Technical Report

Title: ***Drilling Fluid Management and Testing in DGR-1 and DGR-2***

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DGR Site Characterization Document
Intera Engineering Project 06-219

Intera Engineering DGR Site Characterization Document		
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1 Introduction

Intera Engineering Ltd. has been contracted by Ontario Power Generation (OPG) to implement the Geoscientific Site Characterization Plan (GSCP) for the Bruce site located on Lake Huron, Ontario. The purpose of this site characterization work is to assess the suitability of the Bruce site to construct a Deep Geologic Repository (DGR) to store low-level and intermediate-level radioactive waste. The GSCP is described by Intera Engineering Ltd. (2006).

This report summarizes the pre-drilling testing, selection, preparation, handling, tracing, sampling and disposal of drilling fluid during the drilling of two deep bedrock boreholes (DGR-1 and DGR-2) as part of Phase 1 of the GSCP at the Bruce site.

Work described in this Technical Report was completed in accordance with Test Plan TP-06-08 – DGR-1 & DGR-2 Drilling Fluid Management (Intera Engineering Ltd., 2007a), which was prepared following the general requirements of the Intera DGR Project Quality Plan (Intera Engineering Ltd., 2007b).

2 Background

Intera Engineering Ltd. recently completed Phase 1 investigations which included a deep bedrock drilling program of two vertical 159 mm diameter continuously cored boreholes (DGR-1 and DGR-2) to depths of approximately 462 and 862 meters below ground surface (mBGS). Both of these boreholes were drilled at one location at the Bruce site as shown on Figure 1.

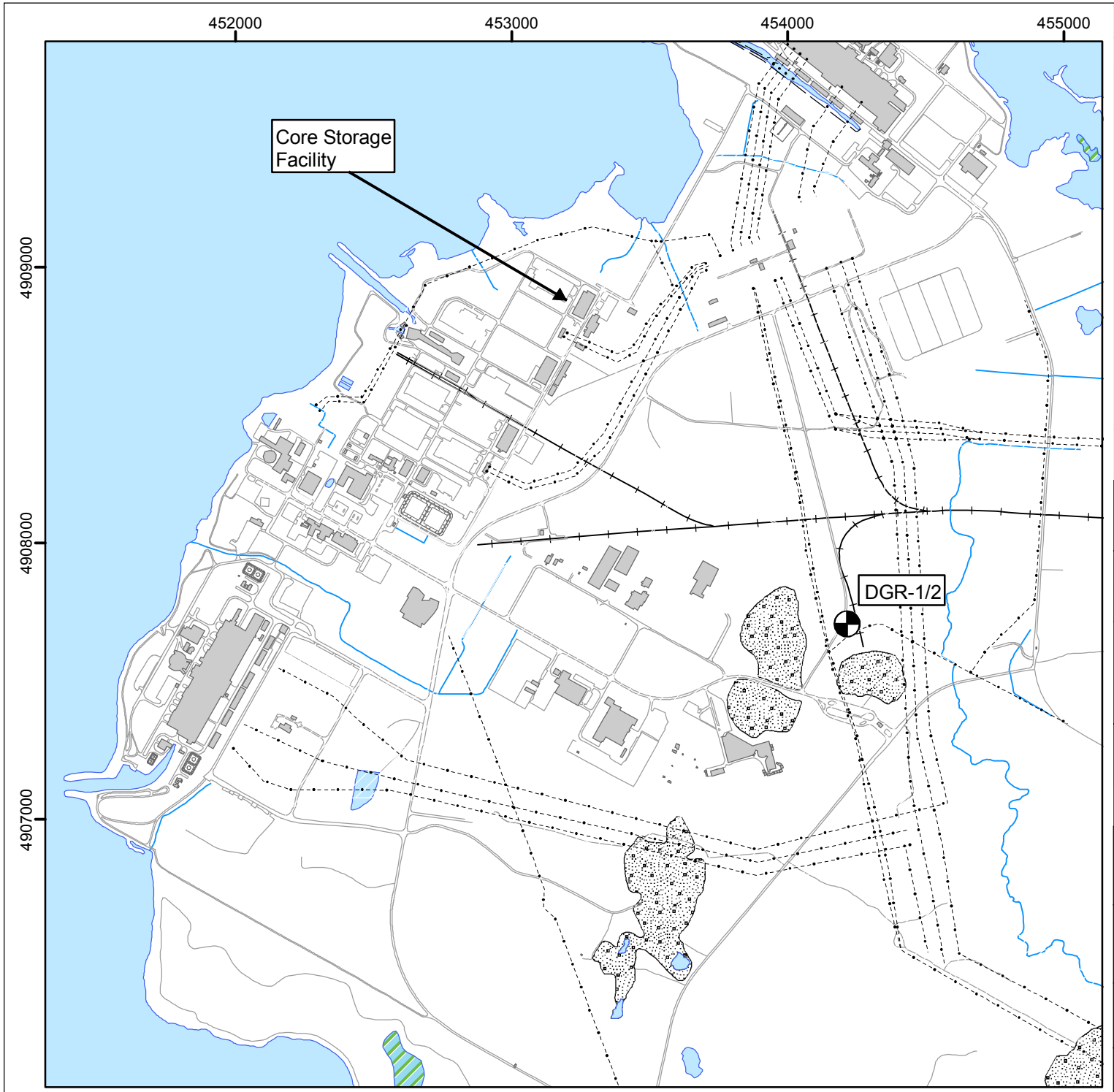
During these drilling activities, different drilling fluids were prepared to optimize success of the drilling program including minimization of borehole deterioration and control of downhole formation pressures and flow. All drilling fluids were traced using a naturally-present tracer (tritium) and an added tracer (Na Fluorescein) to allow future quantification of drilling fluid contamination levels in groundwater and porewater samples to be collected from the boreholes during and following completion of drilling. Pre-drilling testing of Na Fluorescein tracer stability and detectability in proposed drilling fluids was also undertaken as part of TP-06-08.

3 Methodology

3.1 Proposed Drilling Fluids

Proposed major ion chemistry of drilling fluids for drilling of DGR-1 and DGR-2 were specified by Intera Engineering Ltd. based on example groundwater chemistries for formations to be drilled as reported by McNutt et al. (1987) and information on shallow bedrock geochemistry at the Bruce site reported by Lee et al., (1995). MiSwaco of Calgary, Alberta prepared the drilling fluid formulation on behalf of Davidson Drilling to address hole cleaning, fluid loss reduction and corrosion inhibition requirements of the drilling fluids. The drilling fluid formulation does not explicitly address clay hydration as the formations are sufficiently indurated that such hydration should not be a concern.

Based on the above sources, two different drilling fluids were used to complete the drilling program. One drilling fluid, prepared using fresh water, was used for shallow (less than approximately 180-190 mBGS) diamond coring, rotary drilling and reaming in boreholes DGR-1 and DGR-2. A second drilling fluid, prepared using brine, was used for deeper diamond coring, rotary drilling and reaming in DGR-1 to protect against dissolution and wash-out of Silurian bedrock with anhydrite and halite zones. The same brine-based drilling fluid was used for deeper diamond coring, rotary drilling and reaming in DGR-2 to protect against weathering/deterioration of the Ordovician Queenston, Georgian Bay and Blue Mountain Formation shale units. In all cases the starting source of the drill water was treated Lake Huron water.



OPG DGR
Site Characterization Plan

Legend

- Location of DGR-1/2
- Buildings
- Roads
- Railway
- Transmission Line
- Pits or Landfills
- Stream or Drainage

Location of DGR-1 and DGR-2 at the Bruce Site

Figure 1

N

Scale 1:20,000 (approx.)

0 125 250 500 750 1,000 Meters

Date: 27/02/2008 Drawn: NKP
Project: 06-219 Checked: SNS
P:/Projects/2006/06-219/QMS_DGR/TR_Working Files/
TR-07-10/TR-07-09_Figure 1.mxd

Projection: UTM NAD 83 Zone 17

Data Credits:
NRVIS/OBM, MNR, Ontario Power Generation, Bruce Power

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Brine-based drilling fluids were prepared by addition of NaCl and $CaCl_2$ salts to fresh lake water. The proposed deep drilling fluid was a Na:Ca:Cl brine with maximum target concentrations of about 70:32:168 g/L, respectively, for a maximum target total dissolved solids content of about 270 g/L. The maximum density of this brine-based drilling fluid (~1.25 kg/m^3) provided protection against possible artesian flows and minor gas flow zones during drilling. As discussed in Section 4, actual brine drilling fluid salt concentrations were frequently less than proposed with fluid densities ranging from 1,050 to 1,240 kg/m^3.

Table 1 lists the proposed drilling fluid formulations for drilling DGR-1 and DGR-2, exclusive of tracer additions, assuming a nominal borehole diameter of 160 mm, that were proposed before the start of the drilling program (TP-06-08) Quantities of additives for hole cleaning and fluid loss reducers varied with hole diameter and borehole conditions and so differed somewhat from quantities listed in Table 1. For example, during fresh water coring, favourable borehole conditions did not always require the addition of polymers for cleaning cuttings from the borehole or to control excessive fluid loss. Other additives were sometimes used. Table 3 provides a summary of which drilling fluid additives were actually used during the drilling of DGR-1 and DGR-2.

Table 1 Summary of Proposed Drilling Fluid Additives – DGR-1 and DGR-2

Drilling Fluid	***Additives and Quantities (kg/m^3)***	***Additive Type and Purpose***
Fresh Water for Coring, Rotary Drilling & Reaming	Fed Zan D (2.5)	Hole Cleaning Biopolymer
	Fed Pac UL (3.0)	Polysaccharide Fluid Loss Reducer
Brine for Coring, Rotary Drilling & Reaming	Fed Zan D (2.5)	Hole Cleaning Biopolymer
	Fed Pac UL (3.0)	Polysaccharide Fluid Loss Reducer
	Conqor 404 (13.1)	Polyol Phosphate Ester Corrosion Inhibitor
	NaCl (180) and $CaCl_2$ (90)	Salts for Brine to Protect Silurian and Ordovician Formations

The MiSwaco drill water additives as polymers, polysaccharides and phosphate esters were to be added in low mg/L concentrations that based on subsequent sampling, testing and analysis did not negatively affect core pore water or groundwater chemistries.

3.2 Pre-Drilling Testing of Drill Fluid Tracers

Testing of prepared drilling fluids was undertaken prior to commencement of drilling operations to confirm the background concentration and concentration stability of drill water tracers. Drill water tracers include the tritium found in Lake Huron water (which is elevated due to Bruce site activities) and Na Fluorescein, which is added to all drilling fluids. Tritium is not added to the drill water and hence will only include the tritium found in Lake Huron water.

Background tritium and Na Fluorescein tracer concentrations were measured on treated Lake Huron water samples provided by OPG. Background tritium was measured by the Environmental Isotope Lab, University of Waterloo. Background Na Fluorescein tracer concentrations were measured following the general testing procedures described in Section 3.7.

Samples of traced drilling fluid were prepared using liquid samples of treated Lake Huron water, liquid Na Fluorescein, and solid samples of drilling fluid additives following the preparation instructions provided by M-I Swaco and those developed by Intera as indicated on Table 1. These test samples were intended to test

stability of the Na Fluorescein and the background tritium content in prepared drilling fluids prior to undertaking drilling.

Two 500 mL samples of traced drilling fluid were prepared by initially adding sufficient Na Fluorescein to 1 L of treated Lake Huron water to create a Na Fluorescein concentration of about 1 mg/L, which is the targeted drilling fluid concentration. Drilling fluid additives as per Table 1 were then added to the traced water samples to create the traced drilling fluid samples. The traced drilling fluid samples included one fresh water drilling fluid sample and one brine drilling fluid sample as listed in Table 2.

The traced drilling fluid sample was analysed for tritium by direct counting methods by the University of Waterloo. Na Fluorescein tracer concentrations in the prepared drilling fluid samples were measured following the general testing procedures described in Section 3.7, after equilibration periods of 24, 48 and 72 hours.

Table 2 Summary of Pre-Drilling Testing of Drilling Fluid Tracers

Drilling Fluid	***Tritium (TU)***	***Na Fluorescein (µg/L)***				
		Background	***0 hours***	***24 hours***	***48 hours***	***72 hours***
Lake Huron Water	148 ± 8	0.01 to 0.1	-	-	-	-
Fresh Water Drilling Fluid	-	0.20 to 0.58	1000	3070	1500	1600
Brine Drilling Fluid	162 ± 8	0.03 to 0.08	1300	600	600	800

The results listed in Table 2 show that tritium contents in Lake Huron water and brine drilling fluid are elevated and comparable indicating suitability of tritium as a drilling fluid tracer and that drilling fluid additives and salts do not significantly increase the tritium content of treated Lake Huron water.

Table 2 also shows that the background concentrations of Na Fluorescein in Lake Huron water, and in prepared fresh water and brine drilling fluids are all less than 1 µg/L. Table 2 also shows that there are some interferences and fluctuations of Na Fluorescein in both fresh water and brine drilling fluids over periods of 24 to 72 hours after tracing of drilling fluids prepared with the additives listed in Table 1. These tests suggest that frequent testing and adjustment of Na Fluorescein concentrations would allow for use of this dye as a field drilling water tracer in both proposed fresh water and brine drilling fluids.

3.3 Drilling Fluid Preparation

All drilling fluids were prepared using treated Lake Huron water which was obtained from Building B-19 (Spent Solvent Treatment Facility). Water was obtained from a service outlet on the southeast side of the building that is normally used for filling water tankers.

Treated Lake Huron water was trucked from Building B-19 by Davidson Drilling and pumped into the drilling fluid tanks at the DGR-1 and DGR-2 drill site. Drilling fluids for DGR-1 were prepared in a 6.3 m^3 capacity shaker tank and a 33 m^3 capacity settling tank. Drilling fluids for DGR-2 were prepared in a 6.3 m^3 capacity shaker tank, a 33 m^3 capacity settling tank and a 28 m^3 capacity settling tank. Drilling fluid tanks were provided by Davidson Drilling. Intera added the necessary amounts of Na Fluorescein tracer to the drilling fluid tank to achieve a target tracer concentration of 1 mg/L. Drilling fluids were prepared in tanks, by addition of the necessary drilling fluid additives to traced Lake Huron water, by Davidson Drilling under consultation with Davidson's drilling fluid engineer.

