drawings A-21, Revision 5 and A-22, Revision 2). We have summarized the percentages of horizontal and vertical reinforcement for various wall thicknesses in the table below.

		of Reinforcement	
Wall Thicknesses	Vertical	Horizontal	Total
8"	0.24	0.32	0.56
12"	0.16	0.21	0.37
2'-3"	0.14	0.15	0.29
4'-0"	0.116	0.081	0.203

Note: 1. For wall thicknesses between 12" and 2'-3" the percentage of reinforcement would be greater than the percentages specified for a 2'-3" wall thickness.

2. For wall thicknesses between 2'-3" and 4'-0" the percentage of reinforcement would be greater than the percentages specified for a 4'-0" wall thickness.

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1.b Question:

If the joint reinforcement is used to resist tension in the walls meeting the above minimum requirements, it should follow the working stress design method which limits its allowable to 30 ksi. Please clarify whether this requirement has been satisfied. If this requirement is not satisfied, identify all affected walls along with the calculated stress value for each wall and indicate specific actions planned to correct this situation.

Response:

The masonry walls reviewed at DAEC for Bulletin 80-11 are reinforced masonry walls which meet the reinforcing requirements of ACI 531-79. The working stress design method was the method of design utilized (unless noted otherwise for load combinations involving extreme environmental or abnormal loads).

Joint reinforcement was used in resisting the tension in masonry walls. The calculations used an allowable stress for joint reinforcement equal to 24 ksi which is less than the allowable specified by ACI 531-79 ($F_S=30~\rm ksi$). This allowable stress was increased for loading combinations as defined in Reference 3, Attachment 3, Section 5.2.

Therefore the walls reviewed at DAEC for Bulletin 80-11 meet the requirements as stated in the question above.

1.c Question:

Indicate if there are any walls that may have been qualified using the tensile resistance of the joint reinforcement but not satisfying the above stated minimum requirements. It should be noted that the NRC, at present, does not approve the use of joint reinforcement to qualify this type of wall (See attached staff position). In view of this, indicate all walls belonging to this category and your intended actions to bring those walls in compliance with the staff criteria.

Response:

As previously stated the masonry walls reviewed at DAEC for Bulletin 80-11 meet the reinforcing requirements of ACI 531-79 for reinforced masonry walls. Therefore no walls have been qualified using the tensile resistance of the joint reinforcement which do not satisfy the requirements stated in Question 1.a.

2. Question:

With respect to the compressive strength of masonry and mortar strength, the Licensee indicated that a test program was conducted (2) to confirm the assumed values used in the analysis ($f_{m^0} = 2000$ psi and $m_0 = 2000$ psi). Indicate whether the tests were conducted in accordance with ASTM C140 for the masonry units and ASTM E447 for the masonry prisms. Also provide the test results for review.

Response:

Attachment 2 are the test reports for the masonry block and mortar used in the construction of masonry walls at DAEC. The test reports for masonry block do not make specific reference to the procedure used for testing, but do specify that the block conforms to ASTM C90, Grade NI (with exception to moisture content). In reviewing the ASTM specification (ASTM C90) for Hollow Load-Bearing Concrete Masonry Units the specified sampling and testing procedure is ASTM C140. This indicates that the tests were conducted in accordance with ASTM C140.

The masonry prism test (ASTM E447) was not conducted for testing masonry compressive strength.

3. Question:

Please note that the NRC is currently preparing a position statement regarding the energy balance technique, which will be forwarded to the Licensee in the near future. In the meantime, please clarify whether the following walls have also been qualified by the energy balance technique: 412-13, 412-14, 412-17, and 412-18 (from Attachment 4 of Reference 2). If yes, explain why they were not included in the first response of Reference 2.

Response:

Wall 412-13 (subject to pipe rupture load) was originally analyzed using yield line theory as stated in Reference 3, Attachment 4, Page 7 of 11. This wall was re-examined after the NRC expressed a concern with the use of yield line theory. Our re-evaluation of this wall determined that the wall would behave elastically using an energy balance technique as a method of analysis. This is stated in the revised report Reference 2, Attachment 4, Page 7 of 11.

Walls 412-14 and 412-17 were analyzed using the working stress design method. The energy balance technique or yield line theory was not used in the qualification of these walls. (Note: Reference 3, Attachment 4, Page 7 of 11 stated that wall 412-17 used "Yield Line Theory for pipe break". This wall was reanalyzed (for jet impingement load) using working stress design method and Reference 2 deleted the comment with regard to "Yield Line Theory for Pipe Break").

Wall 412-18, (subjected to seismic and room pressurization loads) was originally analyzed using an inelastic energy balance technique as stated in Reference 3, Attachment 4, Page 7 of 11. This wall was re-examined after the NRC expressed a concern with the use of inelastic energy balance technique. Our re-evaluation of this wall determined that the wall would behave elastically using the working stress design method. Therefore the comment stating "Energy balance with pipe break loading" was deleted in the revised report Reference 2, Attachment 4, Page 7 of 11.

References:

- 1. ACI 531-79 and ACI 531-R-79
 Building Code Requirements for Concrete Masonry Structures
 American Concrete Institute, 1979.
- L.D. Root (Iowa Electric Light and Power Company) Letter with Enclosures to H.D. Denton (NRC)
 Subject: IE Bulletin 80-11, Masonry Wall Design October 6, 1982 (LDR-82-264)
- L.D. Root (Iowa Electric Light and Power Company) Letter with Enclosures to J.G. Keppler (NRC) Subject: IE Bulletin 80-11, Masonry Wall Design November 10, 1980 (LDR-80-335)

yin city testing and engineering

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA - PROJECT NO. 7884

November 24, 1971

REPORTED TO: Bechtel Corporation

P.O. Box 209 Palo, Iowa 52324

Attn: M.E. Daubenheyer

FURNISHED BY: Cedar Rapids Block Company

COPIES TO:

LABORATORY No. 6-9695 DIMENSIONS:			. () . () . ()	•	ASTM:C9 SPECIFICA GRADE "	TIONS	
Sample Number 6 Size and Type of Block 12"x8"x1 Length (in.) 15 5/8 Width (in.) 11 5/8 Height (in.) 7 5/8 Shell Thickness (in.) 1 33/64 Web Thickness (in.) 1 9/32 Weight as Received (lb.) 54.69 Number of Cells 2 Voids (%) 51 Equivalent Web (in./lin. ft.) 3.04 Date Cast 3.04	15 5/8 11 5/8 7 5/8 1 17/32	15 5/8	15 5/8 11 5/8 7 5/8 1 17/32	10 15 5/8 11 5/8 7 5/8 1 17/32 1 19/64 54.20 2 51 3.02	Individual Unit	Average of 5 Units Minimum : Minimum	1½" 1 1/8
ABSORPTION:							
Per Cent	3.5 4.9	5.9 8.0	5.7 7.7	5.9 8.0		Maximum 1	l3pcf
DRY DENSITY (pcf)136	141	136	137	136			
MOISTURE CONTENT AS RECEIVED:							
Per Cent of Total Absorption42	73	42	44 .	42		Maximum :	35%
COMPRESSION:				·			
Load (lb.)	400000+ 182 2200+	311,000 182 1710	267,000 182 1470	353,000 182 1940	Min.800psi	Min.1000p	osi
Date of Test November	23, 197	1					

POTENTIAL SHRINKAGE (%).....

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content.

Samples were submitted to the laboratory and received here on November 5, 1971.

This work was authorized by your Purchase Order Number 7884-5-6959.

Twin City Testing and Engineering

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114



CONCRETE BLOCK TEST

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

12-7-71

REPORTED TO: Bechtel Corporation

Box 209

(3) Palo, Iowa 52324

FURNISHED BY:

Copies to:

(3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

LABORATORY No. 70-1966			•				
DIMENSIONS:	8" x 8" x	: 16" Heav	y Density	7		ASTM CO	•
Sample No. Type of Block. Length (Inches) Width (Inches) Height (Inches) Shell Thickness (Inches) Web Thickness (Inches) Weight (Lbs.) No. of Cells.	Corner 15 10/16 7 11/16 7 10/16 1 1/16 1 1/16 11.37 2	W-2 Std. 15 11/16 7 11/16 7 10/16 1 5/16 1 1/16 39.10 2 48	W-3 St. 15 10/16 7 11/16 7 10/16 1 6/16 1 1/16 40.47 2	W-L St. 15 10/16 7 11/16 7 11/16 1 L/16 1 1/16 39.40 2 48	W-5 Std. 15 10/16 7 11/16 7 10/16 1 6/16 1 40.80 2 46	GRADE Individual	"N-I"
Voids (%) Equivalent Web (in./l-f.) COMPRESSION:	2.45	بابار. 2	2.45	2.45	2.30		Min. 234
Load (Lbs.)	179,000 120 11,90 December	121 1690	265,000 120 2210	217,800 120 1810	287,000 120 23 <i>9</i> 0	Min.800psi	Min.100 p.
ABSORPTION:					·		
Per Cent		4.9	4.5	4.8 6.6	4.2 6.0		Max.13 pod
DENSITY (Lbs./Cu.Ft.)	139	138	파이	138	П¹О		
MOISTURE CONTENT (%)	62	5 3	51	59	51		Max. 35%

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content as received.

> Samples W-1 through W-5 were submitted to the laboratory and received here on 11-30-71.

TWIN CITY TESTIL'S AND ENGINEERING LASDRATORY. INC

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

•		
	PROJECT:	

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA PROJECT NUMBER 7884

REPORTED TO: Bechtel Corporation

P.O. Box 209

Palo. Iowa 52324

Attn: M.F. Daubenheyer

December 22, 1971 DATE:

िर्धानि किलेंगांड Block Company

ASTM: C90-70

LABORATORY No.

6-9824-

SPECIFICATIONS

DIMENSIONS:			_	CUTEL C	CRI GRADE "	N-I"
JIMENSIONS:			B	15JOB 72	८म	
Sample Number	12	13	14	15,00		
Size and Type of Block	8"x16" High	Density			Individual	Average Of
Length (in.)	/8 15 5/8	15 5/8	12 2/8		<u>Unit</u>	5 Units
Width (in.)			11 5/8		,	
Height (in)	8 / 5/8	7 5/8	7 5/8	7 5/8		Minimum 1½"
Shell Thickness (in.)	7/64 1 3//64	1 35/64	1 17/64	1 17/64		Min.1 1/8"
Web Thickness (in.)		56.61	56.18	57.82		riii.1 1/0
Weight as Received (lb.)	2 56.2 <i>7</i> 2	2	2	2		
Number of Cells 2	51	5i	51	50		
Voids (%)		3.04	3.04	3.04	•	Minimum 2½"
Date Cast	3.03	3.01	,			
BSORPTION:			٠			
Per Cent3.8	4.0	3.6	3.9	3.7		
Lb./Cu. Ft5.4	5 . 7·	5.2	5.6	5.2		Max. 13 tof
DRY DENSITY (pcf)141	140	141	141	142		*Min. 147pcf -
MOISTURE CONTENT AS RECEIVED:				•		
Per Cent of Total Absorption50	48	57	54	57	-	Maximum 35%
COMPRESSION:		. •				
Load (lb.)	000+400,000	+400,000	+400,000	+400,000+		

182

182 182 182 2200+ 2200+

2200+ Min.800psi Min.1000osi 2200+ Gross Unit Load (psi)......2200+

Net Area (sq. in.)

