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EG&G Idaho, Inc.

Report No. PG-G-79-020

Date: January 1980

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INTERNAL TECHNICAL REPORT

Title: SUMMARY OF RAFT RIVER SUPPLY AND INJECTION SYSTEM OPERATIONAL HISTORY

Organization: GEOTHERMAL TECHNICAL DEVELOPMENT

Author: L. F. Walrath

Checked By: _____ Approved By: _____

[redacted]

Simmons, Patty

From: Dale J Claflin [Dale.Claflin@inl.gov]
Sent: Thursday, December 07, 2006 8:43 AM
To: Simmons, Patty
Cc: Claflin, Dale; Flynn, Vesta; Ponce, Linda
Subject: Re: EG&G Idaho Geothermal Reports
Attachments: EG&G Patent Docs.doc

Patty,

The 13 reports listed are all OK for unrestricted release. Please remove (cover up) the patent caution wording, as well as any other statements concerning restricted distribution. We don't have a concern with the "Internal Technical Report" words, but if you feel it would eliminate confusion by removing that term, please do so. Let me know if you need anything else.

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12/06/2006 12:34 PM

To dfc@inel.gov

cc "Ponce, Linda" <poncel@osti.gov>, "Flynn, Vesta" <flynnv@osti.gov>

Subject EG&G Idaho Geothermal Reports

Dale,

OSTI has been working on a project for the last year or so to collect geothermal documents. At the STIP meeting in April, I sent out a plea to the DOE labs to identify and send to OSTI any geothermal documents that we did not already have in our database. I have a problem with a group of reports from EG&G Idaho. I am not sure you are the person correct person to ask for help on this issue. If not, maybe you can direct me to the responsible individual.

Attached is a list of documents that were sent to OSTI as part of that special geothermal project. All of the documents in this list have a patent caution as well as 'Internal Technical Report' stamped on the front of the report. The date on each of the documents is well past the sunset date for patentable material. If there is no other reason for control, I would like permission to cover up the patent caution and release each as unlimited. Would we also need to cover 'Internal Technical Report'?

If you need me to, I will be happy to fax you a copy of the covers of the reports.

Please let me know if you can help me out with this problem, or advise if I should communicate with someone

else - and who .

Thanks ahead for your help,
Patty

Patty Simmons
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DISCLAIMER

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Checked By: _____ Approved By: Gary M Miller

[redacted]

ABSTRACT

Asbestos-cement (Transite[a]) pipe was installed at the Raft River Geothermal Area in the fall of 1975 and has been used extensively since. The pipe is used to transfer water from the well sites to the testing areas, reserve pits, and reinjection wells.

The pipeline was designed to transport approximately 300°F water at 150 psi over a period of time for the present testing program and later, for the 5 MW(e) Raft River Pilot Plant.

Numerous line failures have occurred since the original lines were installed. Due to the various causes of the line failures and the extensive downtime which has occurred because of them, further examination of Transite pipe is necessary to determine its future use as completion of the 5 MW(e) pilot plant approaches.

The Conversion Technology and Engineering Branch has completed a preliminary study of the effects of S&I system transients on Transite pipe (re: OJD-7-79). Recommendations are proposed to conduct further studies and tests; however, no funding is presently available due to limitations in the budget for the 5 MW(e) pilot plant project.

The Mechanical Design Branch is continuing design analysis in an effort to gather information to determine maximum warmup rates for the S&I system.

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a. Transite is the trade name for this product.

FOREWORD

This report is in response to Memo NWS-3-79, "Development of Operating Procedures," dated August 1, 1979. The information contained herein will address the following five points in the referenced memo:

1. Unusual occurrence reports and follow-up resolutions.

2. Other known supply and injection (S&I) system/component operational problems and failures, and their causes and resolutions.

3. Past and present operating procedures, including precautions used in operating the S&I system/components.

4. Plans to maintain a running history of S&I system operational problems, failures, and resolutions.

5. Recommendations to aid in the development of safe, efficient, and reliable operating procedures for the S&I system on the basis of experiences at Raft River.

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TABLES

INTRODUCTION

The original justification for the use of asbestos-cement (Transite) pipe instead of steel or other types of pipe was because of lower cost, lack of corrosion, uniform expansion, and lower frictional loss. Cost estimates indicated that Transite pipe could be purchased and installed at 55% of comparable steel pipe. Reasons for the cost reductions were attributed to:

1) Transite can be assembled much faster than welded-joint steel pipe.

2) The expansion of each pipe section can be absorbed in each coupling, therefore requiring no large expansion loops.

3) The pressure drop is much less in the smooth-surfaced Transite than in Schedule 40 steel pipe by a ratio of approximately 0.54 to 1.0, thus benefiting throughout its lifetime in reduced pumping costs (ten-inch Transite pipe carrying 1000 gpm experiences a pressure drop of 6.2 psi/mile; a steel pipe 11.5 psi/mile). Corrosion of the steel pipe over a period of years would generally cause this pressure drop ratio to become even larger. In many cases, this reduced frictional loss allows the use of smaller Transite pipe, further reducing the cost.

