

555594

LABORATORY NOTEBOOK

WIPP WGS-1

• WIPP GEOLOGIC SAMPLES •

Notebook No.: 1

Assigned to: MICHAEL SCHUHEN

Date: 11/15/10

RECORDS CODE: WIPP: 1.4.2.3: TD: QAL:

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INSTRUCTIONS FOR KEEPING RESEARCH RECORDS

In addition to providing a complete record of your laboratory work which can be understood and repeated by yourself and others, this notebook has been designed to afford maximum patent right protection. Several practices must be followed to give the notebook value as a legal document in possible patent litigation:

1. Enter all data directly into this book; it is permanently bound with numbered pages so that pages can not be substituted or deleted. Insert a piece of carbon paper between each original and duplicate page in turn such that a copy of all dates, data and signatures are made as work progresses. These copies should be removed from the book and given to your group leader. Do not record data elsewhere for transfer into the book. Write in ink. Never make erasures. Thus, the integrity of the record will not be in question.
2. Record sufficient information. All procedures, reagents, apparatus, sketches, conditions, references, etc., should be entered in the book as the work is done. The purpose and significance of the experiment as well as the observations, results, and conclusions should be made clear. What may seem trivial at the time may later prove of critical importance. Your entries should be clear and complete enough for someone else who is "skilled in the art" to read and comprehend what has been accomplished. Avoid sweeping negative statements, e.g.: "This procedure is worthless," which could later limit the scope of your claims.
3. Not only is the conception of an invention important, but so is the diligence shown in making a working model or demonstrating that the idea works—"reducing the practice." These two elements of an invention, conception and reduction to practice, must be corroborated by a witness. The records of the inventor(s) are not enough. Thus, each page of the notebook should be read, witnessed, and dated (daily, if possible) by someone who is competent to understand it, but who does not claim to be a co-inventor. Charts, tables, etc., should be complete, and lines should be drawn through any blank spaces prior to witnessing. It may be wise to perform key experiments in front of one or more witnesses. Spectra, charts, etc., should be signed, dated, witnessed, and if they can not be permanently attached to the notebook, they should be referred to with an entry in the book and kept on file. Dates and witnesses can establish your priority of invention.
4. To delete an entry, draw a line through it so that is still legible. Corrections should be made adjacent to the deleted entry, and they should be initialed and dated by you and the corroborating witness. Changes made after the page has been witnessed should also be initialed and dated by you and the witness. Always use the current date.
5. The notebook and its contents are to be considered confidential and of great value. Exercise every care in preserving them. Report the loss or theft of a research notebook to a group leader immediately.
6. Index the contents and return each book as completed (or when not in use) for filing.
7. New ideas must be recorded and witnessed as they occur to establish priority of invention. Even ideas which do not pertain to the project at hand should be documented in the book.

Keep your research records as if each project were to be patented. Even though the work contained in the book may not result in a patent application, observance of these practices will provide a clear record for reports, publication, or future reference.

Instructions Read and Understood by  D. MICHAEL CHAPIN JR.
Dated 11/15/10

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*** END OF TOC ENTRIES ***	

time
5/10/11

**Acronym List inserted into WIPP Geologic Samples
Scientific Notebook #1 (WGS-1)
On Page 1 on 11/15/2010** *TMC*

An (*) asterisk indicates out of time sequence due to numerous well site activities.

Some dates may be out of order due to numerous field activities and the use of several different Scientific Notebooks. Entries will be made in a continuous manner.

BTOC = Below Top of Casing measurement implies North side of well head casing.

BTOT = Below Top of Tubing (used when the well is dual completed or has a tool installed).

BGS = Below Ground Surface (above ground well head casing needs to be subtracted).

DL = Dewey Lake

DTW = Depth to Water

SMN = SSW Monitoring Network

SBD = Stewart Brothers' Drilling

SSW = Shallow Subsurface Water

WQ = Water Quality (consists of specific conductance, pH and temperature).

WRES = Washington Regulatory and Environmental Services

WTL= Well Test Lead

Stick-up = the measurement from the top of the tubing that is sticking up out of the casing to the top of the casing.