*Project Requirement

POTENTIAL SHRINKAGE (%).....

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content. The dry density is below the project requirement.

Samples were submitted to the laboratory and received here on December 15, 1971.

Twin City Testing and Engineering

TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA

PROJECT NUMBER 7884 REPORTED TO: Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324

December 22, 1971

FURNISHED BY: Cadar Rapids Block Company

COPIES TO:

Attn: M.F. Daubenheyer						
LABORATORY No. 6-9824					ASTM:C9	TIONS
DIMENSIONS:	•				GRADE "	<u> </u>
	15 5/8	13 Density 15 5/8 11 5/8	14 15 5/8 11 5/8	15 15 5/8 11 5/8	Individual Unit	Average Of 5 Units
Height (in.)	7 5/8 1 37/64 1 17/64 56.27	7 5/8 1 35/64 1 17/64 56.61	7 5/8 1 35/64 1 17/64 56.18	7 5/8 1 39/64 1 17/64 57.82		Minimum 1½" Min.1 1/8"
Number of Cells	2 51 3.05	2 51 3.04	2 51 3.04	2 50 3.04		Minimum 2岁"
ABSORPTION:						
Per Cent	4.0 5.7	3.6 5.2	3.9 5.6	3.7 5.2		Max. 13 pcf
DRY DENSITY (pef)141	140	141	141	142		*Min. 147pcf
MOISTURE CONTENT AS RECEIVED:						
Per Cent of Total Absorption50	48	-57	54	57		Maximum 35%
COMPRESSION:						
Load (lb.)	0 ⁺ 400,000 182 2200+	0 ⁺ 400,000 182 2200+	+400,000 182 2200+	⁺ 400,000 ⁺ 182 2200+	Min.800psi	Min.1000psi
Net Unit Load (psi)	er 21. 19	971			*Proje	ct Requiremen

POTENTIAL SHRINKAGE (%).....

REMARKS: The above blocks meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units except for moisture content. The dry density is below the project requirement.

Samples were submitted to the laboratory and received here on December 15, 1971.

AS A MUTUAL PROTECTION TO CLIENTS. THE PURLIC AND OURSELVES ALL REPORTS AND SUMMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS. AND AUTHOR-IZATION FOR PURLICATION OF STATEMENTS. CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

WIN CITY TESTING AND ENGINEERING LAGORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

CONCRETE BLOCK TEST REPORT OF:

DUANE ARNOLD NUCLEAR PLANT

7884

PROJECT: PALO, IOWA REPORTED TO: PROJECT NO. Bechtel Corporation

P 0: Roy 200

May 10, 1972

FURNISHED BY:

COPIES TO:



P.O. Box 209 Palo, Iowa 52324 Attn: M.F. Daubenhever						
ABORATORY No. 6-10161 DIMENSIONS:	Appet State of the	a a sa madding is die sa			SPECIFI	C90-70 CATIONS "N-I"
Sample Number 26 Size and Type of Block 12"x8"> Langth (in.) 15	·15 5/8	15 5/8	29 15 5/8	30 15 5/8	Individual Unit	Average of 3 Units
Width (in.) 7 5/8 Shell Thickness (in.)				11 5/8 7 5/8 1 35/64 1 19/64 57.52	÷	Minimum 1½ Min. 1,1/8
Voids (%)	50 3.00	50 2.96	50 3.00	50 3.01		Hinimum 2½
ABSORPTION:						
Per Cent	4.3 6.1	4.3 6.2	4.3 6.1	4.3 6.2		Max 13 pcf
DRY DENSITY (pcf)140.3	141.6	140.1	141.4	140.8		
MOISTURE CONTENT AS RECEIVED:						
Per Cent of Total Absorption 56	59	56	58	54		Maximum 35
COMPRESSION:	_					
Load (lb.)	+ 400000+ 182 2200+	400000+ 182 2200+	400000+ 182 2200+	400000+ 182< 2000+	Min.800psi	Min.1000ps
Net Unit Load (psi)	1972	* 4		F .	至 (2)	
POTENTIAL SHRINKAGE (%)			;		四十分	

REMARKS: The above block meet ASTM specifications for Grade N-I-Hollow Load-Bearing

Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and received here on April 28, 1972.

Y TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

CONCRETE BLOCK TEST

DUANE ARNOLD NUCLEAR PLANT

DATE:

May 10, 1972

PALO, IOWA REPORTED TO PROJECT NO. 7884

Bechtel Corporation P.O. Box 209

H.F. Daubenheyer

COMES TO:

FURNISHED BY:

Palo, Iowa 52324

LABORATORY No. 6-10161

DIMENSIONS:

Sample Number Size and Type of Block Length (in.) Width (in.) Height (in.) Shell Thickness (in.) Web Thickness (in.) Weight as Received (lb.) Number of Cells	.8"x8"x16 .15 5/8 .7 5/8 .7 5/8 .1 19/64 .1 3/64 .40.93	15 5/8 7 5/8 7 5/8 1 19/64	15 5/8 7 5/8 7 5/8	7 5/8 7 5/8	35 15 5/8 7 5/8 7 5/8 1 15/64 1 3/64 41.21	Individual Unit	Average 3 Unit	<u>s</u> 1날"
Voids (%)	46 2.48	46 2.48	46 2.48	46 2.48	46 2.48		Minimum	2½"
ABSORPTION: Per Cent		4.4 6.3	4.3 6.2	4.5 6.4	4.4 6.4		Max. 13	ncf
DRY DENSITY (pcf)		142.0	143.2	141.2	142.4			
MOISTURE CONTENT AS RECEIVED:								
Per Cent of Total Absorption	49	50	52	50	51		Maximum	35%
COMPRESSION:				;				
Loed (lb.)							•	

119 119 119 2650 Gross Unit Load (psi) 2720 2690 2870 2740 Date of Test May 8, 1972

Min.800osi in.1000ps:

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and: received here on April 28, 1972. ECTION TO CLIENTS, THE PUBLIC AND OURSELVES. ALL REPORTS ARE SUGMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS. AND AUTHOR-CATION OF STATEMENTS. CONCLULIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REPORT OF: DUANE ARNOLD NUCLEAR PLANT

CONCRETE BLOCK TEST

PALO. IOWA

May 10, 1972

REPORTED TOPROJECT NO. 7884

Bechtel Corporation P.O. Box 209

COPIES TO:

FURNISHED BY:

Palo, Iowa 52324 Attn: M.F. Daubenheye

LABORATORY No. 6-10161

DIMENSIONS:

Sample Number Size and Type of Block Length (in.) Width (in.) Height (in.) Shell Thickness (in.) Web Thickness (in.) Weight as Received (lb.) Number of Cells Voids (%) Equivalent Web (in./lin. ft.)	8"x8"x16 15 5/8 7 5/8 7 5/8 1 19/64 1 3/64 40.93 2 46 2.48	15 5/8 7 5/8 7 5/8	15 5/8 7 5/8 7 5/8	34 15 5/8 7 5/8 7 5/8 1 19/64 1 1/32 41.03 2 46 2.48	35 15 5/8 7 5/8 7 5/8 1 15/64 1 3/64 41.21 2 46 2.48	Individual Unit	Average of 3 Units Minimum 1½" Minimum 1"
ABSORPTION:					•		
Per Cent		4.4 6.3	4.3 6.2	4.5 6.4	4.4 6.4	•	Max. 13 pcf
DRY DENSITY (pcf)	142.1	142.0	143.2	141.2	142.4		•
MOISTURE CONTENT AS RECEIVED:							
Per Cent of Total Absorption	49	50	52	50	51		Maximum 35%
COMPRESSION:					•		
Load (lb.) Gross Area (sq. in.) Gross Unit Loed (psi) Net Area (sq. in.) Net Unit Load (psi) Date of Test	119 2720	119 2690	119	326,000 119 2740	316,000 119 2650	Min.800psi	Min.1000psi

POTENTIAL SHRINKAGE (%)

REMARKS: The above block meet ASTM specifications for Grade N-I Hollow Load-Bearing Concrete Masonry Units, except the moisture content is too high.

Samples were submitted to the laboratory and: received here on April 28, 1972. AN A NUTUAL PROTECTION TO CLIENTS. THE PUBLIC AND OURSELVES ALL REPORTS ARE SHOWITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS. AND AUTHOR-IZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL



ENGINEERS AND CHEMISTS

. 662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IONA

9-1-71

REPORTED TO: Bechtel Corporation

Box 209

FURNISHED BY: Bechtel Corporation

Palo, Iona 52324

COPIES TO: (3) TCT & EL, Inc. - Waterloo
(3) TCT & EL, Inc. - Palo

			(J) 101 G 111, 1	
FIELD DATA:				
# Job Identification	14	18	10	
# Date Cast	8-25-71	8-25-71	8-25-71	
# Age to be Tested, days	7	28	90	
# Type of Sample	2" x 2" cub	es	•	● .
# Location Placed	Turbine bui	lding block pla	cement mortar	
Specified Strength @ 28 Days		•		· ·
Mix Proportions: Cement Fine Agg. Admixture	9l# 25l# Hidra lime	10		
COMPRESSIVE STRENGTH:		1		
Laboratory Number	71116-1	71416-2	714,16-3	
Date Received	8-26-71	8-26-71	8-26-71	
Method of Curing: Days on Job & Enroute Days Lab. Cured	1 6	1 27	1 89	
Area, square inches	4.0			
Load at Failure, pounds	10,500		· .	
Strength, psi	2620			

REMARKS:

^{*} Information taken from field data sheet prepared by Mr. Olson.

ABORATORY. INC. TWIN CITY TESTING AND ENGINEERING L



662 Cramwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

DATE:

9-21-71, 10-11-71

ÿ."

DUANE ARNOLD ENERGY CENTER

PALO, ICHA

FURNISHED BY:

REPORTED TO: Bechtel Corporation

Box 209

(3) Palo, Iowa 52324

COPIES TO:(3) TCT & EL, Inc.-Waterloo (3) TCT & EL, Inc.-Palo

FIELD DATA:									
# Job Identification	A	В	C						
# Date Cast	9-14-71	9-14-71	9-14-71						
# Age to be Tested, days	7	7 7 7							
* Type of Sample	2" x 2" cube	2" x 2" cubes							
* Location Placed	Block mortan	Block mortar room #1 - Turbine Building							
Specified Strength @ 28 Days									
<pre># Mix Proportions: # Cement # Fine Agg. # Admixture # Admixture</pre>	Mortar 9h# 25h# Hydrated lin AEA - 0.7 fi	94#							
COMPRESSIVE STRENGTH:		1	1	•					
Laboratory Number	71479-1	711,79-2	71479-3						
Date Received	9-20-71	9-20-71	9-20-71						
Method of Curing: Days on Job & Enroute Days Lab. Cured	6	6	6						
Area, square inches	1.0	4.0	4.0						
Load at Failure, pounds	13,800	15,300	15,000						
Strength, psi	3450	3820	3750						

REMARKS:

Strength, psi

* Information taken from field data sheet prepared by Mr. Olson.