Table 3 Summary of Actual Drilling Fluid Additives – DGR-1 and DGR-2		
Borehole	***Drilling Depth (mBGS)***	***Additives Used***
DGR-1	0 - 20	QUIK-GEL
	20 - 38	None
	38 - 45	Alkapam A-1103D
	45 - 98	None
	98 - 113	Fed Zan D
	113 -152	Fed Zan D and Fed Pac UL
	152 - 183	Fed Zan D
	183 - 462	NaCl and $CaCl_2$
DGR-2	0 - 23	QUIK-GEL
	23 - 38	None
	38 - 51	Fed Zan D
	51 - 60	Fed Zan D
	60 - 132	Fed Zan D
	132 - 139	Fed Zan D
	139 - 155	Fed Zan D
	155 - 167	Fed Zan D and Alkapam A-1103D
	167 - 179	Fed Zan D
	179 - 188	Fed Zan D
	188 - 192	Fed Zan D and Alkapam A-1103D
	192 - 862	NaCl and $CaCl_2$

QUIKGEL is a Baroid bentonite-based drilling additive intended to increase drill fluid viscosity and cuttings removal. Alkapam A1103-D is an anionic, water-soluble polymer drilling fluid additive used as a flocculent to increase removal of fine drill cuttings. Some loss of Na Fluorescein to this flocculent was noted during drilling of DGR-2, and subsequent use of the flocculent was reduced.

Once diamond coring, rotary drilling or reaming started, the physical properties of the drilling fluids were monitored for fluid density and funnel viscosity on a per drilling shift basis (i.e., once every 12 hours) or more frequently if necessary. Monitoring and maintenance of the drilling fluids was the responsibility of the Davidson drill fluid engineer. Fluid density was monitored using a bulb hydrometer and funnel viscosity was monitored using a conventional Baroid Marsh funnel. These physical measurements were completed by Davidson Drilling. Additions of drilling fluid additives to maintain drilling fluid density and viscosity were the responsibility of Davidson Drilling.

Intera retained responsibility for maintenance of Na Fluorescein drill water tracer levels.

Records of the above drilling fluid preparation and physical property measurements were retained in Scientific Notebooks (ID: SN-06-08-DrillF).

3.4 Drilling Fluid Storage, Reuse and Disposal

Prepared drilling fluids (both freshwater and brine based) were stored in on-site drilling fluid storage tanks.

All drilling fluids and solids identified for disposal were disposed of in accordance with provincial regulations, including Ontario Regulation 347 (Waste Management) as amended by Ontario Regulation 558/00 under the Ontario Environmental Protection Act.

3.5 Tracer Preparation

Na Fluorescein stock solutions were prepared at concentrations of 10 g/L using treated Lake Huron water with appropriate drilling fluid additives for both the fresh water and brine-based drilling fluids. Na Fluorescein stock solutions were used for dosing the drill water tanks to achieve the target drill fluid concentration of 1 mg/L and for preparing Na Fluorescein drilling water standards.

Na Fluorescein drilling water standards were prepared at concentrations bracketing the target drill fluid concentration of 1 mg/L. Standards were prepared from Na Fluorescein stock solutions containing appropriate drilling fluid additives for either the fresh water or brine-based drilling fluids, as required. Na Fluorescein standards were prepared at concentrations of 10, 100, 500, 1000 and 1500 µg/L. The standards were then diluted 1:10 prior to calibration of the fluorometer.

These standards were identified as NaFl-mmmm.m, where NaFl is Na Fluorescein and mmmm.m is the concentration in µg/L. In addition to a name, drill water standards had the following information on the label:

1. the date of preparation;
2. the name of the person who created it;
3. the Scientific Notebook name and page number showing the record of the standard preparation; and
4. the requirement to store standard in a dark place out of direct light.

Na Fluorescein standards were stored in the field lab refrigerator, at approximately 4°C.

Records of the above tracer preparation were retained by Intera in Scientific Notebooks (ID: SN-06-08-DrillF and SN-06-08-NaFl).

3.6 Sample Collection

Sampling and routine testing of drilling fluids was conducted on a regular basis throughout the drilling of DGR-1 and DGR-2, as specified in Table 4. Samples were collected for field and lab determination of drill water tracer concentrations and for characterization of general drill water major ion, metals and environmental isotope contents. Na Fluorescein and electrical conductivity were regularly measured (four times per day) in the field on drill water samples to both ensure maintenance of drill water tracer levels and for detection of production of formation fluids that may trigger opportunistic groundwater sampling. Drill water samples for tritium analyses were regularly collected (once per day).

Samples were collected from the drill water tank (DWT) to quantify drill water concentrations entering the borehole during drilling. Although allowance was made in TP-08-06 for collection of drill water return (DWR) samples, characterization of drilling fluid was judged in the field to be most reliably determined from sampling of the drill water tank.

Table 4 summarizes the total number of samples collected and analysed for different GSCP analytical parameter groups.

Table 4	**Summary of Analyses of Drilling Fluids – DGR-1 and DGR-2**		
GSCP Group and Analytes	***Total No. of Samples Collected***	***Total No. of Samples Analysed***	***Distribution of Analysed Samples***
Group E (Drill Water Tracers [Na Fluorescein and Conductivity])	313	304	143 for DGR-1; 170 for DGR-2
Group E (Drill Water Tracers [Tritium])	73	25	11 for DGR-1; 14 for DGR-2
Group A (Master Variables and Major Ions, including field pH, Conductivity and Temperature)	10	10	DGR-1: 4 Devonian & Silurian Fm
			DGR-2: 2 Devonian & Silurian Fm, 3 Ordovician Fm, 1 Cambrian/ Precambrian Fm
Group B (Trace Elements and Environmental Isotopes [^{18}O, ^{2}H])	10	10	DGR-1: 4 Devonian & Silurian Fm
			DGR-2: 2 Devonian & Silurian Fm, 3 Ordovician Fm, 1 Cambrian/ Precambrian Fm

Samples collected for Na Fluorescein analyses were collected as well-mixed grab samples in 250 mL high density polyethylene (HDPE) containers that were protected from heat and light and stored in refrigerators. Although the drill water return was mechanically cleaned by passage through a shale shaker and silt/sand separation unit, some suspended particulate was present in water returned to the drill water return tank(s). The collected samples for Na Fluorescein analyses were allowed to settle for a reasonable period of time (i.e. up to 3 or 4 hours) to remove suspended fine particulate.

Although TP-08-06 called for dilution to yield a 10 mL aliquot for Na Fluorescein determination, a 20 mL sample was created for ease of sample handling and filtration. Consequently 20 mL of sample was filtered with a 0.45µm filter using a syringe. A 2mL sample of the settled or filtered drilling fluid was collected with a 1-5 mL pipettor (MTE ID: PIP-01) and was mixed with 18 mL of deionized water, which was collected with a 2-10 mL pipettor (MTE ID: PIP-02), to generate a 20 mL water sample for analysis of Na Fluorescein content.

Samples of drilling water were collected for specific analytical tests in high density polyethylene (HDPE) bottles. Some samples were shipped to laboratories for analysis, while others were retained for later on-site tests or for archiving. Table 5 summarizes the drilling water sample container requirements for all analytical parameters that are listed in Table 4.

Drilling water tracer samples collected from the drill-water tank (DWT) were identified by DWT-XXXX-YY where XXXX is the borehole identifier and YY is the index number of the sample. All drill water samples required the time and date of sampling to be recorded on the sample label, as well as the name of the person who collected the sample.

Table 5 Summary of Container Requirements for Drilling Water Samples				
Analytes	***Bottle Type***	***Volume (mL)***	***Preservation***	***Headspace***
Na Fluorescein	HDPE	250	None required	No
Major and Trace Metals	HDPE	60	Filter to 0.45 μm Acidify to pH <2 with Nitric Acid (~5 drops of 50% HNO_3) 4°C	No
Major Anions	HDPE	60	4°C	
^{18}O and ^{2}H in water	HDPE	30	None required	No
Tritium	HDPE	250 and 500	None required	No
Archive	HDPE	1000	4°C	No

Table 5 lists two container sizes for tritium analyses of 250 mL and 500 mL. The 250 mL sample container was specified in TP-06-08 assuming all drill water would be analysed for tritium by direct counting due to the expected high levels (>100 TU) in drilling fluid regardless of salinity. However flowing conditions encountered during drilling of the Cambrian Formation resulted in all drilling fluid being displaced by Cambrian Formation water, which was anticipated to have very low tritium contents. Sample volume requirements for low level tritium analyses in such brine waters were 500 mL.

Records of the above drilling fluid sample collection were retained by Intera in Scientific Notebooks (ID: SN-06-08-DWSampID).

Samples were kept in the field lab refrigerator or in the refrigerators in the Core Storage Facility, at approximately 4°C until analysis or shipment to laboratories. Archived water samples were stored in the Core Storage Facility refrigerators.

3.7 Sample Analysis

Na Fluorescein concentrations were measured in the field laboratory trailer using a Turner Designs Trilogy Model 7200-000 fluorometer (MTE ID: FL-01). The fluorometer was calibrated once per batch of Na Fluorescein tracer stock solution mixed using prepared Na Fluorescein standards. The Na Fluorescein standards were prepared using freshwater and brine-based drilling fluids. The calibration was checked using manufacturer-prepared solid state standards each time the fluorometer was used to measure drilling fluid tracer concentrations. Both standards and collected samples were diluted 1:10 to optimize tracer measurement within the fluorometer linearity range.

Na Fluorescein tracer concentrations were measured with a linearity of $0.99R^2$ and a lower detection limit that was not more the 1% of drill water tracer concentrations. Both of these tolerance levels were met by the Turner fluorometer assuming a drill water source concentration of 1 mg/L and 10:1 dilution on prepared drill water samples and standards (note maximum linear range for Na Fluorescein detection with the Trilogy Model 7200-000 fluorometer is about 150 μg/L).

Records of the above Na Fluorescein analyses and fluorometer calibrations were retained in Scientific Notebooks (ID: SN-06-08-NaFl).

Field measurements of drilling water quality were completed using a digital voltmeter (Orion 5-star benchtop multi-meter, MTE ID: MM-01 or MM-02) and appropriate electrodes for pH (Orion Ross Sure-Flow combination electrode, MTE ID: PHP-01 or PHP-02), Eh (Orion combination platinum electrode, Ag/AgCl reference electrode, MTE ID: ECP-01), dissolved oxygen (Orion dissolved oxygen probe, MTE ID: DOP-01 or DOP-02), temperature (Orion automatic temperature compensation probe, MTE ID: TP-01 or TP-02) and electrical conductivity (Orion 2-electrode conductivity cell, MTE ID: ECP-01 or ECP-02) measurements. Manufacturers' protocols as described in TP-06-11 (Intera Engineering Ltd., 2007c) were followed in their use.

Electrode measurements followed the principles set out in the USGS' National Field Manual for the Collection of Water-Quality Data: Chapter A6. Field Measurements (USGS, 2005 and updates).

Records of the above field measured parameters and digital voltmeter calibrations were retained in Scientific Notebooks (ID: SN-06-08-DVM).

Tritium analyses were completed by the Environmental Isotope Laboratory, University of Waterloo in Waterloo, Ontario. Major and Trace Metals and Major Anions analyses were completed by Activation Laboratories Ltd. in Ancaster, Ontario. ^{18}O and ^{2}H analyses were completed by the University of Ottawa in Ottawa, Ontario. Methods of laboratory analysis are described in TP-07-08 (Intera Engineering Ltd., 2008).

4 Results and Conclusions

4.1 Field Physical Property Measurements

Tabular results of the physical property measurements of the drilling fluids, including fluid density and funnel viscosity, for DGR-1 and DGR-2 are provided as Tables A.1 and A.2, respectively, in Appendix A. Graphical results of the physical property measurements of the drilling fluids, including plots of fluid density and funnel viscosity versus drilling depth, for DGR-1 and DGR-2 are provided as Figures C.1 and C.4, respectively, in Appendix C.

Fluid density measurements in DGR-1 ranged from 1,000 kg/m^3 to 1,150 kg/m^3, with an average value of 1,033 kg/m^3. Fluid density measurements in DGR-2 ranged from 1,010 kg/m^3 to 1,240 kg/m^3, with an average value of 1,099 kg/m^3.

Funnel viscosity measurements in DGR-1 ranged from 28 second/quart (sec/qt) to 36 sec/qt, with an average value of 29.5 sec/qt. Funnel viscosity measurements in DGR-2 ranged from 10.9 sec/qt to 53 sec/qt, with an average value of 41.8 sec/qt. The funnel viscosity of fresh water at 20°C is 26 sec/qt or 0.001 Pascal-seconds.

4.2 Field Chemical Property Measurements

Tabular results of the field chemical property measurements of the drilling fluids, including Na Fluorescein, electrical conductivity, pH and temperature, for DGR-1 and DGR-2 are provided as Tables B.1 and B.3, respectively, in Appendix B. Graphical results of the field measurements of the drilling fluids, including plots of Na Fluorescein, electrical conductivity and pH versus depth, for DGR-1 and DGR-2 are provided as Figures C.2 and C.3 and Figures C.5 and C.6, respectively, in Appendix C.

Na Fluorescein concentrations in DGR-1 ranged from 42.9 µg/L to 6924.6 µg/L, with an average concentration of 1012.4 µg/L. Na Fluorescein concentrations in DGR-2 ranged from 8.3 µg/L to 1559.7 µg/L, with an average concentration of 758.0 µg/L.

Electrical conductivity measurements in the shallow (less than approximately 183 mBGS) section of DGR-1 ranged from 91.6 µS/cm to 7790 µS/cm, with an average concentration of 1424 µS/cm. Electrical conductivity

measurements in the deeper (greater than approximately 183 mBGS) section of DGR-1 ranged from 105.9 mS/cm to 202.3 mS/cm, with an average concentration of 154.3 mS/cm. Electrical conductivity measurements in the shallow (less than approximately 189 mBGS) section of DGR-2 ranged from 163.5 µS/cm to 3740 µS/cm, with an average concentration of 1484 µS/cm. Electrical conductivity measurements in the deeper (greater than approximately 189 mBGS) section of DGR-2 ranged from 6.4 mS/cm to 223.6 mS/cm, with an average concentration of 145.4 mS/cm.

pH measurements in DGR-1 ranged from 6.81 pH units to 12.17 pH units, with an average concentration of 8.92 pH units. pH measurements in DGR-2 ranged from 5.78 pH units to 12.85 pH units, with an average concentration of 8.17 pH units. The higher pH measurements reflect contamination of drilling fluid by cement grouting of the steel well casing.