WIPP WGS-1 (Notebook #1), is a new Scientific Notebook as prescribed by TP-06-01, "Monitoring Water Levels in WIPP Wells"; it will be linked to future WGS Notebooks, which will continue sequentially in numerical order. Entries will be made in a continuous manner.

Individuals that make notations in the Scientific Notebook will sign and date their first entry.

Continued on Page 2

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Document inserted into WIPP Geologic Samples Scientific Notebook #1 (WGS-1), on page 2 on 11/15/2010.

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Technical Review Statement

The technical and QA review requirements for this Scientific Notebook are identified in SNL Test Plan TP-06-01, Monitoring Water Levels in WIPP Wells and the Nuclear Waste Management Program Procedure, NP 20-2, Scientific Notebooks, Revision 4, Section 2.6. To comply with these requirements, the frequency of technical and QA reviews will be every six months.

Objective and Work Description

The activities described in this TP constitute one component of the Sandia National Laboratories (SNL) program to evaluate hydrologic and geologic data collected at the Waste Isolation Pilot Plant (WIPP) site. Types of data collected and recorded in this Scientific Notebook include, but are not limited to:

- Geologic samples and related information acquired during the drilling of a borehole from the ground surface, and
- Information acquired from geophysical logs: 1) depth and thickness of stratigraphic units, 2) lithology, 3) zones or units that include water, 4) wellbore conditions, and 5) hydraulic properties of units or zones.

These data are used primarily for determining which network wells need to be replaced or reconfigured.

NOTEBOOK USER'S LIST

PRINTED NAME

SIGNATURE

INITIALS

D. MICHAEL CHAPIN Jr.
Scott Miks
Dennis W. Powers

TMC
Scott Miks
Dennis W. Powers

TMC
SM
DWP

Continued on Page 3

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Document inserted into (SN) WIPP-WGS-1, on page 3, on 11/15/10. *DMC*

DOCUMENT INSERTED INTO (SN) WIPP-WGS-1, PG. 3, 11/15/10. *DMC*

SP 13-4
Revision 0
Page 1 of 7

IMPORTANT NOTICE: The current official version of this document is available via the Sandia National Laboratories WIPP Online Documents web site. A printed copy of this document may not be the version currently in effect.

ACTIVITY/PROJECT SPECIFIC PROCEDURE

**SP 13-4
LOGGING AND MANAGEMENT OF CUTTINGS
AND OTHER ROCK SAMPLES AT THE SURFACE
Revision 0**

Effective Date: 11/15/10 *DMC*

Author: D. Michael Chapin, Jr. (printed name) *D. Michael Chapin, Jr.* (signature) 11/10/10 (date)

1.0 Purpose and Scope

This procedure describes the processes that guide in the collection, description, and (as appropriate) preservation of geologic samples and data by Sandia National Laboratories-Carlsbad Programs Group (SNL-CPG) personnel or contractors during, or in conjunction with, drilling of boreholes from the surface. This procedure only applies to work related to the Waste Isolation Pilot Plant (WIPP) programs carried out by (SNL-CPG). This procedure applies specifically to geologic samples such as cuttings. Specific requirements for dealing with core samples may be included in the future, if needed. Any incidental fluid samples (i.e., drilling fluids or encounters with groundwater, brine, etc.) will be non-QA information or will be obtained under appropriate procedures. This procedure also describes documentation regarding geologic samples and related information acquired during the drilling of a drillhole from the surface. Templates for recording information are provided that are somewhat generalized and can be modified as needed to meet any requirements that subsequently develop.

The Principal Investigator (PI), or designee, will outline the logging and management requirements in the work control documents (i.e., test plan, work package) for tests that require the extraction of core and will determine which core samples will require logging and management. The work control documents should reference this procedure for specific QA requirements.

NOTE: In the remainder of this document, the use of the term "PI" includes their delegate.

The PI whose activities warrant the use of this procedure is responsible for implementing the requirements of this procedure, and for assuring that the latest revision of this document is followed.

Acronyms and definitions for terms used in this procedure may be found in the **Glossary** located at the Sandia National Laboratories (SNL) WIPP Online Documents web site.