The supply and injection system is a piping network designed primarily to carry hot geothermal water from the four production wells to the 5 MW(e) Raft River Pilot Plant (RRPP), and to carry the cooled water from the plant to the two injection wells. The S&I system also serves to (a) start up and shut down production and injection wells without interrupting the flow to the 5 MW(e) RRPP and the Experiment Water System (EWS), (b) provide geothermal water directly to the EWS from the production wells and the RRPP, (c) carry geothermal water from the EWS to the injection wells, (d) carry water from the well site

ponds to the injection wells, and (e) transport water between well site ponds during times when a pond-to-pond section of the pipeline system is not in production or injection service.

The interconnecting piping system between the wells and the 5 MW(e) RRPP is buried Transite pipe. Piping and components at the wellheads are aboveground and constructed of carbon steel with provision for thermal expansion. All piping (buried and aboveground) is insulated, except for the buried production line from Well 2 to Well 1 and the buried injection line from the 5 MW(e) RRPP to Wells 6 and 7. The aboveground piping at the injection wells is insulated for personnel protection. Check valves are located at the junctions of lines between production wells to prevent reverse flow and exhausting of the entire system through a break that might occur between a well and a check valve.

SYSTEM COMPONENT OPERATION PROBLEMS AND RESOLUTIONS

A listing of S&I system problems, the location of the occurrences, and the methods of correction are presented in Table 1 in chronological order. A summary of system failures, including number of occurrences and causes, is presented in Table 2. The listing is grouped according to the types of problems - pipe ruptures, coupling and gasket leaks, and valve malfunctions. A current history of unusual occurrences and follow-ups indicates further study is warranted. Unusual occurrence reports (Table 1) dated 1-6-76, 1-28-76, 7-2-76, 7-4-76, 10-8-76, 10-15-76, 10-27-76, 8-24-77, 8-25-77, 9-16-77, and 1-17-79 all indicate failures at couplings, which would seem to negate the statement of "fast-shock absorbing" efficient couplings versus welded joints. Unusual occurrence reports (Table 1) dated 1-28-76, 7-8-76, 9-25-76, 11-11-76, 8-29-77, 10-10-77, 2-4-78, 2-15-78, 2-24-78, and 7-24-79 indicate that Transite pipe will not absorb thermal shock or water hammer as originally believed.

TABLE 1. S&I SYSTEM UNUSUAL OCCURRENCE REPORTS AND RESOLUTIONS

Week Of	Occurrence and Resolution
12-7-75	12-inch Transite line completed.
1-16-76	12-inch Transite leak - Dresser coupling moved toward thrust block allowing O-ring to slip off Transite pipe. Recentered coupling.
1-28-76	Dresser coupling leaking during cold-water pumping; recentered coupling between 10-inch steel and 12-inch Transite.

TABLE 1. (continued)

Week Of	Occurrence and Resolution
3-9-76	12-inch Transite pipe ruptured at Well 2 while flowing from Well 1 to Well 2. A slug of cold water was inadvertently pumped into the hot line from the drill rig.
3-29-76	Ruptured section replaced (delayed because of drill rig moving off site).
6-18-76	Valley Utilities replaced gaskets on two couplings.
7-2-76	Transite leak at Well 2 - collar shifted - recentered collar.
7-4-76	Transite leak at Well 2 - collar shifted - recentered collar.
7-7-76	Dresser coupling blow-off at Well 1 - recentered collar.
7-8-76	Transite pipe section fractured due to thermal shock. Broken piece replaced and collar recentered near Well 1.
7-9-76	Replaced gaskets in Dresser coupling at Well 1 with used rubber gaskets.
9-25-76	Transite broke - about four joints from Well 1 - due to thermal shock.
10-1-76	Transite broken section replaced; second broken section found.

TABLE 1. (continued)

Week Of	Occurrence and Resolution
10-2-76	Second broken section replaced.
10-8-76	Broken gasket found on Dresser coupling at Well 1.
10-9-76	Gasket replaced.
10-15-76	Dresser coupling leak found at Well 2.
10-22-76	Replaced gasket at Well 2 with packing.
10-27-76	Dresser coupling continuing to leak at Well 2. Correct couplings on order for its repair.
11-11-76	Transite broke mid-distance between Wells 1 and 2. Cause unknown.
11-13-76	Transite section replaced; still leaking.
11-15-76	Air bleed valve in next section broken and leaking; also, joints leaking from rolled gaskets.
11-17-76	Rolled gaskets still leaking.
11-18-76	Replaced gaskets.
4-1-77	Leak between transite and steel connection repaired at Well 2.
4-27-77	Transite-to-steel connection at Well 2 had to be repaired. New section of Transite installed.

