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TSAP BIT QUALIFICATION TEMPERATURE CRITERIA [TEST
PLAN]

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1	1	CogEng GL Ralston	<i>GL Ralston</i>	10/20/95	H5-09	TJ Bander	<i>TJ Bander</i>	10/20/95	H0-34	1	1
1	1	CogMgr DW Hamilton	<i>DW Hamilton</i>	10/20/95	S7-12	NJ Milliken	<i>NJ Milliken</i>	10/20/95	H4-63	1	1
1	1	QA ML McElroy	<i>ML McElroy</i>	10/20/95	S7-07	KS Witwer	<i>KS Witwer</i>	10/20	L6-13	1	1
1	1	Safety S.A. Norling	<i>S.A. Norling</i>	10/20/95		RJ Blanchard	<i>RJ Blanchard</i>	10/23/95	S7-12	1	2
		Env.				JF McCormick	<i>JF McCormick</i>	10/24/95	S7-12	1	1
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procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

C. WILKINGHAM

10/23/95

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SUPPORTING DOCUMENT

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Test Plan for...

TSAP BIT QUALIFICATION: Temperature Criteria

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WHC-SD-WM-TP-410

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7. Abstract

Test plan for acquiring TSAP bit temperature performance data.

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Test Plan for...

TSAP BIT QUALIFICATION: Temperature Criteria

Gregory L Ralston
TWRS Engineering
October 19, 1995

filename: sd410-0.tp
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TABLE OF CONTENTS

		<u>Page</u>
1	INTRODUCTION	1
	1.1 BACKGROUND	1
	1.2 TEST LOCATION	1
	1.3 SPONSOR	1
2	TEST DESCRIPTION	2
	2.1 SCOPE	2
	2.2 TEST EQUIPMENT	3
	2.3 TEST METHOD	5
3	INDUSTRIAL SAFETY	5
4	QUALITY ASSURANCE	5
5	REFERENCES	6

PHOTOS

Photo 1A: Standard Bit	3
Photo 1B: TSAP Bit	3

1 INTRODUCTION

1.1 BACKGROUND

Hanford Site waste tanks are currently being sampled by several methods. One of these, Rotary Mode Core Sampling (RMCS), uses a cutting bit/sample tube arrangement to obtain core samples of tank contents. Recent efforts to improve sample recovery have resulted in a new bit/sample tube design. Prior to field use, bit performance in two key areas needs to be tested. These areas are:

- penetration into steel plate, and
- temperature rise as a function of downforce, rpm, and time.

A performance test in the above two areas was conducted in August, 1995. Based on a review of that test activity, selected follow-on testing is planned to confirm data obtained in the temperature area. The results of both test activities will then be released as a single test report.

1.2 TEST LOCATION

The additional testing described here will be conducted inside the Engineering Testing Laboratory (305 Bldg, 300 Area).

1.3 SPONSOR

Testing is under the direction of Characterization Equipment Design, Characterization Project.

2 TEST DESCRIPTION

2.1 SCOPE

The activity described in this test plan will measure bit temperature response in concrete under several downforce loading conditions without purge (cooling) gas. The goal in this case is to obtain a minimum data set which can be correlated to a computer model of the new bit. Other operating conditions can then be investigated with the model.

In the past there has been interest in bit temperature performance against steel, but tests conducted in that area (without purge gas) show that temperature excursions are much less severe than when drilling in a medium with low thermal conductivity (Keller 1993, Ralston 1995, Cashdollar et al. 1995). Therefore, no temperature performance tests against steel are planned here.

Two bit designs will be tested: a standard rotary mode core sampling bit, and the new bit design which incorporates several changes to the original physical configuration.

Testing will be performed with the following operating conditions:

Table I Temperature Test Operating Parameters

DOWNFORCE* (lb)	RPM
400	10
650	30
1000	30

*Nominal

The first operating parameter set above (400 lb downforce, 10 rpm) will use 10 rpm instead of 30 because it correlates with previous testing at that force level (Ralston 1995).

2.2 TEST EQUIPMENT

2.2.1 Drilling Rig

A Longyear¹ Model 34 drilling rig, instrumented and used in prior core sampling test activities, will also be used for this test. It is similiar to field units currently in operation.