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Revision 3
Page 7 of 11

Appendix C

NUCLEAR WASTE MANAGEMENT PROCEDURE <small>Sandia National Laboratories</small>	<h2 style="margin: 0;">Training Record</h2>	Form Number: NP 2-1-2 Page 1 of 1
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Section I

Type of Training: Logging and Management of Cuttings and Other Rock Samples at the Surface
SP 13-4, REV. 0

Brief description of material covered:
This procedural training describes the actions and processes that guide in the collection, description, and (as appropriate) preservation of geologic samples during, or in conjunction with, drilling of boreholes from the surface.

Method of Training

<input type="checkbox"/> classroom	DOCUMENT INSERTED INTO (SN) WIPP-WGS-1 ON PAGE 5, 11/17/10. <i>DMC</i> Date of Training: _____ Date of Training: <u>11/15/2010</u>
<input type="checkbox"/> one-on-one	
<input type="checkbox"/> web-based	
<input checked="" type="checkbox"/> self-study	

Instructor for Classroom or One-on-One Training (N/A for web-based or self study)

N/A *DMC* 11/17/10

Print	Signature	Date of Training
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QA Concurrence for Web-Based or Self Study Training (N/A for classroom or one-on-one)

Shelly R. Johnson *Shelly R. Johnson* 11-17-10

Print	Signature	Date
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Section II Roster of Participants

Printed Name of Participant	Signature of Participant	Organization
1 D. Michael Chapin, Jr.	<i>DMC</i>	06212
2 <i>Scott Mikes</i>	<i>Scott Mikes</i>	06212
3 <i>Wesley DeVoye</i>	<i>Wesley DeVoye</i>	6212
4 <i>Kirk Rascon</i>	<i>Kirk Rascon</i>	6212
5 <i>Dick O'Daniel</i>	<i>Dick O'Daniel</i>	6212
6 <i>JEFF PALMER</i>	<i>Jeff Palmer</i>	6212
7 <i>Kris Kuhlman</i>	<i>Kris Kuhlman</i>	6212
8 <i>Kevin Barnhart</i>	<i>Kevin Barnhart</i>	6212
9 <i>Bwalya Makha</i>	<i>Bwalya Makha</i>	6212
10		
11		
12	<i>DMC</i> <u>11/17/10</u>	
13		
14		
15		
16		

Continued on Page **6**

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DMC 11/17/10
Signed Date

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NUCLEAR WASTE MANAGEMENT PROCEDURE <small>Sandia National Laboratories</small>	<h2 style="margin: 0;">Training Record</h2>	Form Number: NP 2-1-2 Page <u>1</u> of 1
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Section I

Type of Training: Logging and Management of Cuttings and Other Rock Samples at the Surface
SP 13-4, REV. 0

Brief description of material covered:
This procedural training describes the actions and processes that guide in the collection, description, and (as appropriate) preservation of geologic samples during, or in conjunction with, drilling of boreholes from the surface.

Method of Training *DOCUMENT INSERTED INTO (SN) WIPP-WGS-1 ON PAGE 6, 11/17/10. DUC*

classroom
 one-on-one
 web-based
 self-study

Date of Training: _____
Date of Training: 11/16/2010

Instructor for Classroom or One-on-One Training (N/A for web-based or self study)
N/A DUC 11/17/10

Print _____ Signature _____ Date of Training _____

QA Concurrence for Web-Based or Self Study Training (N/A for classroom or one-on-one)

Shelly R. JOHNSON *Shelly R. Johnson* 11-17-10
Print _____ Signature _____ Date _____

Section II Roster of Participants

Printed Name of Participant	Signature of Participant	Organization
1 Dennis W. Powers	<i>Dennis W. Powers</i>	06212
2		
3		
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DUC
11/17/10