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645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



DUANE ARNOLD ENERGY CENTER

PALO, IOWA

DATE:

9-23-71

Bechtel Corporation

FURNISHED BY: Bechtel Self Mixed

Box 209

COMES TO: (3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

(3) Palo, Iowa 52324

FIELD DATA:			
# Job Identification	2&	28	2 C
* Date Cast	8-26-71	8-26-71	8-26-71
# Age to be Tested, days	28	28	28
# Type of Sample	2" x 2" cubes	•	

Location Placed

Turbine building block placement mortar

Specified Strength @ 28 Days

* Mix Proportions:

Cement:

91.#

Fine Agg.: Admixture: 254#

Mortar

Admixture:

Hydrated lime-10# AEA - 0.5 fl. oz.

COMPRESSIVE STRENGTH:		ı :	· • • • • • • • • • • • • • • • • • • •	
Laboratory Number	71477-1	71477-2	71477-3	•
Date Received	9-20-71	9-20-71	9-20-71	
Method of Curing: Days on Job & Enroute Days Lab. Cured	25 3	25 3	2 5 3	
Area, square inches	4.0	h.o	4.0	
Load at Failure, pounds	23,600	23,000	23,800	
Strength, psi	5900	5750	5950	

Information taken from field data sheet prepared by Mr. Olson. REMARKS:



. 645-3601

twin city testing <u>and</u> engineering laboratory. I**NC.**



ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSIOR TESTS



DUANE ARNOLD ENERGY CENTER

9-24-71

PALO, IOWA

(3) Palo, Iowa 52324

REPORTED TO: Bechtel Corporation

FURNISHED BY: Bechtel Self Mixed

Box 209

DATE:

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

FIELD DATA:			
* Job Identification	3 &	3 B	3 C
* Date Cast	8-27-71	8-27-71	8-27-71
[∯] Age to be Tested, days	28	28	28

* Type of Sample

2" x 2" cubes

* Location Placed

Turbine building block placement mortar

Specified Strength @ 28 Days

Mix Proportions:

Cement:

Fine Agg.:

94 254#

Mortar

Admixture:

Hydrated lime 12.5#

Admixture:

AEA - 22 oz.

COMPRESSIVE STRENGTH:		1	1	
Laboratory Number	71478-1	71478-2	71478-3	
Date Received	9-20-71	9-20-71	9-20-71	
Method of Curing: Days on Job & Enmute Days Lab. Cured	21ı 1ı	7† 5 †	21 ₄	
Area, square inches	r.0	4.0	4.0	
Load at Failure, pounds	22,200	20,000	19,500	
Strength, psi	5550	5000	4870	

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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645-3601

WIN CITY TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

DUALE ARMOLL ENERGY CENTER

DATE:

10-6-71

PALO, IONA

REPORTED TO:

Bechtel Corporation

FURNISHED SY: Bechtel Self Mixed

Box 209 (3) Palo, Iowa 52324 COMES TO: (3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

FIELD DATA:

* Job Identification

В

* Date Cast

9-29-71

9-29-71

9-29-71

Age to be Tested, days

* Type of Sample

2" x 2" cubes

Location Placed

Control building block walls

Specified Strength @ 28 Days

* Mix Proportions:

Cement:

Fine Agg.:

Admixture:

Load at Failure, pounds

Admixture:

Block mortar

91.#

254#

Hydrated lime - 10#

AEA - 0.7 oz.

COMPRESSIVE STRENGTH:		i - 1	1
Laboratory Number	71522-1	71522-2	71522-3
Date Received	10-1-71	10-1-71	10-1-71
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 5	2 5	2 5
Area, square inches	4.0	h•0	4.0

3380 1100 1130 Strength, psi * Information taken from field data sheet prepared by Mr. Olson. REMARKS:

16,400

16,500

Twin City Testing and Engineering Laboratory, Inc.

13,500

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

10-27-71

PALO, IOWA

REPORTED TO:

Bechtel Corporation

FURNISHED BY: Bechtel Self Wixed

Box 209 Palo, Iowa 52324

COPIES TO: (3) TCT & EL, Inc.-Waterloo

(3) Palo, Iowa 52324		(:	3) TCT & EL, Inc	-Palo		
FIELD DATA:	·					
# Job Identification	ַ ע	B	F			
# Date Cast	9-29-71	9-29-71	9-29-71			
# Age to be Tested, days	28	28	28			
# Type of Sample	2" x 2" cubes	2* x 2* cubes				
₩ Location Placed	Control Build	Control Building block walls				
Specified Strength @ 28 Days				•		
# Mix Proportions: # Cement: # Fine Agg.: # Coarse Agg.: # Admixture:	Block mortar 94# 254# Hydrated lime - 10# AEA - 0.7 oz.					
COMPRESSIVE STRENGTH:		1	1	1		
Laboratory Number	71524-1	71524-2	71524-3			
Date Received	10-1-71	10-1-71	10-1-71			
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 26	2 26	2 26			
Area, square inches	4.0	4.0	4.0			
Load at Failure, pounds	23,000	23,800	22,200			
Strength, psi	5750	5950	5550			

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

TESTING AND ENGINEERING



ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



REPORTED TO:

Strength, psi

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

Box 209

(3) Palo, Iowa 52324 DATE: 10-27-71

FURNISHED BY: Bechte | Self Wixed

COPIES TO: (3) TCT & EL, Inc.-Waterloo (3) TCT & EL, Inc.-Palo

				1		
FIELD DATA:						
# Job Identification	ַ מַ	E	F			
# Date Cast	9-29-71	9-29-71	9- 29-71			
* Age to be Tested, days	28	_ 28	28			
# Type of Sample	2# x 2# cub	95	·			
# Location Placed	Control Bui	Control Building block walls				
Specified Strength @ 28 Days	•					
# Mix Proportions: # Cement: # Fine Agg.: # Coarse Agg.: # Admixture:	94# 254# Hydrated 1					
COMPRESSIVE STRENGTH:						
Laboratory Number	71524-1	71524-2	71524-3			
Date Receivad	10-1-71	10-1-71	10-1-71			
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 26	2 26	2 26			
Area, square inches	14.0	4.0	4-0			
Load at Failure, pounds	23,000	23,800	22,200			
	•	1	ī	I		

* Information taken from field data sheet prepared by Mr. Olson.

5750

5950

Twin City Testing and Engineering Laboratory, Inc.

5550



662 Cramwell Avenue - St. Paul, Minn. 55114



MOSTAR COMPRESSION TESTS

DUALE ARMOLD EMERGY CENTER

PALO, IONA

REPORTED TO: Bechtel Corporation

Box 209

Palo, Iowa 52324

11-2-71 DATE:

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(3) TCT & EL, Inc.-Palo

FIELD DATA:				
Job Identification	٠	E	F	
* Date Cast	10-5-71	10-5-71	10-5-71	
f Age to be Tested, days	28	28	28	
* Type of Sample	2" x 2" cubes			
Location Placed	Turbine building basement - block mortar			
Specified Strength @ 28 Days		•		
Mix Proportions: Cement: Time Agg.:	Block morta 94# 254#	• •		
Admixture:	Hydrated li	**		

COMPRESSIVE STRENGTH:		•		
Laboratory Number	715hh-1	71514-2	715hh-3	
Date Received	10-7-71	10-7-71	10-7-71	
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 25	2 25	2 26	
Area, square inches	1.0	4.0	7.0	
Load at Failure, pounds	19,000	18,000	19,500	
Strength, psi	4750	14500	4875	

* Information taken from field data sheet prepared by Lr. Olson.

TESTING AND ENGINEERING



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR OCMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

DATE: 11-5-71

REPORTED TO:

PALO, IOWA Bechtel Corporation

Palo, Iowa 52324

FURNISHED RT: Bechtel Self Mixed

Box 209

(3)

COMES TO:(3) TCT & EL, Inc.-Waterloo
(3) TCT & EL. Inc.-Palo

(), 1410, 1014		(3) TCT & EL, Inc	•-taTo
FIELD DATA:				
# Job Identification	A	В	C	
# Date Cast	10-28-71	10-28-71	10-28-71	
# Age to be Tested, days	7	7	7	
# Type of Sample	2" x 2" cubes			
# Location Placed	Turbine Building wall BWT #39 & 40 @ 757-6"			
Specified Strength @ 28 Days				
# Mix Proportions: # Cement: # Fine Agg.: # Coarse Agg.: # Admixture: # Admixture:	Block mortar 94# 254# NA Hydrated lime: AEA 25 nl.	: 12.5#		
COMPRESSIVE STRENGTH:		<u> </u>		<u> </u>
Laboratory Number	71593-1	71593-2	71593 - 3	
Date Received	11-1-71	11-1-71	11-1-71	
Method of Curing: Days on Job & Enroute Days Lab. Cured	ц 3	3 14	<u>ነ</u>	
Area, square inches	4.0.	4.0	4.0	
Load at Failure, pounds	11,700	10,200	14,300	
Strength, psi	2925	2550	3575	

REMARKS: # Information taken from field data sheet prepared by Mr. Olson.

TWIN CITY TESTIF AND ENGINEERING LAJORATORY, INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REPORT OF: MORTAR MIX DESIGN-TYPE "PL" FOR REINFORCED MASONRY

DUANE ARNOLD NUCLEAR PLANT PALO, IOWA

REPORTED TO:

PROJECT NO. 7884

November 12, 1971

Bechtel Corporation

FURNISHED BY:

Box 209

Palo, Iowa 52324

COPIES TO:

DATE:

Attn: . M. F. Daubenheyer

LABORATORY No. 6-9681

MATERIAL USED:

- .1) Dewey Portland Cement, Type II (ASTM Specification C150-68) produced by Dewey Portland Cement Company, Davenport Iowa.
- 2 Western Miracle Lime, Type "S", (ASTM Specification C207-49) produced by The Western Lime and Cement Company, Milwaukee, Wisconsin.
- Masonry sand (ASTM Specification C 144-66T) furnished from the project. 3)

MIX PROPORTIONS:

1.9 part Dewey Type II Portland Cement (by volume) 0.31 parts Western Miracle Lime (by volume) O parts Masonry sand (by volume) 13.2%

Flow -126% (by batch weight)

PROPERTIES OF MIX:

A. Water Retention:

ASTM: C476-63 **SPECIFICATIONS**

Initial Flow -126% Flow after Section -108% Water Retention -.85.7%

130 + 5%

Minimum 70%

B. Compressive Strength: (Average of three 2" cubes)

7-Day Strength 4930 psi 28-Day Strength 6380 psi Wet Unit Weight: 132 pcf

Minimum 1600 psi

D. Air Content:

Minimum 2500 ps

8.7%

Maximum 182

REMARKS:

С.