4.3 Laboratory Analyses

Tabular results of the laboratory analyses of the drilling fluids, including tritium and other environmental isotopes, major and trace metals and major anions, for DGR-1 and DGR-2 are provided as Tables B.2 and B.4, respectively, in Appendix B. Graphical results of the laboratory analyses of the drilling fluids, including plots of tritium versus depth, for DGR-1 and DGR-2 are provided as Figures C.3 and C.5, respectively, in Appendix C.

Tritium concentrations in DGR-1 ranged from 71.2 TU to 236 TU, with an average concentration of 190.7 TU. Tritium concentrations in DGR-2 ranged from 18.2 TU to 696.3 TU, with an average concentration of 371.1 TU.

5 Data Quality and Use

The data presented in this Technical Report describe the physical and chemical properties of drilling fluids used to complete boreholes DGR-1 and DGR-2. The physical data, in particular the fluid density data, are suitable for estimation of downhole formation pressures during drilling and in reconstruction of borehole pressure histories to aid in analysis and interpretation of borehole straddle-packer hydraulic tests. The chemical data are suitable for estimation of drilling fluid contamination in subsequent groundwater and potentially in porewater samples collected for laboratory analyses and chemical/isotopic characterization.

There are no identifiable limitations on the use of the data presented in this Technical Report.

6 References

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APPENDIX A

Summary of Field Physical Property Measurements of DGR-1 and DGR-2 Drilling Fluids

Table A.1 – Summary of Field Physical Property Measurements of DGR-1 Drilling Fluids

Table A.2 – Summary of Field Physical Property Measurements of DGR-2 Drilling Fluids

Table A.1 - Summary of Field Physical Property Measurements of DGR-1 Drilling Fluids

Date	Depth (mBGS)	Density (kg/m^3)	Funnel Viscosity (sec/qt)
27-Jan-07	38.35	1,000	--
28-Jan-07	38.35	1,000	--
28-Jan-07	38.35	1,000	--
28-Jan-07	38.35	1,000	--
29-Jan-07	38.35	1,000	--
29-Jan-07	38.35	1,000	--
29-Jan-07	38.35	1,000	--
30-Jan-07	41.40	1,000	--
30-Jan-07	41.40	1,000	--
30-Jan-07	41.40	1,000	--
31-Jan-07	41.40	1,000	--
31-Jan-07	41.40	1,000	--
31-Jan-07	42.40	1,000	--
1-Feb-07	44.45	1,000	--
1-Feb-07	47.50	1,000	--
1-Feb-07	47.50	1,000	--
2-Feb-07	47.50	1,000	--
3-Feb-07	53.60	1,010	--
3-Feb-07	56.65	1,010	--
3-Feb-07	59.70	1,010	--
3-Feb-07	59.70	1,010	--
4-Feb-07	62.75	1,005	--
4-Feb-07	65.80	1,010	--
6-Feb-07	68.85	1,010	--
6-Feb-07	68.85	1,010	28
7-Feb-07	71.90	1,005	29
7-Feb-07	73.45	1,010	28
7-Feb-07	73.45	1,005	28
8-Feb-07	73.45	1,005	28
8-Feb-07	73.45	1,010	28
18-Feb-07	81.05	1,010	29
18-Feb-07	81.05	1,010	28
18-Feb-07	84.10	1,000	28
19-Feb-07	90.20	1,010	29
20-Feb-07	96.30	1,010	29
20-Feb-07	96.30	1,010	29
21-Feb-07	99.35	1,000	30.5
21-Feb-07	105.48	1,000	30.5
21-Feb-07	112.90	1,000	31
23-Feb-07	114.63	1,010	30
23-Feb-07	114.63	1,010	30
23-Feb-07	114.63	1,010	30
23-Feb-07	117.68	1,010	29
24-Feb-07	126.83	1,010	--
25-Feb-07	132.13	1,000	29
26-Feb-07	132.13	1,000	29
26-Feb-07	133.50	1,000	29
28-Feb-07	142.08	1,000	29
28-Feb-07	146.34	1,000	31
28-Feb-07	150.30	1,000	31
28-Feb-07	152.44	1,000	30
1-Mar-07	156.41	1,000	30
1-Mar-07	160.38	1,000	29
1-Mar-07	164.64	1,010	28.5
1-Mar-07	170.45	1,010	30.5
1-Mar-07	175.63	1,010	30.5
2-Mar-07	175.63	1,000	30
2-Mar-07	178.68	1,010	30
6-Mar-07	178.68	1,000	30
7-Mar-07	178.68	1,000	30
7-Mar-07	178.68	1,000	31
7-Mar-07	178.68	1,010	30
7-Mar-07	178.68	1,020	30
7-Mar-07	178.68	1,030	30
7-Mar-07	178.68	1,040	31
8-Mar-07	178.68	1,045	33
8-Mar-07	178.68	1,050	36
8-Mar-07	178.68	1,040	31
8-Mar-07	178.68	1,020	29
8-Mar-07	178.68	1,020	31
9-Mar-07	178.68	1,025	33
9-Mar-07	178.68	1,030	34
9-Mar-07	178.68	1,010	29
9-Mar-07	178.68	1,010	28
10-Mar-07	178.68	1,010	28.5
10-Mar-07	178.68	1,010	28.5
10-Mar-07	178.68	1,010	28.5
11-Mar-07	178.68	1,010	28
11-Mar-07	178.68	1,015	28
27-Mar-07	218.87	1,120	28
27-Mar-07	221.92	1,120	28
27-Mar-07	231.07	1,130	28
28-Mar-07	258.52	--	28
28-Mar-07	270.72	--	28
30-Mar-07	292.07	--	29
30-Mar-07	295.12	--	29
30-Mar-07	304.27	--	29
31-Mar-07	328.67	--	28
31-Mar-07	334.77	--	29
31-Mar-07	340.87	--	29
31-Mar-07	346.97	1,150	--
1-Apr-07	353.07	1,150	--
1-Apr-07	359.17	1,150	--
1-Apr-07	362.22	1,150	--
1-Apr-07	368.32	1,150	--
2-Apr-07	374.42	1,150	--
2-Apr-07	380.52	1,150	--
2-Apr-07	386.62	1,150	--
3-Apr-07	414.07	1,150	29
3-Apr-07	420.17	1,150	29
3-Apr-07	426.27	1,150	29
4-Apr-07	453.72	1,150	29
4-Apr-07	459.82	1,150	29
4-Apr-07	462.87	1,150	29

Notes:

mBGS = metres below ground surface.

-- = Parameter not analyzed.

Prepared by: SNG
Reviewed by: KER
TR-07-09_Drilling Fluid Physical Property Data_R0.xls

Table A.2 - Summary of Field Physical Property Measurements of DGR-2 Drilling Fluids

Date	Depth (mBGS)	Density (kg/m^3)	Funnel Viscosity (sec/qt)
15-Apr-07	36.71	1,030	30
16-Apr-07	38.63	1,030	31
16-Apr-07	42.81	1,020	30
16-Apr-07	48.91	1,020	45
17-Apr-07	52.09	1,020	50
17-Apr-07	53.38	1,020	53
18-Apr-07	69.58	1,050	45
19-Apr-07	73.31	1,050	50
19-Apr-07	76.78	1,050	51
19-Apr-07	78.08	1,060	41
19-Apr-07	84.48	1,130	43
20-Apr-07	85.61	1,140	45
20-Apr-07	85.61	1,140	47
20-Apr-07	91.88	1,150	46
20-Apr-07	94.58	1,140	46
20-Apr-07	94.58	1,010	45
21-Apr-07	97.71	1,010	45
21-Apr-07	103.81	1,010	45
21-Apr-07	103.88	1,040	39
21-Apr-07	109.91	1,040	40
21-Apr-07	116.01	1,040	42
21-Apr-07	116.01	1,090	42
22-Apr-07	122.31	1,090	42
22-Apr-07	128.26	1,100	43
22-Apr-07	129.71	1,100	42
22-Apr-07	134.31	1,100	40
22-Apr-07	138.48	1,080	38
22-Apr-07	138.48	1,060	42
23-Apr-07	146.51	1,060	42
23-Apr-07	150.88	1,070	42
23-Apr-07	151.88	1,070	42
23-Apr-07	152.61	1,020	48
23-Apr-07	152.61	1,050	42
24-Apr-07	158.71	1,050	46
24-Apr-07	163.38	1,050	46
24-Apr-07	164.71	1,050	40
24-Apr-07	170.91	1,070	51
24-Apr-07	177.01	1,070	48
24-Apr-07	177.01	1,060	47
25-Apr-07	183.11	1,060	47
25-Apr-07	188.38	1,070	48
25-Apr-07	189.21	1,070	47
25-Apr-07	189.21	1,070	45
25-Apr-07	189.21	1,070	50
25-Apr-07	189.21	1,050	49
26-Apr-07	189.21	1,050	48
26-Apr-07	189.21	1,050	47
12-May-07	189.21	1,080	--
13-May-07	189.21	1,090	--
13-May-07	206.66	1,090	--
13-May-07	212.76	1,090	--
13-May-07	224.96	1,090	--
14-May-07	243.26	1,090	29
14-May-07	249.36	1,090	29
14-May-07	261.56	1,090	--
14-May-07	273.76	1,090	--
14-May-07	285.96	1,090	--
14-May-07	285.96	1,085	--
15-May-07	298.16	1,085	--
15-May-07	304.26	1,085	--
15-May-07	316.46	1,090	--
15-May-07	328.66	1,090	--
15-May-07	334.76	1,060	29
16-May-07	334.76	1,070	29
16-May-07	346.96	1,085	29
16-May-07	359.16	1,090	--
16-May-07	365.26	1,090	--
16-May-07	377.46	1,100	--
17-May-07	401.86	1,100	--
17-May-07	403.88	1,100	--
17-May-07	403.88	1,060	--
17-May-07	407.96	1,120	--
18-May-07	437.88	1,120	--
18-May-07	444.56	1,120	--
18-May-07	450.66	1,120	10.9
29-May-07	459.90	1,100	--
29-May-07	490.40	1,100	--
30-May-07	496.50	1,100	--
30-May-07	502.60	1,100	--
30-May-07	511.75	1,100	--
30-May-07	523.95	1,100	--
31-May-07	533.10	1,100	--
31-May-07	542.25	1,100	--
31-May-07	548.35	1,100	--
31-May-07	548.35	1,100	--
1-Jun-07	554.45	1,100	--
1-Jun-07	560.55	1,100	--
1-Jun-07	563.60	1,100	--
1-Jun-07	575.80	1,100	--
1-Jun-07	578.85	1,100	--
1-Jun-07	584.95	1,100	--
2-Jun-07	597.15	1,100	--
2-Jun-07	600.20	1,100	--
2-Jun-07	606.30	1,100	--
2-Jun-07	615.45	1,100	--
3-Jun-07	642.90	1,100	--
3-Jun-07	649.00	1,100	--
3-Jun-07	654.40	1,100	--
4-Jun-07	655.10	1,100	--
4-Jun-07	655.10	1,100	--
4-Jun-07	655.10	1,100	--
5-Jun-07	655.10	1,100	--
5-Jun-07	655.10	1,100	--
6-Jun-07	655.10	1,100	--
6-Jun-07	655.10	1,100	--
8-Jun-07	655.10	1,100	--
8-Jun-07	655.10	1,100	--
8-Jun-07	655.10	1,100	--
9-Jun-07	655.10	1,100	--
9-Jun-07	655.10	1,100	--
10-Jun-07	655.10	1,100	--
10-Jun-07	655.10	1,100	--

Table A.2 - Summary of Field Physical Property Measurements of DGR-2 Drilling Fluids

Date	Depth (mBGS)	Density (kg/m^3)	Funnel Viscosity (sec/qt)
11-Jun-07	667.30	1,100	--
11-Jun-07	676.45	1,100	--
11-Jun-07	685.60	1,100	--
13-Jun-07	709.70	1,100	--
14-Jun-07	725.25	1,100	--
14-Jun-07	734.40	1,100	--
15-Jun-07	761.25	1,090	--
15-Jun-07	769.75	1,100	--
17-Jun-07	769.75	1,100	--
17-Jun-07	771.00	1,100	--
18-Jun-07	777.10	1,100	--
18-Jun-07	777.10	1,100	--
18-Jun-07	180.15	1,100	--
18-Jun-07	783.20	1,100	--
18-Jun-07	783.20	1,100	--
19-Jun-07	789.30	1,100	--
19-Jun-07	792.35	1,100	--
19-Jun-07	795.40	1,100	--
19-Jun-07	798.45	1,100	--
19-Jun-07	801.50	1,100	--
21-Jun-07	816.75	1,100	--
21-Jun-07	816.75	1,100	--
21-Jun-07	816.75	1,100	--
22-Jun-07	816.75	1,100	--
22-Jun-07	816.75	1,100	--
22-Jun-07	825.90	1,100	--
22-Jun-07	828.95	1,100	--
22-Jun-07	828.95	1,100	--
22-Jun-07	835.05	1,100	--
23-Jun-07	841.15	1,100	--
23-Jun-07	844.20	1,100	--
23-Jun-07	847.50	1,100	--
28-Jun-07	847.50	1,240	--
7-Jul-07	847.50	1,200	--
7-Jul-07	847.50	1,200	--
7-Jul-07	847.77	1,200	--
7-Jul-07	847.77	1,200	--
8-Jul-07	848.13	1,200	--
8-Jul-07	848.13	1,200	--
8-Jul-07	848.13	1,200	--
8-Jul-07	848.13	1,200	--
8-Jul-07	848.13	1,200	--
10-Jul-07	849.09	1,200	--
11-Jul-07	849.24	1,200	--
11-Jul-07	849.24	1,200	--
11-Jul-07	849.74	1,200	--
21-Jul-07	853.72	1,170	--
21-Jul-07	856.77	1,170	--
22-Jul-07	856.77	1,170	--
22-Jul-07	856.77	1,170	--
23-Jul-07	856.77	1,170	--
3-Aug-07	859.07	1,170	--

Notes:

mBGS = metres below ground surface.