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Read and Understood By

DUC _____ 11/17/10
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12/16/10 <u>t</u>	<u>ACTION / OBSERVATION</u>
0820	<p>12/16/10 <u>D.M.C.</u></p> <p>D. CURNUTT OF MOSAIC INFORMS (SNL) THAT DRILLING OF MOSAIC #20 WILL BEGIN EITHER 12/17/10 OR ON 12/18/10. PREPARATIONS BEGIN TO MOBILIZE DENNIS POWERS + SCOTT MILES TO CARLSBAD, N.M., TO WORK COLLECTING CUTTINGS AND TO MAP THE HOLE. M. CHAPIN IS CURRENTLY IN CARLSBAD, NM, AND PREPARED FOR WORK.</p>
1300	<p>12/17/10 <u>D.M.C.</u></p> <p>M. CHAPIN + S. MILES ARRIVE ONSITE = PAD OF MOSAIC #20, TO ASSESS THE DRILLING ACTIVITIES OF STEWART BROTHERS DRILLING (SBD). HE UNDERSTAND THAT THE CONDUCTOR CASING WILL BE SET SOMETIME THIS EVENING + THAT DRILLING SHOULD COMMENCE SOMETIME ON THE MORNING OF 12/18/10. THE DECISION TO MOBILIZE THE INTERSON PAND (GSD) GENERATOR + THE OBSERVATION TRAILER ONSITE OF MOSAIC #20 PAD IS CONFIRMED.</p>
1500	<p>M. CHAPIN PERFORMS SAFETY BRIEFING.</p>
1600	<p>M. CHAPIN, S. MILES + R. PASCON ARRIVE ONSITE PAD OF MOSAIC #20 AND BEGIN SET-UP.</p>
1725	<p>TRAILER + GENERATOR SET-UP IS COMPLETE.</p>
1730	<p>R. PASCON OFFSITE.</p>
1745	<p>S. MILES TO STAY ONSITE OVERNIGHT.</p>
1750	<p>M. CHAPIN OFFSITE.</p>
~ 2300	<p>NOTE: CONDUCTOR / SURFACE CASING (20' LENGTH) WAS SET ON THE NIGHT OF 12/17/10 AND CEMENT / GROUT WAS EMPLOYED: ~ 2L = APPROX. 2300 Continued on Page 8</p>

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D.M.C.
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12/16/10 - 12/17/10
Date

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12/18/10	TMC	12/18/10	<u>ACTION / OBSERVATION</u>
0630			D. POWERS ONSITE.
0850			M. CHAPIN ONSITE.
0900			M. CHAPIN PERFORMS SAFETY MEETING AND THE GENERATOR DAILY CHECK + FUEL REPORT / OK.
0904			(SBD) BEGINS DRILLING MOSAIC #20. * SURFACE ELEVATION = 3430' AMSL. * (BGS) DEPTH (DEPTH BELOW GROUND SURFACE) • 0-15' 2.5 YR 4/4 (REDDISH BROWN), SILTY FINE (BGS) TO MEDIUM SAND, SOME CAUCHE. • 15-20' 2.5 YR 4/6 (RED), SILTY V. FINE TO FINE (BGS) SAND W/ MEDIUM SAND, INC. SILTY, W/ TRACE CAUCHE, SOME GRAY STAINING: GATUNA FM. ?? • @ 43' BGS: CHERT PEBBLES; POSSIBLE GATUNA FM. / SANTA ROSA FM. CONTACT??
0916			• @ 45' BGS: MOST LIKELY SANTA ROSA FM. ? APPEARS GATUNA FM. ABOVE: (SBD) SHUTS DOWN RIG TO ADD A DRILL JOINT TO THE STEM + TO MAKE MUD PUMP ADJUSTMENTS.
0940			(SBD) REMOVES MUD PUMP AND BEGINS ADJUSTMENTS. 5. MILES OFFSITE.
1013			(SBD) COMMENCES DRILLING AFTER PUMP ADJUSTMENT.
1030			(SBD) @ 65' BGS: DRILLING STOPS TEMP. @ 67' BGS.
1043			(SBD) @ 67' BGS: DRILLING RECOMMENCES.
1159			(SBD) @ (110' BGS) - SAMPLING EVERY 5'; NEW (SBD) CREW IS NOW ONSITE.