Based on the above test results, this mix will have satisfactory strength and water retention for a type "PL" mortar.

645-3601

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.



REPORTED TO:

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: . MORTAR MIX DESIGN-TYPE "PL" FOR REINFORCED MASONRY



PROJECT:

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA

PROJECT NO. 7884

Bechtel Corporation

Box 209

Palo, Iowa 52324

Attn: M. F. Daubenhever

DATE: November 12, 1971

FURNISHED BY:

COPIES TO:

LABORATORY No.

6-9681

MATERIAL USED:

- 1) Dewey Portland Cement, Type II (ASTM Specification C150-68) produced by Dewey Portland Cement Company, Davenport Iowa.
- Western Miracle Lime, Type "S", (ASTM Specification C207-49) produced by The Western Lime and Cement Company, Milwaukee, Wisconsin.
- 3) Masonry sand (ASTM Specification C 144-66T) furnished from the project.

MIX PROPORTIONS:

1.0 part Dewey Type II Portland Cement (by volume)

0.31 parts Western Miracle Lime (by volume)

3.0 parts Masonry sand (by volume)
Water - 13.2% (by batch weight)

Flow - 126%

PROPERTIES OF MIX:

A. Water Retention:- ASTM: C476-63
SPECIFICATIONS

Initial Flow - 126% 130 ± 5%

Initial Flow - 125% 130 ± 5% Flow after Section - 108%

Water Retention - 85.7% Minimum 70%

B. Compressive Strength: (Average of three 2" cubes)

7-Day Strength 4930 psi Minimum 1600 psi 28-Day Strength 6380 psi Minimum 2500 psi

C. Wet Unit Weight: 132 pcf

D. Air Content: 8.7% Maximum 18%

REMARKS:

Based on the above test results, this mix will have satisfactory strength and water retention for a type "PL" mortar.

Twin City Lesting and Engineering Laboratory, Inc.

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twin city testing and engineering

662 Cramwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER.

PALO, IOJA

REPORTED TO: Bechtel Corporation

Box 209

Palo, Iowa 52324 (3)

OATE: 11-26-71

FURNISHED BY: Bechtel Self Mixed

COMES TO:(3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

FIELD DATA:						
* Job Identification	י מ	E	F			
# Date Cast	10-28-71	10-26-71	10-28-71			
# Age to be Tested, days	28	28	28			
* Type of Sample	2" x 2" cubes	2" x 2" cubes				
* Location Placed	Turbine Build	Turbine Building wall BWT #39 & 40 4757-6"				
Specified Strength @ 28 Days						
<pre># Mix Proportions: # Cement: # Fine Agg.: # Admixture: # Admixture:</pre>	Flock mortar Sh# 25h# Hydrated lime: 12.5# AEA 25 nl. 128.6# pcf unit weigh 58° temperature			nit weight ure		
COMPRESSIVE STRENGTH:			<u> </u>	1		
Laboratory Number	71594-1	71591-2	71594-3			
Date Received	11-1-71	11-1-71	11-1-71			
Method of Curing: Days on Job & Enroute Days Lab. Cured	51 ⁷ 1 ⁷	5 t	14 214			
Area, square inches	1.0	4.0	4.0			
Load at Failure, pounds	27,000	21,500	21,500			
Strength, psi	6000	5375	5375 -			

REMARKS: * Information taken from field data sheet prepared by Mr. Olson.

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662 Cromwell Avenue - St. Paul, Minn. 55114



REPORTED TO:



MORTAN COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

Box 209

(3)Palo, Iowa 52324

2-29-72 OATE:

FURNISHED BY: Bechtel Self Mixed

COMES TO: (3) TCT & EL, Inc.-Waterloo

(3) TCT & EL, Inc.-Palo

FIELD DATA:				
* Job Identification	D	E	F	
* Date Cast	2-1-72	2-1-72	2-1-72	
* Age to be Tested, days	28	28	28	
* Type of Sample	2" x 2" cubes	'		•
*Location Placed	Test batch			
*Specified Strength @ 28 Days	-1600 por 20	00 PSI		
*Mix Proportions: * Cement * Fine Agg. * Admixture * Admixture * Admixture	Block mortar Temperature 79° 94# 254# 12.5# hydrated lime 51 Gal. water			
COMPRESSIVE STRENGTH:		1	1	1
Laboratory Number	71746-1	71746-2	71746-3	
Date Received	2-3-72	2-3-72	2-3-72	
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 26	2 26	2 26	
Area, square inchen	4	4	4	
Load at Failure, pounds	11,500	10,400	16,000	
Strength, psi	2875	2600	4000	

*Information taken from field data sheet prepared by Mr. Olson.

TWIN CITY TESTIC AND ENGINEERING LORATORY. INC.



ENGINEERS AND CHEMISTS 662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

P.O. Box 209

DATE: June 7, 1972

FURNISHED BY: Job Mixed

COPIES TO: (1) Twin City Testing and Engineeri

Palo, lowa 52324 Attn: M.F. Daube	enheyer		(1)	Laboratory, Twin City Te Laboratory	Inc Palo, Iowa sting and Engineer Inc Waterloo, Io
FIELD DATA:		• •	• • • •	• •	
* Job Identification	A B	c	D	E	F.
Date Cast	May 31, 19	972			
★ Age to be Tested, days	7 7	7	28	28 .	28
★ Type of Sample	Six 2" Mon	rtar Cubes		•	
★ Location Placed	Reactor Be Turbine Be	ailding BWR 1 ailding BWT 1	3 @757 and 1 @734		
Specified Strength @ 28 Days					•
*Mix Proportions: Cement Lime Sand Admixture	12.5 lbs.	ortland cemen Hydrated lim Masonry Sand			
COMPRESSIVE STRENGTH:			•		
Laboratory Number	210 2	10 210	21	.0 210	210
Date Received	June 5, 1	972	•		•
Method of Curing: Days on Job & Enroute Days Lab. Cured	5 5 2 2	5 2	5 2:	. 5 3 23	. 5
Area, square inches	4.00 4	.00 4.00	4.	.00 4.00	4.00
Loed at Failure, pounds	13,079 1	2,890 13,460			
. Strength, psi	3260 3	220 3360	·		•

* Information taken from data sheet prepared by M. Olson

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WIN CITY TESTING AND ENGINEERING LABORATORY. INC.



- ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Poul, Minn. 55114

REPORT OF:

MCRTAR COMPRESSION TESTS

REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

DATE:

June 12, 1972

FURNISHED BY: Job Mixed
Twin City Testing and Engineer:
COPIES TO: Laboratory, Inc., Palo, Iowa

Twin City Testing and Engineer: Laboratory, Inc., Waterloo, Io:

FIELD DATA:						
★ Job Identification	A	В	C	D	E	F
★ Date Cast	June 5	, 1972				
*Age to be Tested, days	7	7	7	28	28	28
★Type of Sample	Six 2'	'Mortar (Lubes	•	·	. •

*Location Placed

Tubine Building BWT 11 D+E, Reactor Building BWR 13

Specified Strength @ 28 Days

*Mix Proportions:

Cement Lime Sand Admixture 94 lbs. Portland cement 12.5 lbs. Hydrated lime 250 lbs Masonry Sand 25 ml. AEA

COMPRESSIVE STRENGTH:		ĺ		i	!	Ì
Laboratory Number	213	213	213	213	213	213
Date Received	June 9,	1972				
Method of Curing: Days on Job & Enroute	4	4	4	4	4	4
Days Lab. Cured	3	3	3	24	24	24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	15,220	15,320	15,380		Le	
Strength, psi	3810	3830	3850		JUif	

REMARKS:

* Information taken from data sheet prepared by Mr. Olson.

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TWIN CITY TESTING AND ENGINEERING LABORATORY. INC



ENGINEERS AND CHEMISTS 662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS



REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

P.O. Box 209

June 12, 1972 DATE:

FURNISHED BY: Job Mixed

Twin City Testing and Engineer: Laboratory, Inc., Palo, Iowa COPIES TO:

Palo, Iowa 52 Attn: Mr. Day			COPIES TO:	Twin (City Test:	ing and Engineer			
FIELD DATA:									
★ Job Identification	A	В	С	D	E	F			
★ Date Cast	June 5,	1972							
*Age to be Tested, days	7	7	7	28	28	28			
★ Type of Sample	Six 2"	Six 2" Mortar Cubes							
*Location Placed	Tubine	Tubine Building BWT 11 D+E, Reactor Building BWR 13							
Specified Strength @ 28 Days						_			
*Mix Proportions: Cement Lime Sand Admixture	12.5 lb 250 lbs	94 lbs. Portland cement 12.5 lbs. Hydrated lime 250 lbs Masonry Sand 25 ml. AEA JUNI 10 10 70 70 70 70 70 70 70 70 70 70 70 70 70							
COMPRESSIVE STRENGTH:				1	<u>।</u> ।	972			
Laboratory Number	213	213	213	213	213	213			
Date Received	June 9,	1972			·				
Method of Curing: Days on Job & Enroute Days Lab. Cured	4 3	4 3	4 3	4 24	4 24	4 24			
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00			
Load at Failure, pounds	15,220	15,320	15,380						
Strength, psi	3810	3830	3850						

REMARKS:

^{*} Information taken from data sheet prepared by Mr. Olson.