-- = Parameter not analyzed.

APPENDIX B

Summary of Field Chemical Property Measurements and Laboratory Analyses of DGR-1 and DGR-2 Drilling Fluids

Table B.1 – Summary of Field Chemical Measurements of DGR-1 Drilling Fluids

Table B.2 – Summary of Laboratory Analyses of DGR-1 Drilling Fluids

Table B.3 – Summary of Field Chemical Measurements of DGR-2 Drilling Fluids

Table B.4 – Summary of Laboratory Analyses of DGR-2 Drilling Fluids

Table B.1 - Summary of Field Chemical Measurements of DGR-1 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR1-01	25-Jan-07	23.10	1744.6	4890	--	--
DWT-DRG1-02	25-Jan-07	23.10	1437.3	5140	--	--
DWT-DGR1-03	26-Jan-07	26.15	1362.2	6810	--	--
DWT-DGR1-04	26-Jan-07	35.30	991.7	7790	--	--
DWT-DGR1-05	27-Jan-07	38.35	1065.4	6190	--	--
DWT-DGR1-06	27-Jan-07	38.35	1919.6	1712	--	--
DWT-DGR1-07	27-Jan-07	38.35	1980.2	1937	--	--
DWT-DGR1-08	27-Jan-07	38.35	--	--	--	--
DWT-DGR1-09	27-Jan-07	38.35	--	2022	12.17	23.1
DWT-DGR1-10	28-Jan-07	38.35	2029.5	1825	--	--
DWT-DGR1-11	28-Jan-07	38.35	1960.5	739	--	--
DWT-DGR1-12	28-Jan-07	38.35	2015	676	--	--
DWT-DGR1-13	28-Jan-07	38.35	1831.3	1537	--	--
DWT-DGR1-14	29-Jan-07	38.35	1857.8	2061	--	--
DWT-DGR1-15	29-Jan-07	38.35	1322.2	1679	--	--
DWT-DGR1-16	29-Jan-07	38.35	1340.2	1883	--	--
DWT-DGR1-17	29-Jan-07	38.35	1282	1789	--	--
DWT-DGR1-18	30-Jan-07	41.40	1054.8	2995	--	--
DWT-DGR1-19	30-Jan-07	41.40	1020.2	2448	--	--
DWT-DGR1-20	30-Jan-07	41.40	835.7	2831	--	--
DWT-DGR1-21	30-Jan-07	41.40	766	3430	--	--
DWT-DGR1-22	31-Jan-07	41.40	772.6	3380	--	--
DWT-DGR1-23	31-Jan-07	41.40	4289.5	468	--	--
DWT-DGR1-24	31-Jan-07	42.40	2617.3	1818	--	--
DWT-DGR1-25	1-Feb-07	47.50	1474.2	2950	--	--
DWT-DGR1-26	1-Feb-07	47.50	1210.2	2112	--	--
DWT-DGR1-27	1-Feb-07	47.50	1254	1982	--	--
DWT-DGR1-28	2-Feb-07	47.50	1410.1	1767	--	--
DWT-DGR1-29	2-Feb-07	50.55	715.4	2968	--	--
DWT-DGR1-30	2-Feb-07	53.60	943.4	3180	--	--
DWT-DGR1-31	3-Feb-07	56.65	732	2456	--	--
DWT-DGR1-32	3-Feb-07	59.70	581.8	2480	--	--
DWT-DGR1-33	3-Feb-07	59.70	204.6	938	--	--
DWT-DGR1-34	3-Feb-07	62.75	3162	1707	--	--
DWT-DGR1-35	3-Feb-07	62.75	2132.6	2855	--	--
DWT-DGR1-36	4-Feb-07	65.80	1082.5	3880	--	--
DWT-DGR1-37	4-Feb-07	68.85	651.5	4810	--	--
DWT-DGR1-38	4-Feb-07	68.85	--	--	--	--
DWT-DGR1-39	6-Feb-07	68.85	699.3	1700	--	--
DWT-DGR1-40	6-Feb-07	68.85	1045	3940	--	--
DWT-DGR1-41	6-Feb-07	68.85	932.3	4480	--	--
DWT-DGR1-42	7-Feb-07	73.45	736.8	--	--	--
DWT-DGR1-43	17-Feb-07	81.05	6924.6	487	--	--
DWT-DGR1-44	18-Feb-07	81.05	1819.7	176.1	--	--
DWT-DGR1-45	18-Feb-07	84.10	1586.9	232.1	--	--
DWT-DGR1-46	18-Feb-07	87.15	1238.3	217.9	--	--

Table B.1 - Summary of Field Chemical Measurements of DGR-1 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR1-47	18-Feb-07	90.20	1210.9	212.5	--	--
DWT-DGR1-48	18-Feb-07	90.20	1219.8	194.6	--	--
DWT-DGR1-49	19-Feb-07	93.25	1218.1	2536	--	8.9
DWT-DGR1-50	19-Feb-07	93.25	1131	179.8	10.20	--
DWT-DGR1-51	19-Feb-07	93.25	2285.8	105.8	9.76	--
DWT-DGR1-52	20-Feb-07	96.30	2119.7	118.4	10.09	--
DWT-DGR1-53	20-Feb-07	96.30	1986.1	113.0	10.36	--
DWT-DGR1-54	20-Feb-07	96.30	1937.5	95.4	10.10	--
DWT-DGR1-55	20-Feb-07	96.30	1371.1	99.0	9.62	--
DWT-DGR1-56	21-Feb-07	99.35	1470.8	135.7	9.72	--
DWT-DGR1-57	21-Feb-07	102.43	1387.6	175.2	10.18	--
DWT-DGR1-58	21-Feb-07	105.48	1143.2	167.8	10.14	--
DWT-DGR1-59	21-Feb-07	105.48	1111.8	167.8	9.99	--
DWT-DGR1-60	21-Feb-07	108.53	1126.8	165.5	10.01	--
DWT-DGR1-61	21-Feb-07	111.58	1084.8	167.0	10.20	--
DWT-DGR1-62	21-Feb-07	114.63	908.8	439	10.13	--
DWT-DGR1-63	21-Feb-07	114.63	880.8	400.0	9.73	--
DWT-DGR1-64	22-Feb-07	114.63	858.2	378	9.55	--
DWT-DGR1-65	22-Feb-07	114.63	805.3	369.0	9.48	10.4
DWT-DGR1-66	22-Feb-07	114.63	815.3	395	9.17	--
DWT-DGR1-67	23-Feb-07	120.53	614.8	561	9.12	--
DWT-DGR1-68	24-Feb-07	123.78	674.9	583	9.36	--
DWT-DGR1-69	24-Feb-07	126.83	993.8	613	9.57	10.0
DWT-DGR1-70	24-Feb-07	126.83	951.6	685	9.66	8.5
DWT-DGR1-71	24-Feb-07	128.33	708.5	613	9.64	11.0
DWT-DGR1-72	25-Feb-07	131.40	914	629	9.87	10.5
DWT-DGR1-73	26-Feb-07	135.98	1046.7	499	9.36	--
DWT-DGR1-74	27-Feb-07	142.08	746.8	664	8.90	12.7
DWT-DGR1-75	28-Feb-07	142.08	771.3	925	8.47	10.6
DWT-DGR1-76	28-Feb-07	142.08	1185.4	1309	8.47	12.9
DWT-DGR1-77	28-Feb-07	148.17	612.5	1006	9.03	8.4
DWT-DGR1-78	28-Feb-07	148.17	708.7	872	9.12	10.6
DWT-DGR1-79	28-Feb-07	150.30	929.9	807	8.97	8.8
DWT-DGR1-80	28-Feb-07	150.30	1075.2	1087	9.04	10.0
DWT-DGR1-81	28-Feb-07	152.44	956.4	970	9.14	--
DWT-DGR1-82	1-Mar-07	156.41	610.2	589	9.33	8.8
DWT-DGR1-83	1-Mar-07	158.54	678.9	421	9.49	7.1
DWT-DGR1-84	1-Mar-07	162.51	871.1	459	9.26	--
DWT-DGR1-85	1-Mar-07	166.48	866.7	458	9.24	--
DWT-DGR1-86	1-Mar-07	170.45	1222.3	946	8.85	--
DWT-DGR1-87	1-Mar-07	172.58	857.6	880	8.93	9.4
DWT-DGR1-88	1-Mar-07	175.63	709.3	725	8.92	--
DWT-DGR1-89	1-Mar-07	175.63	1089	848	8.69	--
DWT-DGR1-90	2-Mar-07	178.68	844.8	600	8.85	8.9
DWT-DGR1-91	2-Mar-07	182.94	921.7	1052	8.81	--
DWT-DGR1-92	2-Mar-07	182.94	716.9	922	8.85	--

Table B.1 - Summary of Field Chemical Measurements of DGR-1 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR1-93	7-Mar-07	182.94	335	91.6	11.37	--
DWT-DGR1-94	7-Mar-07	182.94	619.2	1836	10.87	--
DWT-DGR1-95	8-Mar-07	182.94	864.9	1683	11.36	--
DWT-DGR1-96	8-Mar-07	182.94	1194	1452	10.98	--
DWT-DGR1-97	8-Mar-07	182.94	1294.6	461	9.79	9.0
DWT-DGR1-98	9-Mar-07	182.94	1076.8	402	9.71	8.6
DWT-DGR1-99	9-Mar-07	182.94	1372.4	335	9.22	10.4
DWT-DGR1-100	9-Mar-07	182.94	1272	310	9.24	9.7
DWT-DGR1-101	9-Mar-07	182.94	902	227.6	8.89	--
DWT-DGR1-102	10-Mar-07	182.94	1622.5	250.9	8.87	10.5
DWT-DGR1-103	10-Mar-07	182.94	1516.7	--	8.92	11.2
DWT-DGR1-104	10-Mar-07	182.94	847.4	--	8.37	11.6
DWT-DGR1-105	10-Mar-07	182.94	686.6	1009	9.99	11.9
DWT-DGR1-106	11-Mar-07	182.94	1174	773	9.24	9.6
DWT-DGR1-107	11-Mar-07	182.94	1258.8	767	10.77	10.8
DWT-DGR1-108	11-Mar-07	182.94	769	746	11.34	12.0
DWT-DGR1-109	11-Mar-07	182.94	883.8	776	11.10	11.0
DWT-DGR1-110	12-Mar-07	182.94	1082.2	651	10.15	11.0
DWT-DGR1-111	12-Mar-07	182.94	140.3	105900	11.08	5.8
DWT-DGR1-112	12-Mar-07	182.94	151.4	109400	10.88	7.3
DWT-DGR1-113	12-Mar-07	182.94	275.1	124000	10.01	6.9
DWT-DGR1-114	27-Mar-07	212.77	362.2	144600	8.49	16.4
DWT-DGR1-115	27-Mar-07	218.87	323.5	155100	8.07	16.1
DWT-DGR1-116	27-Mar-07	228.02	266.8	137500	7.79	--
DWT-DGR1-117	27-Mar-07	240.22	219.3	141000	7.56	10.8
DWT-DGR1-118	28-Mar-07	252.42	251.1	154100	7.32	14.7
DWT-DGR1-119	28-Mar-07	267.67	182.1	165600	7.13	14.1
DWT-DGR1-120	28-Mar-07	276.82	197.2	159800	7.11	12.9
DWT-DGR1-121	30-Mar-07	289.02	190.3	144500	7.04	--
DWT-DGR1-122	30-Mar-07	292.07	272.9	138300	7.11	8.5
DWT-DGR1-123	30-Mar-07	301.22	224.9	150000	7.13	12.8
DWT-DGR1-124	30-Mar-07	307.32	159.3	149200	7.06	--
DWT-DGR1-125	31-Mar-07	319.52	153.4	151800	7.02	--
DWT-DGR1-126	31-Mar-07	328.67	153.7	145800	7.00	12.8
DWT-DGR1-127	31-Mar-07	340.87	110.7	155700	6.81	14.7
DWT-DGR1-128	31-Mar-07	346.97	82.3	152800	6.84	11.6
DWT-DGR1-129	1-Apr-07	356.12	63.9	166100	6.81	--
DWT-DGR1-130	1-Apr-07	365.27	93.4	186700	6.87	--
DWT-DGR1-131	1-Apr-07	374.42	60	162600	6.95	--
DWT-DGR1-132	2-Apr-07	380.52	42.9	159200	7.07	--
DWT-DGR1-133	2-Apr-07	386.62	156.5	148000	6.92	--
DWT-DGR1-134	2-Apr-07	398.82	131.5	139700	6.96	--
DWT-DGR1-135	2-Apr-07	398.82	132.3	--	--	--
DWT-DGR1-136	3-Apr-07	407.97	141.9	140000	6.98	--
DWT-DGR1-137	3-Apr-07	420.17	118.4	202300	6.89	--
DWT-DGR1-138	3-Apr-07	429.32	506.5	178300	7.00	--

Table B.1 - Summary of Field Chemical Measurements of DGR-1 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR1-139	3-Apr-07	438.47	861.5	179400	7.05	--
DWT-DGR1-140	4-Apr-07	447.62	524.3	187500	7.02	10.3
DWT-DGR1-141	4-Apr-07	456.77	587.1	160900	6.99	--
DWT-DGR1-142	4-Apr-07	456.77	--	--	--	--
DWT-DGR1-143	4-Apr-07	462.87	429.2	186000	6.97	--

Notes:

mBGS = metres below ground surface.

-- = Parameter not analyzed.