2.2.2 Test Bits

Test data will be obtained with the two bit designs listed below:

- Standard rotary core drilling bit, Item #10 of Dwg H-2-821457 (Longyear Part # 100IVD/5).
- The new Tank Sampling Assistance Panel bit (Longyear Part #ABYIVD/3, hereafter referred to as the TSAP Bit).

Photographs 1A and 1B show the two bits with a scale for reference.

PHOTO 1A: Standard Bit

PHOTO 1B: TSAP Bit

For ease of testing the drill string will not contain sample tube hardware. This simpler

¹ Longyear is a trademark of the Longyear Company.

configuration saves setup time and will also tend to bias the rate of temperature rise in the conservative direction (faster rise).

2.2.3 Data Acquisition/Instrumentation

A Validyne data acquisition system (DAS) controlled by a host PC running EasySense^{®2} software will be configured to monitor and record the following test parameters every five seconds: time, bit temperature and depth, downforce, and RPM.

- **Bit temperature** will be monitored with type K, stainless/sheathed thermocouples. These are mounted near the tip of each bit with either high thermal conductivity epoxy or silver solder. Thermocouples will be characterized by WHC Standards Lab before testing. Data acquisition system temperature measurement accuracy will be checked with a known input signal from an Omega Engineering, Inc. CL 505A Calibrator.
- **Bit depth** will be measured with a string potentiometer. Accuracy will be checked and recorded prior to test.
- **Downforce**, as recorded by the DAS, is measured indirectly by pressure transducers on the positioning cylinders. Downforce recorded by the DAS will be retained in the data set for reference (accuracy not verified). Verified downforce values will be recorded manually from an electronic floor scale. Scale accuracy will be checked and recorded prior to test.
- **RPM** will be measured by a proximity sensor counting gear teeth rotating with the drill string. Accuracy will be checked and recorded prior to test.

²EasySense[®] is a registered trademark of Validyne Engineering Corporation.

2.2.4 Test Material

Concrete block about 2" thick by 7" wide (commonly referred to as "plain scallop", and used as decorative edging around lawns, etc.), made up of about 80% coarse paving sand and 20% Portland Cement, will be used for the temperature testing. This block was used in the August testing and measured thermal conductivity values are available. These values are low enough to provide test data in the conservative region in terms of temperature rate of increase. The low thermal conductivity, consistent material mix (portland cement and paving sand with no aggregate), high resistance to penetration, and availability combine to form the basis for selection as test material in this case.

2.3 TEST METHOD

- 1) Lower bit (non-rotating) to concrete block and adjust downforce. Raise bit.
- 2) Engage clutch and check/adjust rpm.
- 3) Start DAS.
- 4) Position hydraulic valve to lower rotating bit to concrete, allowing full pre-adjusted downforce to develop (after contact, several seconds elapse as the force builds to maximum value).

3 INDUSTRIAL SAFETY

There are no unique safety hazards associated with this test activity. All test activities will comply with the requirements of WHC Industrial Safety and Hygiene Manuals (WHC-CM-4-3 and WHC-CM-4-40), and 305 Building Work Plan/Instruction "General Operation of Longyear Drilling Maching", dated 9/18/95.

4 QUALITY ASSURANCE

Quality Assurance will review and approve all documentation associated with this testing activity.

Test data accuracy will be verified as described in section 2.2.3 under the direction of cognizant engineering staff assigned to this test activity. Quality Control "hold points" and/or "witness" responsibilities will not be required for this testing.

5 REFERENCES

Cashdollar, K. L., K. S. Witwer, A. Furno, G. M. Green, R. A. Thomas, 1995, *Ignitability Testing for Core Drilling System*, WHC-SD-WM-TRP-224, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Keller, C. M., 1993, *Core Drill Operating Envelope Test Report*, WHC-SD-WM-TRP-123, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Ralston, G.L., 1995, *Test Report for Slow Rotation Core Sampling Test*, WHC-SD-WM-TRP-230, Rev. 0, Westinghouse Hanford Company, Richland, Washington.