TWIN CITY TEST G AND ENGINEERING LOBORATORY. INC. McCiana



14

REPORT OF:

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

REPORTED TO: P.O. Box 209

(3) Palo, Iowa 52324

Attn: M.F. Daubenheyer

June 19, 1972 DATE:

FURNISHED BY:

Job Mixed

28

COMES TO: (3) TCT & EL; Inc. - Waterloo (3) TCT & EL, Inc. - Palo

28

FIELD DATA:						
Job Identification	А	В	c	D	E	F
* Date Cast	May 19	, 1972				

Type of Sample

Six 2" Mortar Cubes

* Location Placed

Reactor Building, BWR - 30 and Turbine Building BWT 24, 26, 11A, 12, 13 & 14

Specified Strength @ 28 Days

Age to be Tested, days

* Mix Proportions: Cement Lime Sand Admixture

94 lbs. Portland Cement 12.5 lbs. Hydrated Lime 254 lbs. Masonry Sand 25 m1 AEA -

COMPRESSIVE STRENGTH:				ı		
Laboratory Number	202	202	202	202	202	202
Date Received	May 30	. 1972				
Method of Curing:						
Days on Job & Enroute	11	11	11	11	11	11
Days Lab. Cured	3	3	3	ī7 ·	17	17
Area, square inches	4.0	4.0	4.0	4. 0	4.0	4.0
Load at Failure, pounds	16,160	14,950	15,490	19,480	19,240	18,110
Strength, psi	4040	3740	3870	4860	4810	4530

REMARKS: *Information taken from field data sheet prepared by Mr. Olson

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TWIN CITY TESTING AND ENGINEERING LATORATORY. INC. Mc Crake



ENGINEERS AND CHEMISTS

· 662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

REPORTED TO

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

₹.0. Box 209

DATE: June 28, 1972

FURNISHED BY: Job Mixed

COPIES TO: (1) Twin City , Testing and Engineerin

Palo, Iowa 52324 Atrn: M.F. Daubenh	eyer			Labo (1) Twin Labo	ratory, City Te	Inc Palo, Towa sting and Engineering Inc Waterloo, Ich
FIELD DATA:						
* Job Identification	A .	B .	C.	ם	E .	F
→ Date Cast	May 31,	1972	•			•
* Age to be Tested, days	7	7	7	28	28	28
★ Type of Sample	Six 2"	Mortar (Cubes	1,	· •	
★ Location Placed Specified Strength @ 28 Days	Resctor Turbine	Buildi Buildi	ng BWR 13 @757 ng BWT 11 @734	and .		
*Mix Proportious: Cement Lime Sand Admixture		s. Hydr	nd cement sted lime ry Sand		B	JUN 3 0 1972 ECITIZE CURP. JOB 7884
COMPRESSIVE STRENGTH:	.,	•		1 .		1
Laboratory Number	210	210	210 .	210	210	210
Date Received	June 5,	1972			,	
Method of Curing: Days on Job & Enroute Days Lab. Cured	5 2	5 2	5 2	5 23	5 23	5 23
Area, squure inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,070	12,890	13,460	18,570	18,980	19,920
Strength, psi	3260	3220	3360	4640	4750	4 980

REMARKS:

^{*} Information taken from data sheet prepared by M. Olson.

645-3601

twin city testing and engineering La.



662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS

REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

AO. Box 209

DATE.

July 3, 1972

FURNISHED BY: Job Mixed

Twin City Testing and Engineer to Laboratory, Inc., Palo, 1582

Palo, Iowa 52 Attn: Mr. Day	COPIES TO:	Twin City Testing and Engines Laboratory, Inc., Waterless,							
FIELD DATA:		•		·					
* Job Identification	A B	C	ם	E	F				
[‡] : Date Cast	June 5, 1972			,					
* Age to be Tested, days	7 . 7	7 .	28	28	28				
* Type of Sample .	Six 2" Mortar C	Six 2" Mortar Cubes							
*Location Placed	Tubine Building	, BWT 11 D+E, I	Reactor 1	Building BW	R 13				
Specified Strength @ 28 Days					·				
*Mix Proportions:									
Cement Lime Sand Admixture	94 lbs. Portlan 12.5 lbs. Hydra 250 lbs Masonry 25 ml. AEA	ited lime							

COMPRESSIVE STRENGTH:			1	I		-
Laboratory Number	213	213	213	213	. 213	213
Date Received	June 9,	1972	·	*		
Method of Curing: Days on Job & Enroute Days Lab. Cured	4 3	4 3	4 3	4 24	4 24	4 24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	15,220	15,320	15,380	21,870	22,800	22,780
Strength, psi	3810	3830	3850	5480	5700	5700

THE SHELL AND CURSELYTS, ALL REPORTS ARE SUBMITTED AS THE CORPIDENTIAL PROPERTY OF CLIENTS. AND ALL NEW, CONCLUSIONS ON EXTHACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WESTERN AND

Thiormation taken from data sheet prepared by Mr. Olson.

page 27 of 51

TWIN CITY TESTING AND ENGINEERING LADORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: MORTAR COMPRESSION TESTS
DUANE ARNOLD ENERGY CENTER

PALO, IDWA

Beentel Corporation

REPORTED TO: P.O. Box 209

Palo, Iowa 52324 Attn: M.F. Daubenheyer DATE:

July 6, 1972

FURNISHED BY: Job Mixed

COPIES TO: TCT & EL - Palo, Iowa

COPIES TO: TCT & EL - Waterloo, Iowa

FIELD DATA:								
Job Identification	A	В	С	D	Ε	F		
Date Cast	June 2	29, 1972				•		
Age to be Tested, days	7	7	7	28	28	28		
Type of Sample	Six 2	Six 2" Mortar Cubes						
Location Placed	Reacto	Reactor Suilding BWR-49, 13, 30, 51, and Radwaste Building						
Specified Strength @ 28 Days	BWRW 4	BWRW 2C, 3A						
Mix Proportions: Cement Lime Sand Admixture	12.5 254 18	94 lbs. Portland Cement 12.5 lbs. Hydrated Lime 254 lbs. Masonry Sand 25 ml AEA						
COMPRESSIVE STRENGTH:				1		ı		
Laboratory Number	221	221	221	221	221	221		
Date Received	July !	5, 1972			-			
Method of Curing: Days on Job & Enroute Days Lab. Cured	6	6	6	6 22	6 22	6 22		
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00		

REMARKS:

Strength, psi

Load at Failure, pounds

The above samples were taken on the job by Mr. Olson.

A NUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND DURSELVES, ALL REPORTS ARE SUBMITTED AS THE COMPIDENTIAL PROPERTY OF CLIENTS, AND AUTHORITION FOR PUBLICATION OF STATEMENTS. CONCLUSIONS ON EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Theodore Publication

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16,960 17,610

4400

4240

page 28 of 51 645-3601

TWIN CITY TESTING AND ENGINEERING

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR: COMPRESSION TESTS REPORT OF:

DUANE ARNOLD ENERGY CENTER

PALO, IDWA

Bechtel Corporation

REPORTED TO: Q.O. Box 209

Palo, Iowa 52324

Attn: M.F. Daubenheyer

DATE: July 27, 1972

Job Mixed FURNISHED BY:

TCT & EL - Palo, Iowa

COPIES TO: TCT & EL - Waterloo, Iowa

FIELD DATA:							
Job Identification	A	В	C.	D	E	F	
Date Cast	June 29	, 1972				•	
Age to be Tested, days	7	7	7	28	28	28	
Type of Sample	Six 2" Mortar Cubes						
Location Placed	Reactor Building BWR-49, 13, 30, 51, and Radwaste Building BWRW 2C, 3A						
Specified Strength @ 28 Days							
Mix Proportions: Cement Lime Sand	94 lbs. Portland Cement 12.5 lbs. Hydrated Lime 254 lbs. Masonry Sand						
Admixture	25 ml /		. y came		19 <u>1. ja y</u>	• -	
COMPRESSIVE STRENGTH:				* 47		1	
Laboratory Number	221	221	221	221	221	221	
Date Received	July 5	, 1972					
Method of Curing: Days on Job & Enroute Days Lab. Cured	6 1	6	6	6 22	6 22	6 22	
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00	
Load at Failure, pounds	16,960	17,610	17,000	23,000	23,290	22,420	
Strength, psi	4240	4460	4250	5750	5 820	5500	

REMARKS:

The above samples were taken on the job by Mr. Olson.

TWIN CITY TESTINO AND ENGINEERING LAWRATORY. INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

DUANE ARNOLD NUCLEAR PLANT

PALO, IOWA PROJECT NUMBER 7884

REPORTED TO: Gechtel Corporation

A.O. Box 209

Pàlo, Iowa 52324

DATE: - August 8,1972

FURNISHED BY: Job Mixed

COPIES TO: TCT & EL, Inc. - Palo, Iowa

TCT & EL, Inc. - Waterloo, Iowa.

Attn: M.F. Daub	enheyer			101 0	LL, INC.	- Materiou, 10Wa		
FIELD DATA:			,		•			
Job Identification	A	В	c .	D	Ε	F		
Date Cast	July 1	0, 1972				. •		
Age to be Tested, days	7	7	7	28	28	28		
Type of Sample	Six 2"	Mortar C	Cubes	•				
Location Placed	Reacto	Reactor Building BWR 30 & Radwaster Building BWRW 1B, 2-A & 2-B						
Specified Strength @ 28 Days					•			
Mix Proportions: Cement Lime Sand Admixture	12.5 7		nd Cement ited lime by Sand	•				
COMPRESSIVE STRENGTH:				. 1		1		
Laboratory Number	227	227	227	227	227	227		
Date Received	July 1	5, 1972				•		
Method of Curing: Days on Job & Enroute Days Lab. Cured	δ 2	5 2	5 2	5 23	5 23	5 23		
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00		
Load at Failure, pounds	14,480	14,830	14,800	20,670	19,650	19,450		
Strength, psi	3610	3710	3700	5170	4910	4860		

REMARKS:

The above samples were taken on the job by Mr. Olson.

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



MORTAR COMPRESSION TESTS

REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

R.O. Box 209 Palo, Iowa 52324

Attn: M.F. Daubenheyer

DATE:

August 2, 1972

FURNISHED BY: Job Mixed

COPIES TO: TCT & EL, Inc. - Palo, Iowa TCT & EL, Inc. - Waterloo, Iowa

					· · · · · · · · · · · · · · · · · · ·	
FIELD DATA:						
Job Identification	A	В	c	ם	Ε	F
Date Cast	July	26, 1972				
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2	" Cubes	•		٥	al III. Nasa
Location Placed	React	or Build	ing, BWR-31	G. C.		
Specified Strength @ 28 Days				AU	G 110-	•
Mix Proportions: Cement Lime Sand Admixture	12.5	lbs Hydr bs. Maso	and Cement ated Lime nry Sand	tog SECH)	G <u>4</u> 1977 TEL COUR B Zees	2 '*
COMPRESSIVE STRENGTH:			1	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	1
Laboratory Number	233	233	233	233	233	233
Date Received	July	28, 1972				
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 5	2 5	2 5	2 26	2 26	2 26
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	16,30	0 15,890	16,910			
Strength, psi	4070	3970	4230			

REMARKS:

The above samples were taken by Mr. Olson.

Twin City Testing

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS

REFORT OF

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

REPORTED TO:

Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324

Attn: M.R. Daubenheyer



DATE: March 21, 1973

FURNISHED BY: Job Mixed

COMES TO:(1) TCT & EL - Palo, Iowa
(1) TCT & EL - Waterloo, Iowa

FIELD DATA:									
Job Identification	A	В	С	D	Ε	F			
Date Cast	Februar	y 21, 19	73						
Age to be Tested, days	7	7	7	28	28	28			
Type of Sample	Six 2"	Six 2" Mortar Cubes							
Location Placed					ing BWR-	19, 29, 43, 50			
Specified Strength @ 28 Days	42 & 46	, Redwas	te Building B	#R#-19					
Mix Proportions: Cement me and Admixture	94 lbs. Portland Cement 12.5 lbs. Hydrated Lime 254 lbs. Masonry Sand 25 ml AEA								
COMPRESSIVE STRENGTH:				1					
Laboratory Number	495	495	495	495	495	495			
Date Received	Februar	y 26, 1	73						
Method of Curing: Days on Job & Enroute Days Lab. Cured	5 2	5 2	5 2	5 23	5 23	5 23			
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00			
Loed at Failure, pounds	11,070	11,020	10,750	16,460	16,950	17,740			
Strength, psi	2770	2760	2690	4110	4240	4440			

REMARKS: The above samples were taken on the job by Mr. Olson.