Table B.2 - Summary of Laboratory Analyses of DGR-1 Drilling Fluids

Parameter	MDL	Units	DWT-DGR1-09	DWT-DGR1-13	DWT-DGR1-48	DWT-DGR1-68	DWT-DGR1-94	DWT-DGR1-100
Depth (mBGS)>			38.35	38.35	90.20	123.78	182.94	182.94
Date Sampled>			27-Jan-07	28-Jan-07	18-Feb-07	24-Feb-07	7-Mar-07	9-Mar-07
FIELD PARAMETERS								
pH	0.01	pH units	12.17	--	--	9.36	10.87	9.24
Eh	0.1	mV	338.4	--	--	--	--	86
Dissolved Oxygen	0.01	mg/L	2.67	--	--	--	--	4.71
Electrical Conductivity	0.1	µS/cm	2022	1537	194.6	583	1836	310
Temperature	0	ºC	23.1	--	--	--	--	9.7
Na Fluorescein	0.01	µg/L	--	1831.3	1219.8	674.9	619.3	1272
LAB PARAMETERS								
General Parameters								
pH	0.1	pH units	11.7	--	--	--	--	8
Total Dissolved Solids	NV	mg/L	1470	--	--	--	--	693
Alkalinity (as $CaCO_3$)	2	mg/L	430	--	--	--	--	228
Fluid Density	NV	g/L	1004	--	--	--	--	980.8
Major Cations								
Calcium	0.7	mg/L	232	--	--	--	--	33
Iron	0.01	mg/L	ND	--	--	--	--	ND(0.1)
Magnesium	0.001	mg/L	0.027	--	--	--	--	16.1
Manganese	0.0001	mg/L	0.0001	--	--	--	--	0.002
Potassium	0.03	mg/L	19.6	--	--	--	--	22
Silicon	0.2	mg/L	1.6	--	--	--	--	5.0
Sodium	0.005	mg/L	17.4	--	--	--	--	83.7
Strontium	0.01	mg/L	1.57	--	--	--	--	8.45
Major Anions								
Bromide	0.003	mg/L	0.394	--	--	--	--	0.180
Chloride	0.03	mg/L	51.9	--	--	--	--	129
Fluoride	0.01	mg/L	0.3	--	--	--	--	1.5
Iodide	0.001	mg/L	0.002	--	--	--	--	ND(0.01)
Bicarbonate	1	mg/L	ND	--	--	--	--	228
Carbonate	1	mg/L	39	--	--	--	--	ND
Nitrate	0.01	mg/L	0.3	--	--	--	--	0.2
Nitrite	0.01	mg/L	0.09	--	--	--	--	ND(0.1)
Phosphate	0.02	mg/L	0.5	--	--	--	--	ND(0.2)
Sulphate	0.03	mg/L	15.9	--	--	--	--	120
Environmental Isotopes								
Tritium, ^3H	± 8.0	TU	--	184.0	211	139	203	71.2
Deuterium, ^2H	± 1.0	δD (‰)	-56.23	--	--	--	--	-55.57
Oxygen-18, ^{18}O	± 1.5	$\delta^{18}O$ (‰)	-6.84	--	--	--	--	-6.82
Selected Trace Elements								
Aluminum	2	µg/L	260	--	--	--	--	ND(20)
Antimony	0.01	µg/L	0.47	--	--	--	--	2.1
Arsenic	0.03	µg/L	0.25	--	--	--	--	2.4
Barium	0.1	µg/L	830	--	--	--	--	54
Beryllium	0.1	µg/L	ND	--	--	--	--	ND(1)
Bismuth	0.3	µg/L	ND	--	--	--	--	ND(3)
Cadmium	0.01	µg/L	0.08	--	--	--	--	ND(0.1)
Cesium	0.001	µg/L	1.54	--	--	--	--	0.03
Chromium	0.5	µg/L	41.4	--	--	--	--	ND(5)
Cobalt	0.005	µg/L	0.022	--	--	--	--	0.06
Copper	0.2	µg/L	0.8	--	--	--	--	3
Gadolinium	0.001	µg/L	0.002	--	--	--	--	ND(0.01)
Gallium	0.01	µg/L	1.19	--	--	--	--	ND(0.1)
Lead	0.01	µg/L	0.07	--	--	--	--	0.1
Lithium	1	µg/L	66	--	--	--	--	60
Mercury	0.2	µg/L	ND	--	--	--	--	ND(2)
Molybdenum	0.1	µg/L	18.9	--	--	--	--	17
Nickel	0.3	µg/L	ND	--	--	--	--	4
Rubidium	0.005	µg/L	73.7	--	--	--	--	8.8
Selenium	0.2	µg/L	2.1	--	--	--	--	6
Thallium	0.001	µg/L	0.023	--	--	--	--	0.03
Titanium	0.1	µg/L	0.3	--	--	--	--	1
Tungsten	0.02	µg/L	8.49	--	--	--	--	17.6
Uranium	0.001	µg/L	ND	--	--	--	--	1.7
Vanadium	0.1	µg/L	1.1	--	--	--	--	3
Zinc	0.5	µg/L	45.1	--	--	--	--	6

Table B.2 - Summary of Laboratory Analyses of DGR-1 Drilling Fluids

Parameter	MDL	Units	DWT-DGR1-105	DWT-DGR1-109	DWT-DGR1-121	DWT-DGR1-129	DWT-DGR1-136	DWT-DGR1-142
Depth (mBGS)>			182.94	182.94	289.02	356.12	407.97	456.77
Date Sampled>			10-Mar-07	11-Mar-07	30-Mar-07	1-Apr-07	3-Apr-07	4-Apr-07
FIELD PARAMETERS								
pH	0.01	pH units	9.99	11.10	7.04	6.81	6.98	--
Eh	0.1	mV	--	--	--	--	--	--
Dissolved Oxygen	0.01	mg/L	--	--	--	--	--	--
Electrical Conductivity	0.1	µS/cm	1009	776	144500	166100	140000	--
Temperature	0	ºC	11.9	11.0	--	--	--	--
Na Fluorescein	0.01	µg/L	686.6	883.6	190.3	63.9	141.9	--
LAB PARAMETERS								
General Parameters								
pH	0.1	pH units	--	--	--	6.7	--	6.8
Total Dissolved Solids	NV	mg/L	--	--	--	118000	--	115000
Alkalinity (as $CaCO_3$)	2	mg/L	--	--	--	28	--	38
Fluid Density	NV	g/L	--	--	--	1107	--	1132
Major Cations								
Calcium	0.7	mg/L	--	--	--	1620	--	1640
Iron	0.01	mg/L	--	--	--	1	--	ND(10)
Magnesium	0.001	mg/L	--	--	--	49.3	--	108
Manganese	0.0001	mg/L	--	--	--	2.13	--	3.10
Potassium	0.03	mg/L	--	--	--	761	--	740
Silicon	0.2	mg/L	--	--	--	ND(20)	--	ND(200)
Sodium	0.005	mg/L	--	--	--	65900	--	50400
Strontium	0.01	mg/L	--	--	--	291	--	22.1
Major Anions								
Bromide	0.003	mg/L	--	--	--	35.5	--	30.0
Chloride	0.03	mg/L	--	--	--	121000	--	105000
Fluoride	0.01	mg/L	--	--	--	ND(10)	--	ND(10)
Iodide	0.001	mg/L	--	--	--	0.1	--	ND(1)
Bicarbonate	1	mg/L	--	--	--	28	--	38
Carbonate	1	mg/L	--	--	--	ND	--	ND
Nitrate	0.01	mg/L	--	--	--	ND(10)	--	ND(10)
Nitrite	0.01	mg/L	--	--	--	ND(10)	--	ND(10)
Phosphate	0.02	mg/L	--	--	--	ND(20)	--	ND(20)
Sulphate	0.03	mg/L	--	--	--	1960	--	840
Environmental Isotopes								
Tritium, ^3H	± 8.0	TU	216	222	183	205	228	236
Deuterium, ^2H	± 1.0	δD (‰)	--	--	--	-42.69	--	-45.79
Oxygen-18, ^{18}O	± 1.5	$\delta^{18}O$ (‰)	--	--	--	-6.53	--	-6.49
Selected Trace Elements								
Aluminum	2	µg/L	--	--	--	ND(200)	--	ND(2000)
Antimony	0.01	µg/L	--	--	--	4	--	ND(10)
Arsenic	0.03	µg/L	--	--	--	215	--	ND(30)
Barium	0.1	µg/L	--	--	--	660	--	700
Beryllium	0.1	µg/L	--	--	--	ND(10)	--	ND(100)
Bismuth	0.3	µg/L	--	--	--	ND(30)	--	ND(300)
Cadmium	0.01	µg/L	--	--	--	9	--	ND(10)
Cesium	0.001	µg/L	--	--	--	4.4	--	6
Chromium	0.5	µg/L	--	--	--	210	--	ND(500)
Cobalt	0.005	µg/L	--	--	--	2.8	--	ND(5)
Copper	0.2	µg/L	--	--	--	190	--	ND(200)
Gadolinium	0.001	µg/L	--	--	--	ND(0.1)	--	ND(1)
Gallium	0.01	µg/L	--	--	--	ND(1)	--	ND(10)
Lead	0.01	µg/L	--	--	--	2	--	ND(10)
Lithium	1	µg/L	--	--	--	9900	--	10000
Mercury	0.2	µg/L	--	--	--	ND(20)	--	ND(200)
Molybdenum	0.1	µg/L	--	--	--	ND(10)	--	ND(100)
Nickel	0.3	µg/L	--	--	--	240	--	ND(300)
Rubidium	0.005	µg/L	--	--	--	860	--	702
Selenium	0.2	µg/L	--	--	--	100	--	ND(200)
Thallium	0.001	µg/L	--	--	--	0.2	--	ND(1)
Titanium	0.1	µg/L	--	--	--	10	--	ND(100)
Tungsten	0.02	µg/L	--	--	--	ND(2)	--	ND(20)
Uranium	0.001	µg/L	--	--	--	1.7	--	1
Vanadium	0.1	µg/L	--	--	--	30	--	ND(100)
Zinc	0.5	µg/L	--	--	--	190	--	ND(500)

Notes:

mBGS = metres below ground surface.

MDL = Method Detection Limit.

-- = Parameter not analyzed.

ND = Not detected above MDL.

ND(0.1) = Not detected above elevated MDL.

Table B.3 - Summary of Field Chemical Measurements of DGR-2 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR2-01	14-Apr-07	18.41	1058	3050	12.85	--
DWT-DGR2-02	14-Apr-07	24.51	1005.7	3230	12.73	--
DWT-DGR2-03	15-Apr-07	24.51	927.8	3350	12.64	--
DWT-DGR2-04	15-Apr-07	30.51	861.7	3600	12.73	--
DWT-DGR2-05	15-Apr-07	30.51	851.8	3260	12.65	--
DWT-DGR2-06	15-Apr-07	36.71	849.2	2514	12.46	--
DWT-DGR2-07	16-Apr-07	36.71	1157.9	2667	12.47	--
DWT-DGR2-08	16-Apr-07	42.81	955.1	2026	12.53	--
DWT-DGR2-09	17-Apr-07	49.18	1131.9	1271	12.26	--
DWT-DGR2-10	17-Apr-07	49.18	1017.7	1454	12.22	--
DWT-DGR2-11	17-Apr-07	53.28	1537.9	1248	12.20	--
DWT-DGR2-12	17-Apr-07	54.98	1472.1	1234	12.12	--
DWT-DGR2-13	18-Apr-07	54.98	1265.2	1238	11.94	--
DWT-DGR2-14	18-Apr-07	73.28	1559.7	831	11.88	--
DWT-DGR2-15	19-Apr-07	73.28	1199.6	817	11.61	--
DWT-DGR2-16	19-Apr-07	76.58	1087.4	656	11.53	--
DWT-DGR2-17	19-Apr-07	76.58	1122.5	812	11.24	--
DWT-DGR2-18	19-Apr-07	76.58	678.2	1596	10.77	--
DWT-DGR2-19	20-Apr-07	76.58	1532.8	1387	10.40	19.3
DWT-DGR2-20	20-Apr-07	91.08	1358.4	1114	10.15	--
DWT-DGR2-21	21-Apr-07	91.08	374.2	533	9.26	14.7
DWT-DGR2-22	21-Apr-07	91.08	775.6	569	9.17	15.5
DWT-DGR2-23	21-Apr-07	101.88	684.7	538	9.14	--
DWT-DGR2-24	21-Apr-07	101.88	1065.5	679	8.87	--
DWT-DGR2-25	21-Apr-07	114.88	1164.5	648	8.71	21.2
DWT-DGR2-26	22-Apr-07	114.88	1092.1	750	8.51	19.2
DWT-DGR2-27	22-Apr-07	127.98	831.5	888	8.25	--
DWT-DGR2-28	22-Apr-07	127.98	1146.5	913	7.81	--
DWT-DGR2-29	22-Apr-07	138.38	841.7	710	7.72	20.4
DWT-DGR2-30	23-Apr-07	138.38	1140.7	851	7.52	20.0
DWT-DGR2-31	23-Apr-07	151.08	984.5	936	7.42	
DWT-DGR2-32	23-Apr-07	151.88	1000.1	877	7.56	17.3
DWT-DGR2-33	23-Apr-07	151.88	1026.3	862	7.60	17.1
DWT-DGR2-34	24-Apr-07	151.88	1051.7	932	7.42	16.4
DWT-DGR2-35	24-Apr-07	163.38	805.1	1009	7.41	18.1
DWT-DGR2-36	24-Apr-07	163.38	1340.9	893	--	--
DWT-DGR2-37	24-Apr-07	176.88	--	--	--	--
DWT-DGR2-38	24-Apr-07	176.88	951.2	1606	7.15	19.8
DWT-DGR2-39	25-Apr-07	176.88	1036.1	2165	7.08	18.7
DWT-DGR2-40	25-Apr-07	188.08	1059.1	2256	--	--
DWT-DGR2-41	25-Apr-07	188.08	967.2	2268	--	--
DWT-DGR2-42	25-Apr-07	189.21	821.8	1937	7.17	17.5
DWT-DGR2-43	26-Apr-07	189.21	947	2008	7.11	17.8
DWT-DGR2-44	11-May-07	189.21	30.3	163.5	10.91	15.2
DWT-DGR2-45	12-May-07	189.21	1438.5	680	11.82	15.3
DWT-DGR2-46	12-May-07	189.21	484.3	3740	12.65	17.4