TABLE 1. (continued)

Week Of	Occurrence and Resolution
8-7-77	Wind blew well house down at Well 4, damaging logging stem; main valve closed to secure well.
8-8-77	Stinger pulled at Well 3; well shut down.
8-24-77	Coupling broke in Transite pipe between Wells 1 and 3.
8-25-77	Coupling broke in Transite pipe between Wells 1 and 3.
8-29-77	Transite pipe leaking between Wells 1 and 3. Replaced two sections of pipe.
9-16-77	Transite pipe at Well 2 found to have a break next to coupling between Transite and steel.
10-10-77	Transite pipe defective between Wells 1 and 4. Replaced by Valley Utilities.
2-4-78	Transite pipe broken at Well 2; repaired 2-8-78.
2-15-78	Section of Transite pipe broken in line between Wells 1 and 2.
2-24-78	Broken section of Transite pipe replaced.
12-27-78	Transite line broken between Wells 1 and 4 while digging for check valve.

TABLE 1. (continued)

Week Of	Occurrence and Resolution
1-14-79	Transite pipe break in line at Well 2; iron saddle eroded away from original installation. Replaced with new Transite.
1-17-79	Leak in Transite line between Wells 3 and 6. Replaced seal ring that was pinched on original installation.
7-24-79	Transite pipe break on line between Wells 1 and 2 due to water hammer.
10-1-79	Leak in Transite line at 5-MW area, caused by faulty initial installation. Contractor replaced 13-foot section of 12-inch pipe with two 6.5-foot sections and installed new gaskets.
10-6-79	Same problem as 10-1-79, except different joint was leaking.

TABLE 2. SUMMARY OF SYSTEM FAILURES

Type Of Failure/Date	Number Of Occurrences	Cause
Transite Pipe Ruptures:		
3-9-76	1	Thermal shock
7-8-76	1	Thermal shock
9-25-76	1	Thermal shock
11-11-76	1	?
8-29-77	1	Broken pipe
10-10-77	1	Defective pipe
2-4-77	1	?
2-15-78	1	?
12-27-78	1	Accidental
1-14-79	1	Iron saddle eroded
7-24-79	1	Water hammer
Sub Total	11	
Coupling/Gasket Leaks:		
1-16-76	1	Coupling moved
1-28-76	1	Coupling moved
7-2-76	1	Collar shifted
7-4-76	1	Collar shifted
7-7-76	1	Collar shifted
10-8-76	1	Broken gasket
10-22-76	1	Broken gasket
10-27-76	1	Broken gasket
8-24-77	1	Broken coupling
8-25-77	1	Broken coupling
9-16-77	1	Broken coupling
1-17-79	1	Pinched seal ring
10-1-79	1	Pinched seal ring
10-6-79	1	Pinched seal ring
Sub Total	14	
Valves:		
11-15-76	1	Air bleed valve broken
Sub Total	1	
TOTAL	26	

System component problems, other than direct line related, were documented after personal interviews with involved personnel and review of the daily maintenance log.

The unusual occurrence report file at Raft River Geothermal Area was started recently and provided documentation on the more recent occurrences. TREE-1114 provided useful data prior to 1977.

In resolving the cited problems, the S&I system was necessarily shut down and repairs were made. In each case the system was cooled slowly, repaired, and reheated slowly. This process required extensive downtime and cautious startup to prevent further failures. An analysis and cost-effective comparison to determine the feasibility of continued use of this piping material will be performed during the second quarter of FY 1980.

A preliminary cost estimate shows the average cost to repair each break or leak to be about $500. The estimate does not, however, include the cost of work schedule interruption (downtime). It has been estimated, for instance, that the downtime and schedule interruption caused by the 7-24-79 pipe break cost approximately $30,000.

OPERATING PROCEDURES

Since the Raft River Geothermal Project is still relatively new, complete operating procedures are not yet available. The project personnel are currently following test plans and procedures, that have been written to date, for specific operational functions. Operating procedures are scheduled to be written during systems operation testing and finalized with the performance of integrated testing. The integrated testing will incorporate the results of all previous testing and engineering analyses to date.

The Fluids Experiments Testing (FET) has proceeded in accordance with FET procedures in 1978-79.

Drafts have been made of standard practices for plant operations, with finalization expected in FY 1980. The Testing and Facility Branch will take the lead in finalizing the Standard Practice documents.

S&I SYSTEM OPERATIONAL PROBLEM ONGOING RECORDS

Daily and weekly reports are being written and maintained to show a running record of system problems, failures, and resolutions.

Daily reports provide a summary of the previous day's activities, and they are telecopied to the Willow Creek Building each morning. The weekly reports contain the minutes of the weekly planning meeting at Raft River, as well as a report of the work status, planned work, and any anomalies or problems and how they were or will be resolved.

A Standard Practice document, incorporating the information from the daily and weekly reports, will be prepared and issued to provide guidelines for the creation of a Maintenance History File. The regularly updated Maintenance History File will be compiled and issued as an annual report.