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Twin City Testing and Engineering Laboratory, Inc

By Theolore Oplanson



ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS



REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324



DATE: March 21, 1973

FURNISHED BY: Job Mixed

COPIES TO: (1) TCT & EL - Palo Iowa (1) TCT & EL - Waterloo, Iowa

Attn: M.R. D	aubenheyer			(., 101	4 55 - 11	200, 100, 10114
FIELD DATA:						
Job Identification	A	В	С	D	Ε	F
Date Cast	March 14	, 1973				
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" M	ortar C	ubes	1	1	
Location Placed	Reactor	Buildin	ig BWR-19, 12,	64 & 34		
Specified Strength @ 28 Days						
Mix Proportions: Cement Lime Sand Admixture	12.5 lbs 254 lbs	. Hydra	d Cement ted Lime y Sand			
COMPRESSIVE STRENGTH:	• .	1		1	1	
Laboratory Number	504	504	504	504	504	504
Date Received	March 19	7, 197	1			
Method of Curing: Days on Job & Enroute Days Lab. Cured	5 2	5 2	5 2	5 23	5 23	5 23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	10,670	10,03	10,170			
Strength, psi	2670	2510	2540			

The above samples were taken on the job by Mr. Olson.

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.



REPORTED TO:

ENGINEERS AND CHEMISTS 662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF

MORTAR COMPRESSION TESTS

ARNOLD EMERGY CENTER DATE: IOWA

June 28, 1973

FURNISHED SY: Job mixed Bechtel Corporation

0. Box 209 COPIES TO: Palo, Iowa 52324

TCT & EL - Pale

Attn: Mr. Da	ubonheyer	• "	TOT & BL - WEE	EL100
FIELD DATA:	••	<u>-</u> .		
Job Identification	A. B	c	D E	7
Date Cast	May 29,1973	May 29, 1973	May 29, 1973	May 29 , 1973
Age to be Tested, days	7 7	7	28 28	28
Type of Sample	Six 2" Morta	r Cubes	'	
Location Placed	Reactor Build	ling BWR-16, 35	& 19, off gas bu	ilding BWOG-6
Specified Strength @ 28 Days		•		
Mix Proportions:				•
Cement	94 lbs. Port	Land cement		
Line	12.5 1ba Hyd:			
Sand	254 lbs. Mase	onry Sand		•
Admixture	25 ml. AEA			

COMPRESSIVE STRENGTH:		1	1 1	
Laboratory Number	567	567	567	5 67
Date Received	June 1, 1973	June 1, 1973	Juna 1, 1973	June 1, 1973
Method of Curing: Days on Job & Enroute Days Lab. Cured	3 3	3	3 3 25 25	3 25
Area, square inches	4,00 Å.0	4.00	4.00 4.00	4.00
Load at Failure, pounds	13270 12,87	12,620	19,770 19,82	19,920
Strength, psi	3310 3220	3160	4940 4960	4980

REMARKS:

The above cubes were cast by Marv Olson.

Twin City Testing and Engineering

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114



MORTAR OCMPRESSION TESTS

EXPORTED TO:

DUARE ARNOLD ENERGY CENTER

PALO, IOWA

Sechtel Power Corporation

P.O. Box 209

Palo. Iowa 52324

Attn: Mr. Daubenheyer

DATE: July 2, 1973

FURNISHED SY: Job Mixed

COPIES TO: (1) TCT & EL, Inc. - Palo
(1) TCT & EL, Inc. - Waterloo

					I	14	
First D DATA:	A	В	C	D	E	F	
Date Cast	June 25	, 1973					<u> </u>
Age to be Tested, days	7	7	7	28	28	28	
Type of Sample	Six 2°				•		
Location Placed	Turbine	Buildir	ng BWT-10, I	Reactor Buil	ding BWR	-61 	
Specified Strength @ 28 Days							
Mis Proportions: Cement	94 1bs.	Portla	nd Cement				
Lime Sand Admixture		. Mason	ated Lime ry Sand	•	•		
COMPRESSIVE STRENGT.I:			•				
Laboratory Number	602	602	602	602	602	602	
Dute Received	June 27	, 1973				-	
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 5	2.	2 5	2 26	2 26	2 26	
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00	
Load at Failure, pounds	8,900	8,960	8,940	•			
Strength, psi_	2220	2240	2230	e			<u>.</u>

REMARKS: The above cubes were cast by Mr. Marvin Olson.

JUL 6 1973

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JOB 7834

Twin City Testing and Engineering Laboratory, Inc.

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page 35 of 51

TWIN CITY TESTANG AND ENGINEERING LABORATORY. INC.

REPOR

ENGINEERS AND CHEMISTS
662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS



NEFOR OF		LETY				
PROJECT: DUANE ARNOLD ENERGY CENTER PALO, IOWA Bechtel Power Corporation P.O. Box 209 Pale, Iowa 52324 Attn: Mr. Daubenheyer						
FIELD DATA:]					
Job Identification	A B C D E	<u> </u>				
	June 4, 1973					
Age to be Tested, days	7 7 7 28 28	28				
Type of Sample	Six 2" Mortar Cubes					
Location Placed	Turbine Building BWT-10A, B, C, & D & 32 & 33	off-gas buildi				
Specified-Strongth @ 28-Days	BWOG-6					
Mix Proportions:	<u> </u>					
Cement Lime Sand Adrixture	94# Portland cement 12.5 # Hydrated lime 254# Mazonry Sand 25 ml. AEA					
COMPRESSIVE STRENGTH:						
Laboratory Number	579 579 579 579	57 9				
Date Received	June 7, 1973	<u>.</u>				
Method of Curing: Days on Job & Enroute	3 3 3 3	3				
Days Lab. Cured	4 4 25 25	25				
Area, square inches	4.00 4.00 4.00 4.00	4.00				
Load at Failure, pounds	11,195 10,839 11,078 19,070 17,7	19,430				
Strength, psi	2790 2740 2770 4760 4440	4860				

REMARKS

The above cubes were cast by Mr. Marvin Olson.

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AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHOR-MEATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN (PPROVAI

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Twin City Testing and Engineering Laboratory, Inc

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page 36 of 51

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twin city testing and engineering (

ENGINEERS AND CHEMISTS
642 Cramwell Avenue - St. Paul, Minn. 55114



REPORT OF:

MORTAE COMPRESSION TESTS



PROJECT:

REPORTED TT.

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Corporation

9.0. Box 209

Palo, Iowa 52324

Attn: - Mr. Dauben Heyer

DATE: July 10, 1973

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

TELD DATA:			,	•	ļ.		
Job Identification	A B	С	ם	E	F		
Date Cast	June 7, 1973						
Age to be Tested, days	7 7	7	28	28	28		
Type of Sample	Six 2" Grout	Cubes	•		•		
Location Placed	Reactor Buildaround Suppo	Reactor Building R.P.V. Skirt, Interior Wall Grouting					
Specified Strength @ 28 Days	ar ound suppo						
Mix Proportions:							
Cement	94 lbs. Port						
Fly Ash	10 lbs. Fly 209 lbs. San	ASN A			•		
Sand Admixture	4 ounces WRA		·				
Admixture	4 OUNCES WKA			• mention	÷		

COMPRESSIVE STRENGTH:		1	1	· 	*	•
Laboratory Number	581	581	581	581	581	581
Date Received	June 11	, 1973				
Method of Curing: Days on Job & Enmute Days Lab. Cured	4 3	4 3	4 3	4 24	4 24	4. 24
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	24,730	26,100	25,870	32,240	32,500	32,650
Strength, psi	6180	6520	6470	8060	8130	8170

REMARKS:

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JUL 12 1973

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Twin City Testing and Engineering Laboratory, Inc.

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TWIN CITY TESTING ME ENGINEERING LABORATORY. INC



ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAR COMPRESSION TESTS



PROJECT:

REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOHA

Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

DATE:

July 13, 1973

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

Attn: Mr. Dauben	heyer		•			
FIELD DATA:						
Job Identification	A	В	C	ם	E	F
Date Cast	June 14	, 1973				•
Age to be Tested, days.	7	7	7	28	28	28
Type of Sample	Six 2"	Mortar (Cubes	.		•
Location Placed	Turbine	Buildi	ng BWT-13, 25	and 10A,	B, C & D	
Specified Strength @ _8 Days		•	, ·	•		
Mix Proportions: Cement Sand Admixture		. Luson	nd Cement ry Sand			
COMPRESSIVE STRENGTH:				ı		• • • •
Laboratory Number	586	586	586	586	586	586
Date Received	June 18	3, 1973				:
Method of Curing: Days on Job & Ensoute Days Lab. Cured	4 3	4 3	4 3	4 24	4 24	4 24
Area, square inches	4.00	4.00	4,00	4.00	4.00	4.00
Load at Failure, pounds	9,500	9,520	10,600	16,210	16,000	15,700
Strength, psi	2370	2380	2650	4060	4000	3930

REMARKS:

è à mutual protection to cliente, the public and guerrives, all reports are submitted as the comparatial professy of cliente, and author Eation por publication of statements, cossilisions de exprects from on regarding une reports is resceived perding our writtes apports

Twin City Testing and Engineering Laboratory, Inc.

By & wight F. Beglow

testing <u>and</u> engineering loborat

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REPORT OF:

MORTAE COMPRESSION TESTS



REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO. IOWA

Bechtel Corporation

Ф.O. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

DATE:

July 13, 197

FURNISHED BY: Job Mit

COPIES TO: (2) TCT & E

28

(2) TCT & E

1

Inc. - Palo

Inc. - Waterloo

28

& D

FIELD DATA:

Job Identification

Date Cast

Age to be Tested, days

Type of Sample

Location Placed

Specified Strength @ 29 Days

Mix Proportions:

Cement

Sand Admixture 94 lbs. Portland Cement 254 lbs. Maconity Sand

586

2380

June 18, 1973

25 ml AEA

586

June 14, 1973

Six 2" Mortar Cubes

COMPRESSIVE STRENGTH:

Laberatory Number

Date Received

Method of Curing: Days on Job & Enroute

Days Lab. Cured

Area, square inches

Load at Failure, pounds

Strength, psi

24. 3 3 4.00 4.00 4.00 4.00 10,600 9,520 9,500

586

Turbine Building BWT-13, 25 and 10A, E

16,210 f. 4060 2650

586

3930

586

24

4.00

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REMARKS:

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Twin City Testing and E

ering Laboratory, Inc.

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ING AND ENGINEERING LABORATORY. INC.