Table B.3 - Summary of Field Chemical Measurements of DGR-2 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR2-47	13-May-07	189.21	39	127400	10.22	16.4
DWT-DGR2-48	13-May-07	189.21	89.6	129400	10.02	16.0
DWT-DGR2-49	13-May-07	202.28	1544.1	136200	9.97	10.3
DWT-DGR2-50	13-May-07	202.28	1433.3	157600	9.69	20.2
DWT-DGR2-51	13-May-07	227.48	1344.3	128900	10.50	19.0
DWT-DGR2-52	14-May-07	227.48	1229.1	130300	9.48	18.0
DWT-DGR2-53	14-May-07	259.88	714.6	144400	8.84	13.6
DWT-DGR2-54	14-May-07	259.88	647.7	137300	8.56	15.0
DWT-DGR2-55	14-May-07	259.88	--	--	--	--
DWT-DGR2-56	14-May-07	259.88	--	--	--	--
DWT-DGR2-57	14-May-07	259.88	--	--	--	--
DWT-DGR2-58	14-May-07	289.18	380.2	131200	8.43	21.4
DWT-DGR2-59	15-May-07	289.18	282	116200	8.15	19.1
DWT-DGR2-60	15-May-07	312.38	492.6	129100	9.47	24.1
DWT-DGR2-61	16-May-07	334.68	404.3	122700	7.98	16.3
DWT-DGR2-62	16-May-07	334.68	1254.1	127200	7.88	16.3
DWT-DGR2-63	16-May-07	358.78	452.9	137800	7.63	9.0
DWT-DGR2-64	16-May-07	358.78	304.8	160200	7.83	16.4
DWT-DGR2-65	16-May-07	382.88	1143.3	133600	7.76	16.3
DWT-DGR2-66	17-May-07	382.88	1161.1	114700	7.64	11.7
DWT-DGR2-67	17-May-07	401.58	503.5	148500	7.75	18.5
DWT-DGR2-68	17-May-07	407.88	261	129600	7.30	19.2
DWT-DGR2-69	18-May-07	407.88	313.6	128900	7.52	17.3
DWT-DGR2-70	18-May-07	438.08	349.1	133600	8.26	15.1
DWT-DGR2-71	26-May-07	450.66	774.9	6400	12.44	--
DWT-DGR2-72	27-May-07	450.66	725	7580	12.78	10.1
DWT-DGR2-73	27-May-07	453.80	364.6	130500	10.61	18.3
DWT-DGR2-74	28-May-07	453.80	413.6	128400	10.33	18.0
DWT-DGR2-75	29-May-07	456.85	570.7	140900	9.68	15.9
DWT-DGR2-76	29-May-07	466.00	795.1	118600	9.41	13.8
DWT-DGR2-77	29-May-07	481.25	683.6	139000	8.92	16.3
DWT-DGR2-78	29-May-07	490.40	675.9	130900	8.75	21.0
DWT-DGR2-79	30-May-07	496.50	871.7	140000	8.60	18.8
DWT-DGR2-80	30-May-07	502.60	833.9	130200	8.59	16.9
DWT-DGR2-81	30-May-07	514.80	704.2	137300	8.26	--
DWT-DGR2-82	30-May-07	523.95	745.3	121200	8.23	16.5
DWT-DGR2-83	31-May-07	533.10	873.3	136500	8.10	21.2
DWT-DGR2-84	31-May-07	536.15	632.5	127400	7.65	17.9
DWT-DGR2-85	31-May-07	548.35	609	148200	7.75	23.9
DWT-DGR2-86	31-May-07	554.45	652.4	125100	7.79	14.3
DWT-DGR2-87	1-Jun-07	557.50	796	124800	7.86	14.2
DWT-DGR2-88	1-Jun-07	569.70	790.5	115300	7.70	16.2
DWT-DGR2-89	1-Jun-07	575.80	661.9	131800	7.51	18.7
DWT-DGR2-90	2-Jun-07	588.00	1103.9	119000	7.56	--
DWT-DGR2-91	2-Jun-07	594.10	568	124000	7.51	--
DWT-DGR2-92	2-Jun-07	600.20	717.7	120600	7.52	17.0

Table B.3 - Summary of Field Chemical Measurements of DGR-2 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR2-93	2-Jun-07	615.45	567.7	118600	7.40	13.1
DWT-DGR2-94	3-Jun-07	639.85	708.5	134200	7.23	20.8
DWT-DGR2-95	3-Jun-07	645.95	759.1	120400	7.30	17.1
DWT-DGR2-96	3-Jun-07	654.40	655	117100	7.37	10.7
DWT-DGR2-97	3-Jun-07	655.10	1130.7	145400	7.26	21.4
DWT-DGR2-98	4-Jun-07	655.10	679.5	131000	7.30	16.3
DWT-DGR2-99	4-Jun-07	655.10	902.4	127100	7.41	13.2
DWT-DGR2-100	4-Jun-07	655.10	627.5	121900	7.29	12.2
DWT-DGR2-101	4-Jun-07	655.10	666.8	124500	7.45	7.7
DWT-DGR2-102	5-Jun-07	655.10	646.1	135200	7.36	15.5
DWT-DGR2-103	5-Jun-07	655.10	653.1	131600	7.47	14.4
DWT-DGR2-104	6-Jun-07	655.10	570.5	143400	7.35	12.2
DWT-DGR2-105	11-Jun-07	655.10	337.2	105800	6.21	11.3
DWT-DGR2-106	11-Jun-07	664.25	610.3	103400	7.03	10.5
DWT-DGR2-107	11-Jun-07	670.35	560.6	113500	6.98	14.8
DWT-DGR2-108	11-Jun-07	682.55	451.3	137600	6.95	22.1
DWT-DGR2-109	11-Jun-07	694.75	621.7	144200	6.96	9.9
DWT-DGR2-110	12-Jun-07	703.90	571.5	127200	6.90	11.8
DWT-DGR2-111	13-Jun-07	706.95	300.7	136900	6.78	23.8
DWT-DGR2-112	13-Jun-07	716.10	581.6	135400	6.86	21.7
DWT-DGR2-113	14-Jun-07	725.25	595.3	133100	7.00	19.3
DWT-DGR2-114	14-Jun-07	731.35	731.1	138500	6.83	22.7
DWT-DGR2-115	14-Jun-07	746.60	541.2	127000	6.79	22.2
DWT-DGR2-116	15-Jun-07	755.75	525.3	123700	7.21	12.0
DWT-DGR2-117	15-Jun-07	767.95	708.5	137400	7.29	22.1
DWT-DGR2-118	17-Jun-07	769.75	222.6	156600	6.59	21.0
DWT-DGR2-119	17-Jun-07	774.05	519.1	133600	7.00	11.4
DWT-DGR2-120	18-Jun-07	777.10	522.3	153300	7.02	18.7
DWT-DGR2-121	18-Jun-07	780.15	582.7	156000	6.98	18.8
DWT-DGR2-122	18-Jun-07	783.20	663	174300	6.90	24.8
DWT-DGR2-123	18-Jun-07	786.25	1190.9	124700	6.87	14.5
DWT-DGR2-124	19-Jun-07	792.35	1137.6	147800	6.92	23.8
DWT-DGR2-125	19-Jun-07	795.40	1111	150500	6.84	22.4
DWT-DGR2-126	19-Jun-07	801.50	644.3	144700	6.66	18.8
DWT-DGR2-127	19-Jun-07	804.55	808.3	138900	6.94	9.0
DWT-DGR2-128	20-Jun-07	810.65	980	148300	7.03	12.2
DWT-DGR2-129	20-Jun-07	813.70	622.8	167400	6.84	19.0
DWT-DGR2-130	20-Jun-07	816.75	267	180200	7.05	22.7
DWT-DGR2-131	21-Jun-07	816.75	463.2	121600	6.75	12.0
DWT-DGR2-132	22-Jun-07	816.75	414	170900	6.59	16.0
DWT-DGR2-133	22-Jun-07	825.90	362.1	--	7.00	20.1
DWT-DGR2-134	22-Jun-07	835.05	740.3	158500	6.89	19.5
DWT-DGR2-135	23-Jun-07	841.15	683.8	164500	7.04	16.0
DWT-DGR2-136	23-Jun-07	844.20	705.7	165400	7.22	17.4
DWT-DGR2-137	23-Jun-07	847.50	534.4	162200	6.86	22.8
DWT-DGR2-138	24-Jun-07	847.50	608.6	185300	6.87	19.7

Table B.3 - Summary of Field Chemical Measurements of DGR-2 Drilling Fluids

Sample ID	Date Collected	Depth (mBGS)	Na Fluorescein (µg/L)	Electrical Conductivity (µS/cm)	pH (pH units)	Temperature (ºC)
DWT-DGR2-139	26-Jun-07	847.50	466	218200	6.73	25.9
DWT-DGR2-140	26-Jun-07	847.50	--	--	--	--
DWT-DGR2-141	26-Jun-07	847.50	--	--	--	--
DWT-DGR2-142	26-Jun-07	847.50	--	223600	--	--
DWT-DGR2-143	28-Jun-07	847.50	1191.6	220100	7.58	23.1
DWT-DGR2-144	28-Jun-07	847.50	907.8	214400	7.68	22.1
DWT-DGR2-145	7-Jul-07	847.50	338.5	176000	6.43	6.4
DWT-DGR2-146	7-Jul-07	847.50	634.6	184600	6.28	20.2
DWT-DGR2-147	7-Jul-07	847.77	557	177300	6.28	23.5
DWT-DGR2-148	7-Jul-07	847.77	856.8	182200	6.29	22.2
DWT-DGR2-149	8-Jul-07	848.13	772	185400	6.23	20.9
DWT-DGR2-150	8-Jul-07	848.13	699.7	157500	6.32	14.7
DWT-DGR2-151	8-Jul-07	848.13	629.6	180800	6.28	22.3
DWT-DGR2-152	8-Jul-07	848.13	929.4	176200	6.23	23.1
DWT-DGR2-153	10-Jul-07	849.09	611.3	156600	6.09	15.3
DWT-DGR2-154	11-Jul-07	849.09	792.9	173700	6.02	21.0
DWT-DGR2-155	11-Jul-07	849.24	776.4	145700	6.02	9.6
DWT-DGR2-156	11-Jul-07	849.74	700.9	158000	6.06	12.9
DWT-DGR2-157	11-Jul-07	850.32	711.5	174800	6.12	19.3
DWT-DGR2-158	19-Jul-07	850.67	280.9	182500	6.03	15.8
DWT-DGR2-159	19-Jul-07	850.67	867.4	198200	6.02	20.8
DWT-DGR2-160	20-Jul-07	853.72	8.3	158300	6.07	16.8
DWT-DGR2-161	21-Jul-07	853.72	158.8	--	--	--
DWT-DGR2-162	21-Jul-07	853.72	944.6	198800	6.03	22.3
DWT-DGR2-163	21-Jul-07	853.72	688.7	197400	6.02	21.6
DWT-DGR2-164	22-Jul-07	856.77	870.9	194100	5.99	22.0
DWT-DGR2-165	22-Jul-07	856.77	605.7	165700	5.96	21.3
DWT-DGR2-166	23-Jul-07	856.77	621.9	171000	5.97	19.6
DWT-DGR2-167	23-Jul-07	856.77	550.4	202600	5.87	21.2
DWT-DGR2-168	3-Aug-07	859.07	32.4	162600	5.78	23.9
DWT-DGR2-169	3-Aug-07	859.07	804.6	--	--	--
DWT-DGR2-170	3-Aug-07	862.25	460.5	202000	5.93	--

Notes:

mBGS = metres below ground surface.

-- = Parameter not analyzed.