REPORTED TO:

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR CCMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOHA Bechtel Corporation

P.O. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

July 13, 1973 DATE:

FURNISHED SY: Job Mixed

COPIES TO:(2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

FIELD DATA:						·	
Job Identification	Α	В	С	ם	E	F	
Date Cast	June 14,	1973					
Age to be Tested, days	7 ·	7	7	28	28	28	
Type of Sample	Six 2" M	ortar (Cubes	•	•		
Location Placed	Turbine	Buildi	ng BWT-13, 25 a	nd 10A, 1	B, C & D)	
	1						

Specified Strength @ 18 Days

Mix Proportions:

Cement Sand

Admixture

94 lbs. Portland Cement 254 lbs. Rusonry Sand

25 ml AEA

COMPRESSIVE STRENGTH:				1		
Laboratory Number	586	586	586	586	586	586
Date Received	June 18	, 1973			·	
Method of Curing: Days on Job & Enzoute Days Lab. Cured	4 3	4	4 3	4 24	4 24	4 24
Area, square inches	4.00	4.00	4,00	4.00	4.00	4.00
Load at Failure, pounds	9,500	9,520	10,600	16,210	16,000	15,700
Strength, psi	2370	2380	2650	4060	4000	3930

REMARKS:

Twin City Testing and Engineering Laboratory, Inc.

page 40 of 51

Pouters 3601

ENGINEERS AND CHEMISTS

G AND ENGINEERING LOCAL

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



-	
PROJECT	r

DUANE ARNOLD ENERGY CENTER PALO, IOHA Bechtel Corporation

July 13, 190

FURNISHED BY: Job !!!:

REPORTED TO:

P.O. Box 209 Palo, Iowa 52324

COPIES TO: (2) TCT & E'

Inc. - Palo

Attn: Mr. Daubenheyer

(2) TCT & E

Inc. - Waterloo

F	TEL	<u>D</u>	DA	T	١:

Date Cast

Job Identification

В

D

Age to be Tested, days

June 14, 1973

C

28

28

Type of Sample

Six 2" Mortar Cubes

7

& D

Location Placed

Turbine Building BWT-13, 25 and 10A, [

Specified Strength @ 29 Days

Mix Proportions:

Cement

Sand

Admixture

94 lbs. Portland Cement 254 lbs. Masonly Sand 25 ml AEA

COMPRESSIVE STRENGTH:	1			1
Laboratory Number	586	586	586	586
Date Received	June 18	, 1973		
Method of Curing: Days on Job & Enroute Days Lab. Cured	4 3	4	4 3	4 24
Area, square inches	4.00	4.00	4,00	4.00
Load at Failure, pounds	9,500	9,520	10,600	16,210
Strength, psi	2370	2380	2650	4060

586

24

)

000

4.00

15,700

3930

REMARKS:

UL171973

HTEL CORP

AS A SUTUAL PROTECTION TO CL IZATION POS PUZLICATION OF F

ering Laboratory, Inc.

JA 1-3 500

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF

MORTAR COMPRESSION TESTS

(T)

PROJECT:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

Bechtel Power Corporation

P.O. Box 209

DATE: July 20, 1973

FURNISHED SY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo

P.O. BOX 209 Palo, Iowa 523: Attn: Mr. Daub	24 enheyer		COPIES	(2) TCT		Palo Waterloo) —
FIELD DATA:							
Job Identification	A	В	C ·	ם	E	F	
Date Cast	July	6, 1973					
Age to be Tested, days	7	· 7	7.	28	28	28	
Type of Sample	Six 2	. Mortar	Cubes	•	•		
Location Placed	React	or Buildi	ng BWR-64, ilding BWC	Turbine Bui	ilding BWT	-25,	
Specified Strength @ 28 Days	and C	ONCIOI BU	tiding bac	-5			
x Proportions: Cement Lime Sand Admixture	12.5	1bs. Hydr bs. Masor	nd Cement ated Lime ry Sand				
COMPRESSIVE STRENGTH:		<u>-</u>		1	· •		

COMPRESSIVE STRENGTH:		1		i		
Laboratory Number	627	627	627	627	627	627
Date Received	July` 12	1973				
Method of Curing: Days on Job & Enroute Days Lab. Cured	6	6	6 ~ 1	6 22	6 22	6 22
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,400	12,16	12,170	,	D	سئن شارتان
Strength, psi	3350	3040	3040		以体	per (St

REMARKS: The above cubes were taken on the job by Mr. Marvin Olson.

JUL 2 5 1973

BECHTEL CORP JOB 7884

e cubes were taken on the job by the factor

Bennelvity SWD

AS A NUTUAL PROTECTION TO CLIENTS. THE PUBLIC AND DURSELVES, ALL REPORTS ARE SUBMITTED AS THE COMPIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WEITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

8 9-1. A-2 501

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS 662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



REPORTED TO:

DUANE ARNOLD ENERGY CENTER

PALO, IOWA Sechtel Power Corporation

P.O. Box 209

Palo, Iowa 52324 Attn: Mr. Daubenheyer

July 20, 1973

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

Attn: Mr. Daub	enneyer					
FIELD DATA:		1				
Job Identification	A	В	C	ם	E	F
Date Cast	July 6,	1973				
Age to be Tested, days	7 .	7	7	28	28	28
Type of Sample	Six 2" 1	Sortar Ci	ubes			
Location Placed	Reactor and Cont	Building trol Bui	g BWR-64, T Iding BWC-5	urbine Buil	ding BWT-2	25,
Specified Strength @ 28 Days						
Mix Proportions: Cement Lime Sand Admixture		. Hydra Masonr	d Cement ted Lime y Sand			
COMPRESSIVE STRENGTH:				1		
Laboratory Number	627	627	627	627	627	627
Date Received	July 12	, 1973				
Method of Curing: Days on Job & Enroute Days Lab. Cured	6 -1	6	6 ~ 1	6 22	6 2 2	6 22
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,400	12,160	12,170			<u> </u>
Strength, psi	3350	3040	3040		以即	951V (F)

The above cubes were taken on the job by Mr. Marvin Olson. REMARKS:

JUL 2 5 1973

BECHTEL CORP 108 7884

B THE COMPIDENTIAL PROPERTY OF CLIENTS, AMD AUTHOR-REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

9-1. 1-2 501

CITY TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



DUANE ARNOLD ENERGY CENTER

DATE: August 16, 1973

ALPORTED TO:

PALO, IOWA Bechtel Power Corporation

FURNISHED BY: Job Mixed

P.O. Box 209

Palo, Iowa 52324

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

Attn: Mr. Daubenh	eyer			(– ,		
FIELD DATA:						
Job Identification	А	В	С	ם	E	F
Date Cast	August 8	, 1973				
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" M	ortar (Cubes	•		
Location Placed	Turbine	Buildir	ng BWT-50 & 5	8		
Specified Strength @ 28 Days						
Mix Proportions: Cement Lime Sand Admixture	94 lbs. Portland Cement 12.5 lbs. Hydrated Lfme 254 lbs. Masonry Sand 25 ml AEA					
COMPRESSIVE STRENGTH:					1	
Laboratory Number	691	691	691	691	691	691
Date Received	August 1	0, 197	3			
Method of Curing: Days on Job & Enroute Days Lab. Cured	2 5	2 5	2 5	2 26	2 26	2 26
Area, square inches	4.00	4.00	4 .20	4.00	4.00	4.00
Load at Failure, pounds	17,840	18,00	0 16,530			
Strength, psi	4460	4500	4140			

REMARKS: The above samples were cast on the job by Mr. Marvin Olson.



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TWIN CITY TEST IG AND ENGINEERING DEC



662 Cromwell Avenue - St. Paul, Minn. 55114



MORTAR COMPRESSION TESTS

REPORTED TO:

Method of Curing:

Area, square inches

Strength, psi

Days on Job & Enroute

Days Lab. Cured

Load at Failure, pounds

DUANE ARNOLD ENERGY CENTER PALO, IOWA Bechtel Power Corporation

P.O. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

August 16, 1973 DATE:

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

ACCII: MI. DOC	abenneyer					
FIELD DATA:		·				
Job Identification	Α	В	С	ם	E ·	F
Date Cast	July 1	8, 1973				
Age to be Tested, days	7	7	7	28	28	28
Type of Semple	Three	3" x 6" 1	Mortar Cyli	nders	·	•
Location Placed	Reacto	r Buildi	ng BWR-61, ing BWR¥-2	33 & 62, M	echanic Si	hop BWM-1,
Specified Strength @ 28 Days	Nauwas	ice build	ing balla-E			
Mix Proportions: Cement Lime Sand Admixture	12.5	lbs. Hydra os. Mason	nd Cement ated Lime ry Sand			
COMPRESSIVE STRENGTH:						1
Laboratory Number	644	644	644	644	644	644
Date Received	July	20, 1973				

REMARKS: The above cubes were cast on the job by Mr. Marvin Olson.

2 5

4.00

12,250

3060

4.00

12,170

3040

Twin City Testing and Engineering Laboratory, Inc.

26

4.00

4780

19,100

4.00

2990

11,930

26

4.00

17,100

4280

2

26

4.00

18,140

4530

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114





REPORTED TO:

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOWA Bechtel Power Corporation

A.O. Box 209

Palo, Iowa 52324

DATE:

August 24, 1973

FURNISHED BY: Bechtel Power Corp.

COPIES TO: (2) TCT & EL, Inc. - Palo

(2) TCT & EL, Inc. - Waterloo

Attn: Mr. Dau	benheyer					
TELD DATA:						
Job Identification	Α.	В	С	D	E	F
Date Cast	August 1	5, 1978				•
Age to be Tested, days	7	7	7	28	28	28
Type of Sample	Six 2" M	lortar Cut	es	•		
Location Placed	Block Mo Reactor	rtar for Building	Turbine Bu BWR-61	ilding BWT	-50+58 and	
Specimed Strength @ 28 Days					N.	
Mix Proportions: Cement Line Sand Admixture	12.5 lbs	Portland s. Hydrate . Masonry EA	ed Lime			-
OMPRUSSIVE STRENGTH:					ı	
Laboratory Number	706	706	706	706	706	706
Date Received	August	20, 1978				
Method of Curing: Days on Job & Enroute Days Lab, Cured	5 2	5 2	5 2	5 23	5 23	5 23
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00
Load at Failure, pounds	13,980	13,29	12,970			
Strength, psi	3490	3320	3240		وغرن	(C)
					1360	

REMARKS:

AUG 2 7 1973

BECHTEL CORP

AS A NUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE RUBNITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS. AND AUTHOR. REALTION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FICY OF REGARDING OUR REPORTS IS RESERVED SENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

CITY TESTIN AND ENGINEERING LAL RATORY INC.