Table B.4 - Summary of Laboratory Analyses of DGR-2 Drilling Fluids

Parameter	MDL	Units	DWT-DGR2-10	DWT-DGR2-19	DWT-DGR2-34	DWT-DGR2-52	DWT-DGR2-66	DWT-DGR2-75	DWT-DGR2-89
Depth (mBGS)>			49.18	76.58	151.88	227.48	382.88	456.85	575.80
Date Sampled>			17-Apr-07	20-Apr-07	24-Apr-07	14-May-07	17-May-07	29-May-07	1-Jun-07
FIELD PARAMETERS									
pH	0.01	pH units	12.22	10.40	7.42	9.48	7.64	9.68	7.51
Eh	0.1	mV	--	-27.3	--	-198.3	--	--	-368.5
Dissolved Oxygen	0.01	mg/L	--	3.43	--	3.41	--	--	4.02
Electrical Conductivity	0.1	µS/cm	1454	1387	932	130300	114700	140900	131800
Temperature	0	ºC	--	19.3	16.4	18.0	11.7	15.9	18.7
Na Fluorescein	0.01	µg/L	1017.7	1532.8	1051.7	1229.1	1161.1	570.7	661.9
LAB PARAMETERS									
General Parameters									
pH	0.1	pH units	--	--	--	--	--	--	6.7
Total Dissolved Solids	NV	mg/L	--	1820	--	97500	--	--	96100
Alkalinity (as $CaCO_3$)	2	mg/L	--	--	--	--	--	--	25
Fluid Density	NV	g/L	--	999.83	--	1091.05	--	--	1094.65
Cations									
Calcium	0.7	mg/L	--	111	--	10400	--	--	10900
Iron	0.01	mg/L	--	0.3	--	ND(10)	--	--	ND(10)
Magnesium	0.001	mg/L	--	5.72	--	38	--	--	126
Manganese	0.0001	mg/L	--	0.003	--	0.3	--	--	1.33
Potassium	0.03	mg/L	--	>200	--	450	--	--	605
Silicon	0.2	mg/L	--	16	--	ND(200)	--	--	ND(200)
Sodium	0.005	mg/L	--	229	--	38300	--	--	31800
Strontium	0.00004	mg/L	--	2.78	--	189	--	--	198
Anions									
Bromide	0.003	mg/L	--	2.98	--	28	--	--	41.3
Chloride	0.03	mg/L	--	369	--	75400	--	--	81300
Fluoride	0.01	mg/L	--	ND(0.3)	--	ND(10)	--	--	ND(10)
Iodide	0.001	mg/L	--	0.05	--	ND(1)	--	--	ND(1)
Bicarbonate	1	mg/L	--	--	--	--	--	--	25
Carbonate	1	mg/L	--	--	--	--	--	--	ND(1)
Nitrate	0.01	mg/L	--	ND(0.3)	--	ND(10)	--	--	10
Nitrite	0.01	mg/L	--	ND(0.3)	--	ND(10)	--	--	ND(10)
Phosphate	0.02	mg/L	--	ND(0.5)	--	ND(20)	--	--	ND(20)
Sulphate	0.03	mg/L	--	60.4	--	1690	--	--	1120
Isotopes									
Tritium, ^3H	± 8.0	TU	*	572.0	*	209.6	273.8	396.5	391.8
Deuterium, ^2H	± 1.0	δD (‰)	--	-51.35	--	-52.7	--	--	-59.0
Oxygen-18, ^{18}O	± 1.5	$\delta^{18}O$ (‰)	--	-6.42	--	-6.64	--	--	-6.55
Selected Trace Elements									
Aluminum	2	µg/L	--	80	--	ND(2000)	--	--	ND(2000)
Antimony	0.01	µg/L	--	65	--	ND(10)	--	--	ND(10)
Arsenic	0.03	µg/L	--	0.6	--	ND(30)	--	--	ND(30)
Barium	0.1	µg/L	--	153	--	600	--	--	1550
Beryllium	0.1	µg/L	--	ND(1)	--	ND(100)	--	--	ND(100)
Bismuth	0.3	µg/L	--	ND(32)	--	ND(300)	--	--	ND(300)
Cadmium	0.01	µg/L	--	0.3	--	ND(10)	--	--	ND(10)
Cesium	0.001	µg/L	--	2.8	--	2	--	--	10.2
Chromium	0.5	µg/L	--	ND(5)	--	ND(500)	--	--	2070
Cobalt	0.005	µg/L	--	3.2	--	ND(5)	--	--	ND(5)
Copper	0.2	µg/L	--	9	--	ND(200)	--	--	ND(200)
Gadolinium	0.001	µg/L	--	ND(0.01)	--	ND(1)	--	--	ND(1)
Gallium	0.01	µg/L	--	ND(0.1)	--	ND(10)	--	--	ND(10)
Lead	0.01	µg/L	--	0.2	--	30	--	--	ND(10)
Lithium	1	µg/L	--	530	--	8000	--	--	6080
Mercury	0.2	µg/L	--	ND(2)	--	ND(200)	--	--	ND(200)
Molybdenum	0.1	µg/L	--	122	--	ND(100)	--	--	ND(100)
Nickel	0.3	µg/L	--	ND(3)	--	ND(300)	--	--	ND(300)
Rubidium	0.005	µg/L	--	541	--	423	--	--	669
Selenium	0.2	µg/L	--	27	--	300	--	--	ND(200)
Thallium	0.001	ug/L	--	0.23	--	8	--	--	ND(1)
Titanium	0.1	µg/L	--	8	--	100	--	--	ND(100)
Tungsten	0.02	µg/L	--	9.5	--	ND(20)	--	--	ND(20)
Uranium	0.001	µg/L	--	0.52	--	ND(1)	--	--	ND(1)
Vanadium	0.1	µg/L	--	8	--	ND(100)	--	--	ND(100)
Zinc	0.5	µg/L	--	16	--	ND(500)	--	--	ND(500)

Table B.4 - Summary of Laboratory Analyses of DGR-2 Drilling Fluids

Parameter	MDL	Units	DWT-DGR2-107	DWT-DGR2-116	DWT-DGR2-138	DWT-DGR2-145	DWT-DGR2-154	DWT-DGR2-164	DWT-DGR2-170
Depth (mBGS)>			670.35	755.75	847.50	847.50	849.09	856.77	862.25
Date Sampled>			11-Jun-07	15-Jun-07	24-Jun-07	7-Jul-07	11-Jul-07	22-Jul-07	3-Aug-07
FIELD PARAMETERS									
pH	0.01	pH units	6.98	7.21	6.87	6.43	6.02	5.99	5.93
Eh	0.1	mV	-362.2	--	--	--	--	--	--
Dissolved Oxygen	0.01	mg/L	6.48	--	--	--	--	--	--
Electrical Conductivity	0.1	µS/cm	113500	123700	185300	176000	173700	194100	202000
Temperature	0	ºC	14.8	12.0	19.7	6.4	21.0	22.0	--
Na Fluorescein	0.01	µg/L	560.6	525.3	608.6	338.5	792.9	870.9	460.5
LAB PARAMETERS									
General Parameters									
pH	0.1	pH units	6.7	6.7	6.8	--	--	--	--
Total Dissolved Solids	NV	mg/L	97600	89600	206000	--	--	--	--
Alkalinity (as $CaCO_3$)	2	mg/L	39	35	35	--	--	--	--
Fluid Density	NV	g/L	1082.62	1086.20	1106.51	--	--	--	--
Cations									
Calcium	0.7	mg/L	11800	11400	12900	--	--	--	--
Iron	0.01	mg/L	0.05	0.52	ND(10)	--	--	--	--
Magnesium	0.001	mg/L	168	174	416	--	--	--	--
Manganese	0.0001	mg/L	3.37	3.60	4.44	--	--	--	--
Potassium	0.03	mg/L	684	690	803	--	--	--	--
Silicon	0.2	mg/L	0.2	0.8	ND(200)	--	--	--	--
Sodium	0.005	mg/L	33200	33000	45500	--	--	--	--
Strontium	0.00004	mg/L	129	129	219	--	--	--	--
Anions									
Bromide	0.003	mg/L	38.8	43.5	90.6	--	--	--	--
Chloride	0.03	mg/L	66200	66900	100000	--	--	--	--
Fluoride	0.01	mg/L	ND(5)	ND(5)	ND(20)	--	--	--	--
Iodide	0.001	mg/L	ND(1)	ND(1)	4.25	--	--	--	--
Bicarbonate	1	mg/L	39	35	35	--	--	--	--
Carbonate	1	mg/L	ND(1)	ND(1)	ND(1)	--	--	--	--
Nitrate	0.01	mg/L	ND(5)	ND(5)	ND(20)	--	--	--	--
Nitrite	0.01	mg/L	ND(5)	ND(5)	ND(20)	--	--	--	--
Phosphate	0.02	mg/L	626	675	ND(40)	--	--	--	--
Sulphate	0.03	mg/L	2010	2000	1040	--	--	--	--
Isotopes									
Tritium, ^{3}H	± 8.0	TU	448.3	605.6	696.3	402.1	379.5	18.2	59.0
Deuterium, ^{2}H	± 1.0	δD (‰)	-78.0	-75.8	-44.6	--	--	--	--
Oxygen-18, ^{18}O	± 1.5	$\delta^{18}O$ (‰)	-5.83	-7.02	-5.02	--	--	--	--
Selected Trace Elements									
Aluminum	2	µg/L	ND(2000)	ND(2000)	ND(2000)	--	--	--	--
Antimony	0.01	µg/L	ND(10)	ND(10)	ND(10)	--	--	--	--
Arsenic	0.03	µg/L	53.5	116	ND(30)	--	--	--	--
Barium	0.1	µg/L	1030	813	1780	--	--	--	--
Beryllium	0.1	µg/L	ND(100)	ND(100)	ND(100)	--	--	--	--
Bismuth	0.3	µg/L	ND(300)	ND(300)	ND(300)	--	--	--	--
Cadmium	0.01	µg/L	3	ND(10)	ND(10)	--	--	--	--
Cesium	0.001	µg/L	9.18	6.7	6.85	--	--	--	--
Chromium	0.5	µg/L	532	1460	ND(500)	--	--	--	--
Cobalt	0.005	µg/L	3	3	ND(5)	--	--	--	--
Copper	0.2	µg/L	ND(200)	ND(200)	ND(200)	--	--	--	--
Gadolinium	0.001	µg/L	ND(1)	ND(1)	ND(1)	--	--	--	--
Gallium	0.01	µg/L	ND(10)	ND(10)	ND(10)	--	--	--	--
Lead	0.01	µg/L	49	48.8	ND(10)	--	--	--	--
Lithium	1	µg/L	9300	9240	8670	--	--	--	--
Mercury	0.2	µg/L	ND(200)	ND(200)	ND(200)	--	--	--	--
Molybdenum	0.1	µg/L	14	ND(100)	ND(100)	--	--	--	--
Nickel	0.3	µg/L	16	10	ND(300)	--	--	--	--
Rubidium	0.005	µg/L	644	625	676	--	--	--	--
Selenium	0.2	µg/L	205	258	ND(200)	--	--	--	--
Thallium	0.001	ug/L	2.83	2.77	ND(1)	--	--	--	--
Titanium	0.1	µg/L	120	130	ND(100)	--	--	--	--
Tungsten	0.02	µg/L	ND(20)	ND(20)	ND(20)	--	--	--	--
Uranium	0.001	µg/L	ND(1)	ND(1)	ND(1)	--	--	--	--
Vanadium	0.1	µg/L	107	417	ND(100)	--	--	--	--
Zinc	0.5	µg/L	53	13	ND(500)	--	--	--	--

Notes:

mBGS = metres below ground surface.

MDL = Method Detection Limit.

-- = Parameter not analyzed.

ND = Not detected above MDL.

ND(0.1) = Not detected above elevated MDL.

* = Sample could not be analyzed due to contamination by drilling fluid additives.