ENGINEERS AND CHEMISTS

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

Ø, IOWA

... PORTET TO:

Bech al Power Corporation

.O. Box 209

Palo, Iowa 52324

Mr. Daubenhever

DATE: September 6, 1973

FURNISHED BY: Job Mixed

copies to:(2) TCT & EL, Inc. - Palo
(2) TCT & EL, Inc. - Waterloo

/ Attn: Mr. Daube	meyer		·				
FIRI.D DATA:							
Job Identification	A	В	C	D	E	F.	
Date Cast	August 8	, 1973					
Age to be Tested, days	7	7	7	28	28	28	
Type of Sample	Six 2"	ortar (Cubes	• .			
Location Placed	Turbine	Buildi	ng BWT-50 & 58		DEG	CIVE	
Specified Strength @ 28 Days			·		CER	1 n 1073	
Mix Proportions: Cement		94 lbs. Portland Cement					
Lime Sand	254 1bs	. Mason	ated Lime ry Sand			TEL CORP. 08 7884	
Admixture	25 ml /	AE (A					
COMPRESSIVE STRENGTH:			I	1		· 	
Laboratory Number	691	691	691	691	691	691	
Date Received	August	10, 197	3				
Method of Curing: Days on Job & Enroute	2 5	2 5	2 5	2 26	2 26	2 2 26	
Days Lab. Cured	5	5	5	20	20		
Area, square inches	4.00	4.00	4.20	4.00	4.00	4.00	
Load at Failure, pounds	17,840	18,00	n 16,530	27,050	28,00	28,000	
Strength, psi	4460	4500	4140	6770	7000	7000	

REMARKS: The above samples were cast on the job by Mr. Marvin Olson.

Mc Cracken

d a mutual protection to cliente, the puelic and ourselves, all zation for publication of statements, conclusions or extracts

Twin City Testing and Engineering Laboratory, Inc.

Me Cracken 1 2350.

TYIN CITY TESTEL'S AND ENGINEERING LELORATORY. INC page 470

ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

REPORT OF: .

MORTAR COMPRESSION TESTS

PROJECT:

DUANE ARNOLD ENERGY CENTER

REPORTED TO:

PALO, IOMA Bechtel Power Corporation 9.0. Box 209

Palo, Iowa 52324

Attn: Mr. Daubenheyer

September 12, 1973 DATE:

FURNISHED BY: Bechtel Power Corp.

COPIES TO: (2) TCT & EL, Inc. - Pain

(2) TCT & EL, Inc. - Materica

FIELD DATA:								
Job Identification	A	В	C	D	E	F		
Date Cast	August 1	5, 197	3		1	•		
Age to be Tested, days	7	7 ·	7	28	23	28		
Type of Sample	Six 2" N	ortar (Cubes	•	•			
Location Placed	Block Mortar for Turbine Building BWT-50+58 and							
Specified Strength & 28 Days	Reactor Building BWR-61							
Mix Proportions:			•					
Cement			nd Cement		5:51	41873		
Line Sand	254 1bs		ated Lime ry Sand	ě	Cs	• • •		
Admixture	25 ml Al				350-73	1.67.2		
COMPRESSIVE STRENGTH:			•		1	· · · · · · · · · · · · · · · · · · ·		
Laboratory Number	706	706	705	706	705	795		
Date Received	August :	20, 197	1 3 1					
Method of Curing:		_			_	-		
Days on Job & Enroute	5 2	5 2	5 2	5 23	5· 23	5 22		
Days Lab. Cured								
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00		
Load at Failure, pounds	13,980	13,29	12,970	17,080	17,510	17,770		
Strength, psi	3490	3320	3240	4270	4:10	4:43		

REMARKS:

AS A MUTUAL PROTECTION TO CLIENTY, THE PUBLIC AND GURRELYES, ALL REPORTS ARE SUBMITTED AS THE COMPUTENTIAL PROPERTY OF CLIENTS.

IZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR PERAIDING OUR REPORTS IN SECRETED PENDING. DUE 1871.

Twin City Testing and Engineering Laboratory, inc.

Mc Cracken 64 AND ENGINEERING LA DRATORY. INC.

ENGINEERS AND CHEMISTS

662 Cromwell Avanue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

REFORTED TO:

DUANE ARNOLD ENERGY CENTER

Bechtel Power Corporation

PALO, IOWA

September 24, 1973 DATE:

FURNISHED BY: Job Mixed

P.O. Box 209

Palo, Iowa 52324

COPIES TO:

(2) TCT & EL. Inc. - Waterloo

Attn: Mr. Dau	benheyer			(2) (6)	a EL, INC	Maceriou	
FIELD DATA:							
Job Identification	A	В	C	D	Ε	F .	
Date Cast	Septembe	r 13, 197	73	·			
Age to be Tested, days	7 .	7	7	28	28	28	
Type of Sample	Two 3" x	6" Morta	r Cylinders	i i	1		
Location Placed	Turbine	Building	BWT-23, 20A	+ 12E	B B6		
Specified Strength @ 28 Days		REGETA					
Mix Proportions:		94 lbs Portland Cement SEP 26 1973					
Cement Lime	94 1bs. 12.5 1bs	Portland . Hydrate	Cement ed Lime	. •			
Sand		Masonry			BECHTEL CORP JOB 7884		
COMPRESSIVE STRENGTH:				,			
Laboratory Number	754	754	754	754	754	754	
Date Received	Septembe	er 17, 9	73	·			
Method of Curing:			4	4	. 4	4	
Days on Job & Enroute Days Lab. Cured	3	3	4 3	24	24	24	
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00	
Load at Failure, pounds	14,250	14,000	14,050			·	
Strength, psi	3560	3500	3510				

REMARKS:

Strength, psi

Twin City Testing, and Engineering Laboratory, Inc.

TWIN CITY TESTING AND ENGINEERING LABORATORY. INC.



ENGINEERS AND CHEMISTS

662 Cromwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS



DUANE ARNOLD ENERGY CENTER

PALO, IOWA

REPORTED TO: Bechtel Power Corporation

P.O. Box 209 Palo, Iowa 52324

Attn: Mr. Daubenheyer

September 27, 1973

FURNISHED BY: Job Mixed

COPIES TO: (2) TCT & EL, Inc. - Palo (2) TCT & EL, Inc. - Waterloo

A	В	С	ם	E.	F	
August	29, 197] B				
7	7	7	28	28	28	
Six 2"	Mortar	cubes	ı	1		
Off-Gas Building BWG-7 and Reactor Building BWR-5						
			r		ست تاون	
				REGE.	W. Colonia	
			, U			
				00T 1 1973		
		i j Juliu		DC/1:==:	_	
	A August 7 Six 2" Off-Ga 94 lbs 12.51 254 lb	A B August 29, 197 7 7 Six 2" Mortar Off-Gas Buildi 94 1bs. Portla 12.5 1bs. Hydr	August 29, 1978 7 7 7 Six 2" Mortar Cubes Off-Gas Building BWG-7 and 94 1bs. Portland Cement 12.5 1bs. Hydrated Lime 254 1bs. Masonry Sand	A B C D August 29, 197B 7 7 7 28 Six 2" Mortar Cubes Off-Gas Building BWG-7 and Reactor B 94 1bs. Portland Cement 12.5 1bs. Hydrated Lime 254 1bs. Masonry Sand 25 ml AEA	A B C D E August 29, 1978 7 7 7 28 28 Six 2" Mortar Cubes Off-Gas Building BWG-7 and Reactor Building BWG-7 94 1bs. Portland Cement 12.5 1bs. Hydrated Lime 254 1bs. Masonry Sand 25 ml AEA	

		BECHTEL COUR					
COMPRESSIVE STRENGTH:		1		109 7884			
Laboratory Number	719	71.9	719	719	719	719	
Date Received	September 4, 1973						
Method of Curing: Days on Job & Enroute Days Lab. Cured	6	6	6 1	6 22	6 22	6 22	
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00	
Load at Failure, pounds	17,050	17,00	16,800	23,250	24,300	23,450	
Strength, psi	4260	4250	4200	5820	6070	6120	

REMARKS:

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and Engineering Naboratory, Inc.

Mchaben

ECRATORY. INC. TVMN CITY TESTING AND ENGINEERING

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

MORTAR COMPRESSION TESTS

DUANE ARNOLD ENERGY CENTER

PALO, IOWA

REFORTED TO: Bechtel Power Corporation

P.O. Box 209

Palo, Iowa 52324

DATE:

October 11, 1973

FURNISHED BY: Job Mixed

COPIES TO:

(2) TCT & EL. Inc. - Waterloo

/ Attn: Mr. Dau	benheyer			(2) 101	- LC, 1			
FIELD DÁTA:	·	·				•		
/ Job [dentification	A	В	С	٥ -	E	F		
Date Cast	Septembe	er 13, 197	73					
Age to be Tested, days	7	7	7	28	28	28		
Type of Sample	Two 3" >	Two 3" x 6" Mortar Cylinders						
Location Placed	Turbine	Turbine Building BWT-23, 20A + 12E						
Specified Strength @ 28 Days		DEGE VE						
Mix Proportions:		94 1bs. Portland Cement OCT 15						
Lime Sand		. Hydrate . Masonry	BECHTEL CORP					
COMPRESSIVE STRENGTH:		1	•			·		
Laboratory Number	754	754	754	754	754	754		
Date Received	Septemb	September 17, 973						
Method of Curing: Days on Job & Enroute Days Lab. Cured	4 3	4 3	4 3	4 24	4 24	4 24		
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00		
Load at Failure, pounds	14,250	14,000	14,050	19,700	19,950	20,850		
Strength, psi	3560	3500	3510	4920	4990	5210		

REMARKS:

Mc Cracken

Twin City Testing and Engineering Laboratory, Inc.

Lib A-3 500

CITY TESTING AND ENGINEERING LABORATORY. INC.

ENGINEERS AND CHEMISTS

662 Cramwell Avenue - St. Paul, Minn. 55114

REFORTED TO:

PALO, IOWA

P.O. Box 209

DUANE ARNOLD ENERGY CENTER

Bechtel Power Corporation

MORTAR COMPRESSION TESTS

DATE.

October 11, 1973

FURNISHED BY: Job Mixed

Palo, Iowa 52 Palo, Iowa 52 Attn: Mr. Daul			COPIES TO:		& EL, In	c Waterloo			
FIELD DATA:									
Job Identification	A	В	C .	0	Ë	F			
Date Cast	Septembe	September 13, 1973							
Age to be Tested, days	7	7	7 .	28	28	28			
Type of Sample	Two 3" x	Two 3" x 6" Mortar Cylinders							
Location Placed	Turbine	Turbine Building BWT-23, 20A + 12E							
Specified Strength @ 28 Days									
Mix Proportions: Cement Lime Sand	12.5 1bs	94 lbs. Portland Cement 12.5 lbs. Hydrated Lime 254 lbs. Masonry Sand							
COMPRESSIVE STRENGTH:			•						
Laboratory Number	754	754	754	754	754	754			
Date Received	Septembe	September 17, 1973							
Method of Curing: Days on Job & Enroute Days Lab. Cured	4 3	4. 3	4 3	4 24	4 24	4 24			
Area, square inches	4.00	4.00	4.00	4.00	4.00	4.00			
Load at Failure, pounds	14,250	14,000	14,050	19,700	19,950	20,850			
Strength. psi	3560	3500	3510	4920	4990	5210			

REMARKS:

Twin City Testing and Engineering Laboratory, Inc.