APPENDIX C

Depth Plots of Selected Analyses of DGR-1 and DGR-2 Drilling Fluid

Figure C.1 - Fluid Density and Funnel Viscosity in DGR-1

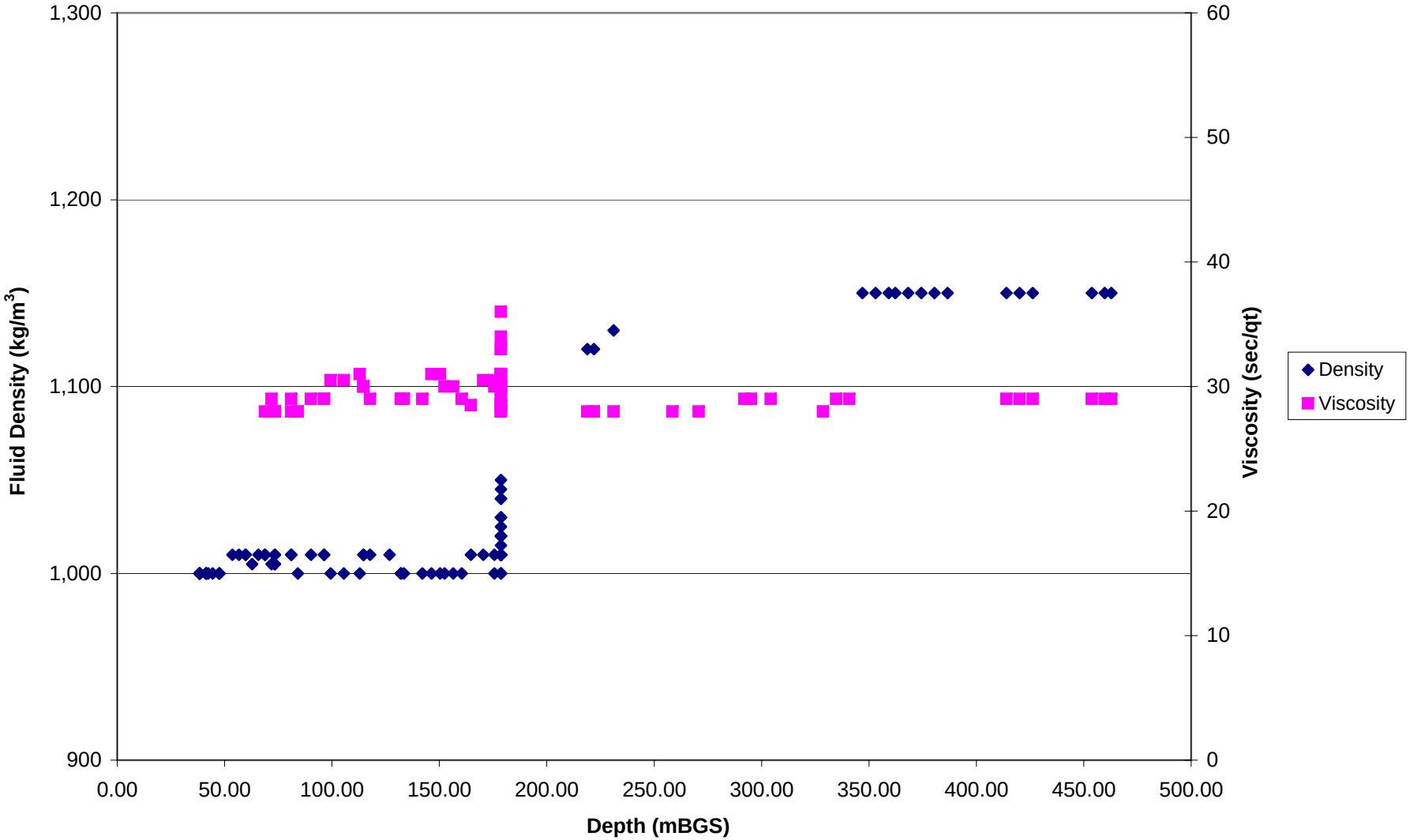

Figure C.2 - Na Fluorescein and Tritium in DGR-1

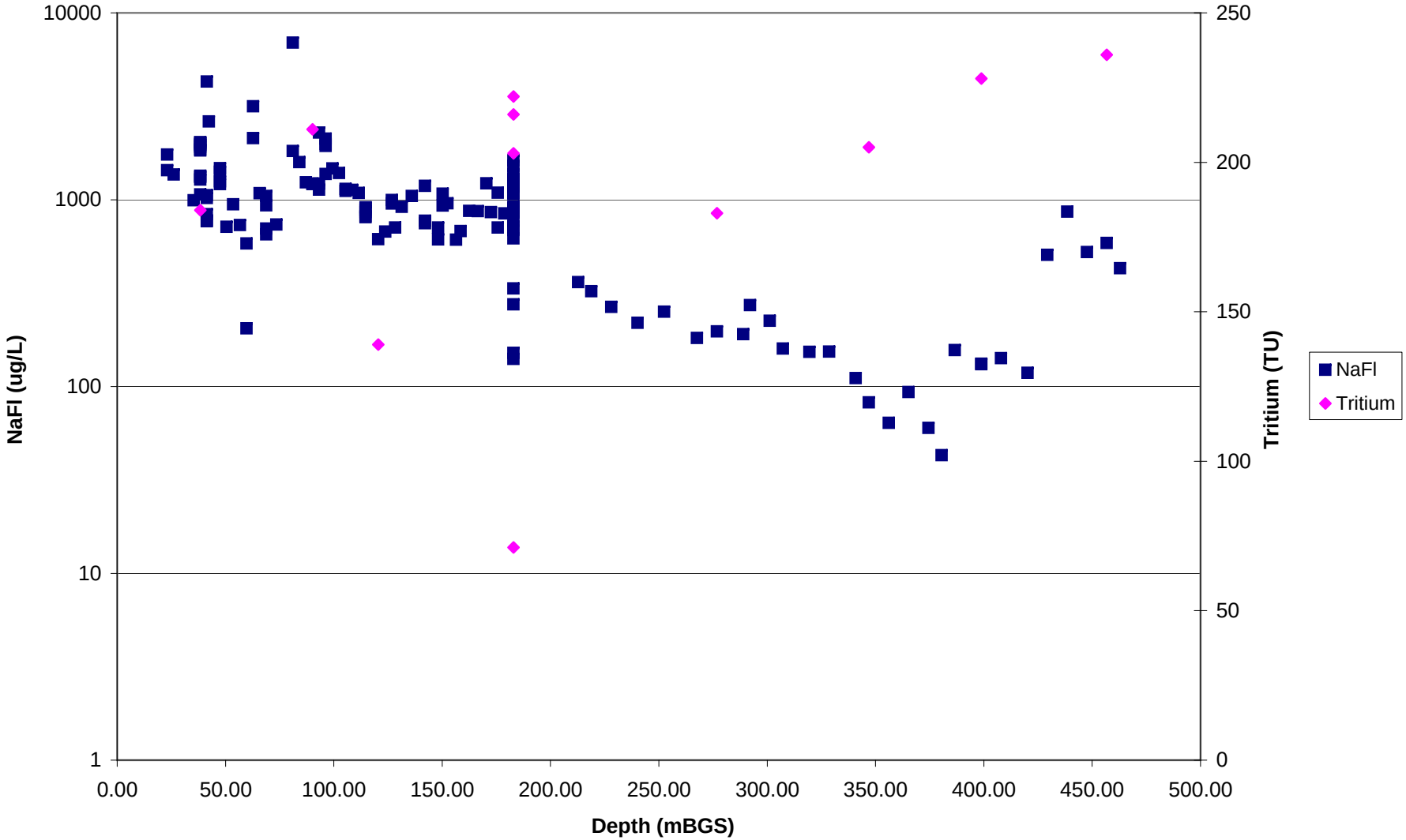

Figure C.3 - Electrical Conductivity and pH in DGR-1

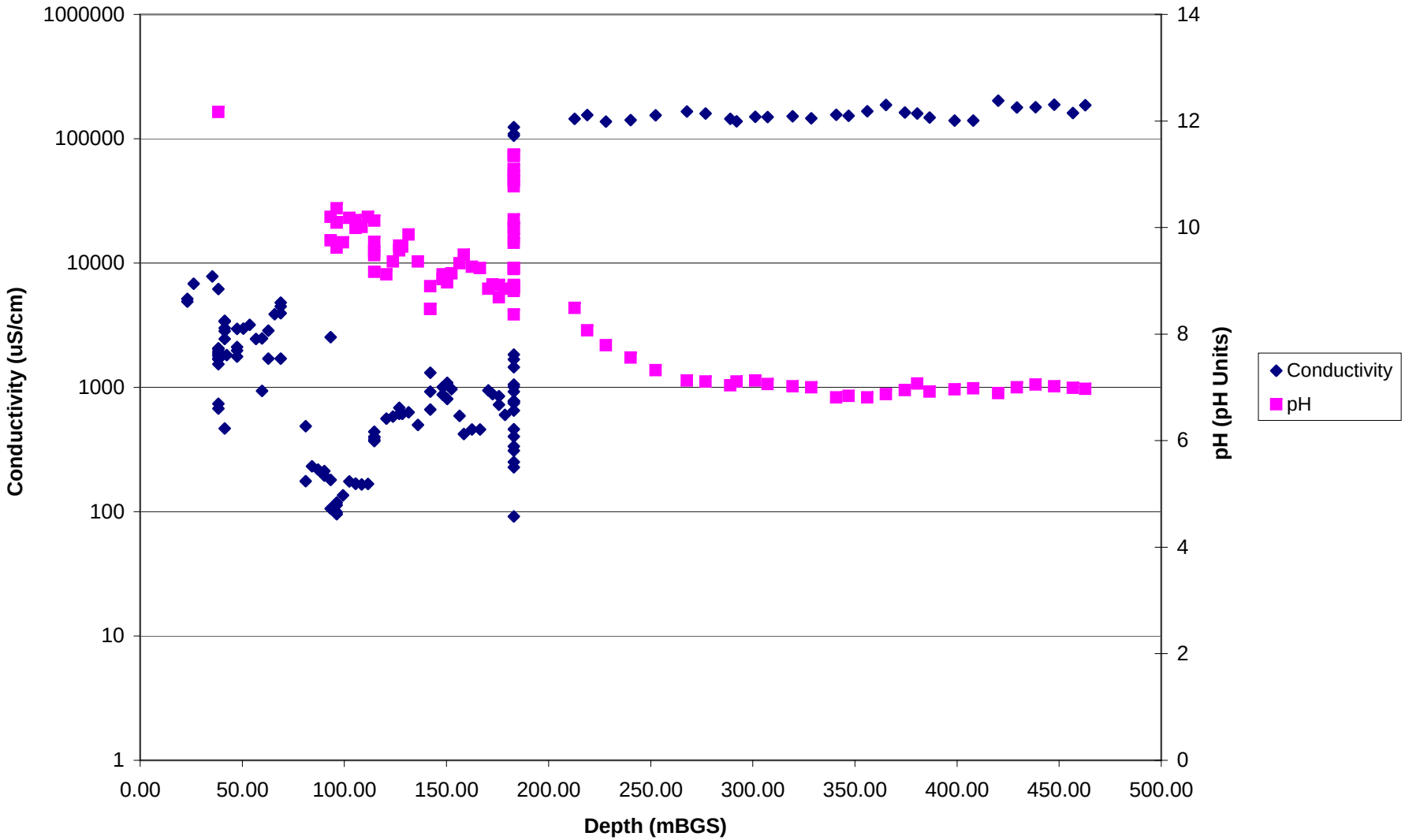

Figure C.4 - Fluid Density and Funnel Viscosity in DGR-2

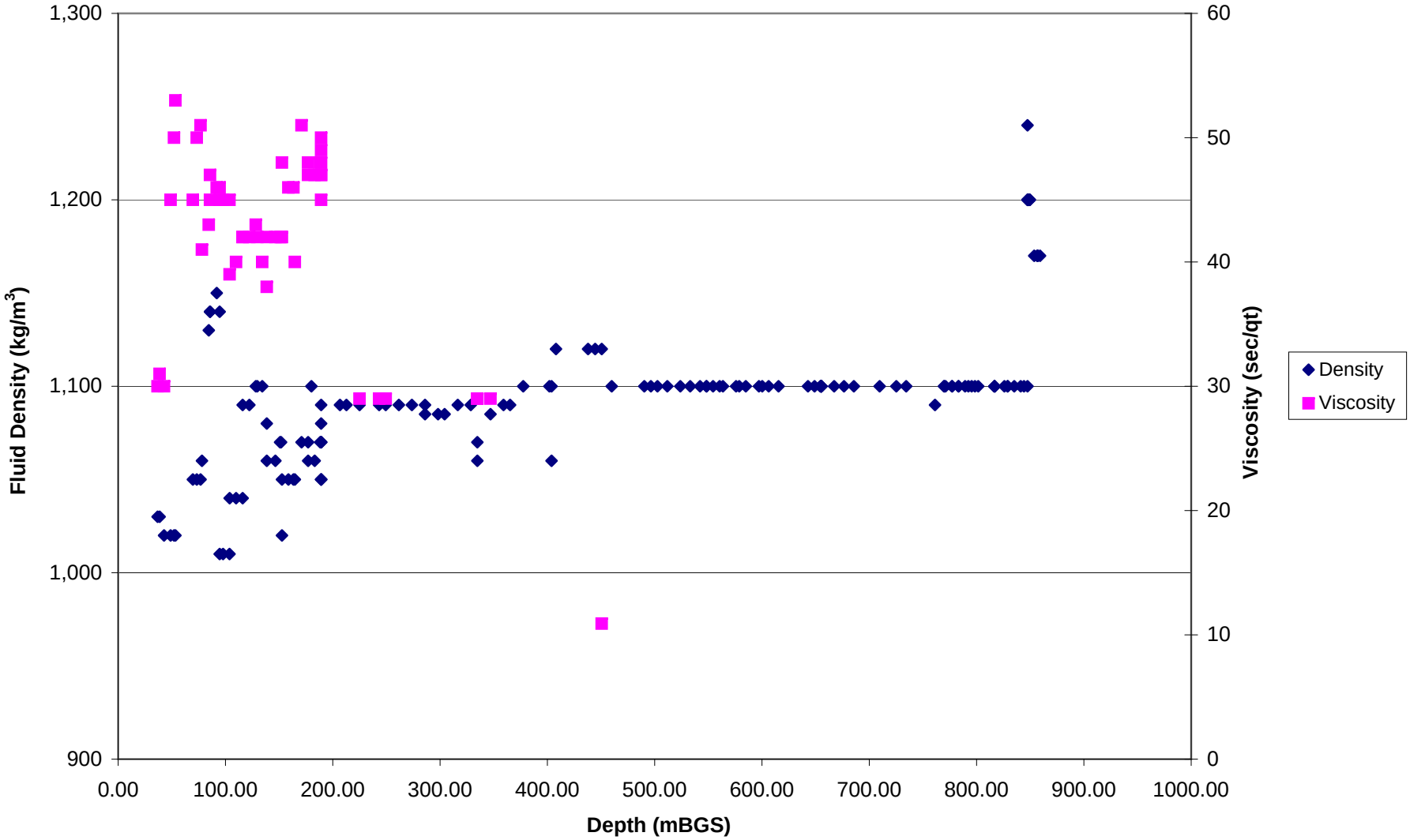

Figure C.5 - Na Fluorescein and Tritium in DGR-2

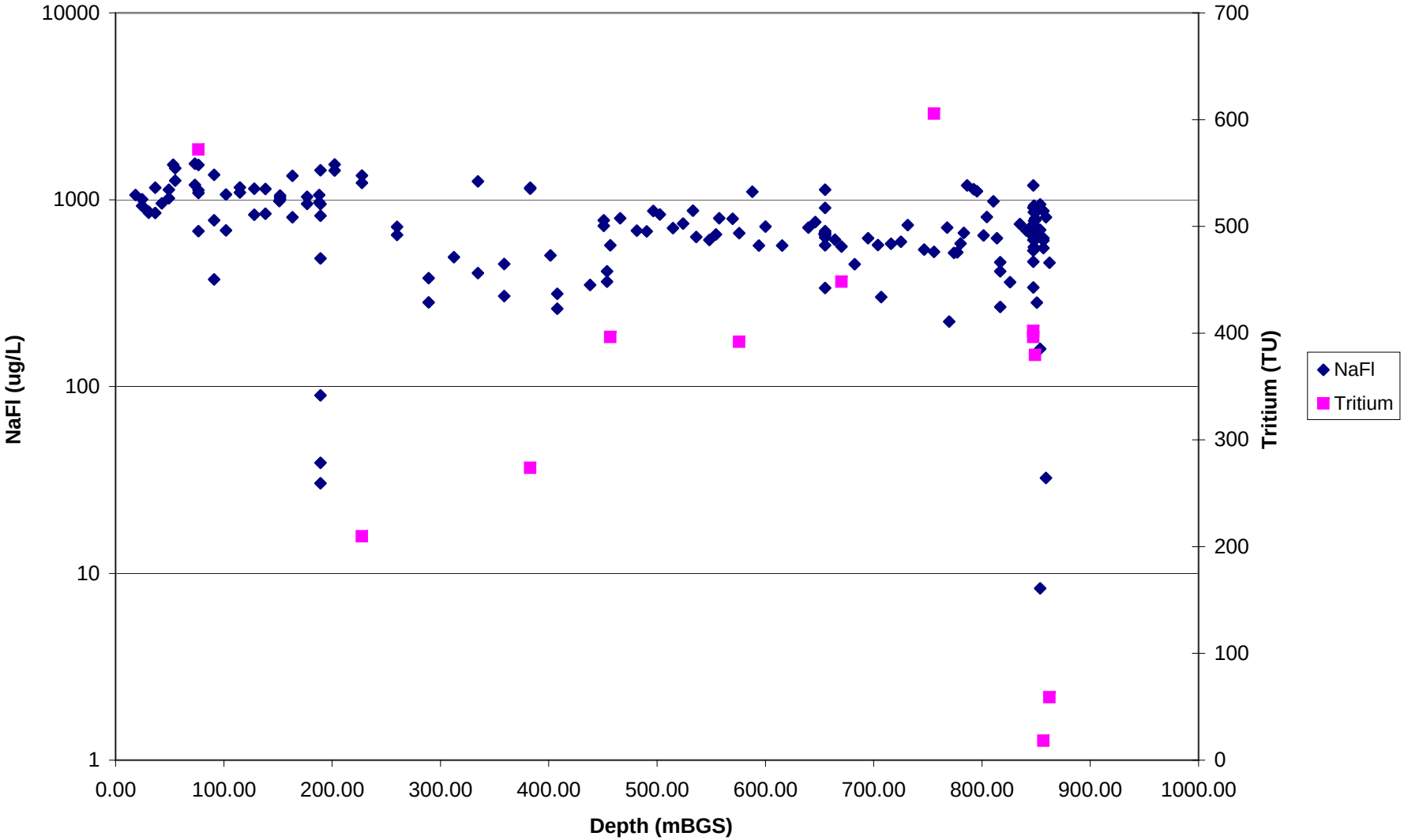

Figure C.6 - Electrical Conductivity and pH in DGR-2