Continued on Page 9

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12/18/10
Date

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12/18/10	DWC	12/18/10	<u>ACTION / OBSERVATION</u>
1302			SANTA ROSA FM/ DEWEY LAKE TRANSITION ZONE APPEARS @ <u>± 120-130'</u> INTERVAL. WHEN COLLECTING CUTTINGS IN THE SIEVE, H ₂ O DRAINING WELL THROUGH SAMPLES IS A FAIR INDICATION OF SANTA ROSA CUTTINGS. WHEN CUTTINGS CLUMP-STICK (CLAY CONTENT IS INCREASED) + H ₂ O STANDS ON CUTTINGS (LOW DRAINAGE RATE), THIS IS A FAIR INDICATION THAT THE DRILLERS ARE IN THE DEWEY LAKE FORMATION. (150' BGS @ E=1315) DWC 12/18/10
1320			(SBD) @ 150' (1315) - DRILLING WILL CONTINUE AS USUAL BUT WE WILL NOW COLLECT CUTTINGS @ 10' INTERVALS.
1410			CUTTINGS CONTAIN GYPSUM.
1515			D. POWERS OFFSITE.
1620			CUTTINGS SAMPLE C-42 @ 270' BGS IS TOO FINE TO COLLECT, ∴ NO SAMPLE COLLECTED.
1630			MUD ENGINEERS ONSITE TO ASSESS PROBLEMS W/ THE PUMP, W/ THE FLUID VISCOSITY, AND TO DETERMINE WHY THE CUTTINGS ARE SO FINE. (VALERIE - M.E.) HAYES
1634			CUTTINGS SAMPLE, C-43 @ 280' BGS IS STILL TOO FINE TO COLLECT - (SBD) ADDRESSING ISSUE.
1644			RIG CREW WORKING ON MUD VISCOSITY AND ON PUMP NO. 2. THE MUD IS SIMPLY CIRCULATING DOWNHOLE AND THE CUTTINGS ARE NOT EXITING SURFACE PIPE. (DON TAYLOR - DRILLING SUPERVISOR ONSITE) • D.S. - DRILLING SUPERVISOR • M.E. - MUD ENGINEER

Continued on Page 10

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DWC
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12/18/10
Date

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12/18/10	<u>T</u> <u>TMC</u>	12/18/10	<u>ACTION / OBSERVATION</u>
1650			CUTTINGS SAMPLE <u>C-44</u> COLLECTED @ 280' BGS.
1710			(SBD) CREW + MUD ENGINEERS CONTINUE TO ADDRESS THE MUD / FLUID VISCOSITY + CUTTINGS CIRCULATION ISSUE.
1717			TOWER LIGHTS 'ON' - SUNSET + DUSK.
1730			(SBD) per DON TAYLOR NEEDS TO REMOVE PIPE FROM HOLE. (SBD) EITHER HAS A PLUGGED JET IN THE ASSEMBLY OF CEMENT IN THE SYSTEM (PROGNOSIS MADE BY D. TAYLOR - D.S.). - NEW PROGNOSIS: CEMENT ON THE FLOAT ABOVE THE DRILL BIT???
1840			(SBD) PULLING PIPE FROM THE HOLE TO REPAIR PROBLEM.
1915			(SBD) CLEARS (2) 5/8" HOLES @ DRILL BIT OF DEBRIS.
1925			(SBD) BEGINS TO RESET DRILL BIT + PIPE.
2030			(SBD) RE-COMMENCES DRILLING.
2038			COLLECT CUTTINGS SAMPLE <u>C-45</u> @ A DEPTH OF 310' BGS.
2200			S. MILES ONSITE.
2230			D. POWERS ONSITE; Mike Chapin departs 2250.
2400 2330	2400 12/18/10		Drilling Crew shift change.

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12/19/10		
±	12/19/10	<u>ACTION / OBSERVATION</u>
0555		(SBD) performs limited maintenance of rig, upper rotating block during extended circulation on bottom @ 675'; complete @ 0602 MST. Cuttings showed more gypsum/anhydrite as chips after circulation.
0810		Mike Chapin arrives on site; M. CHAPIN PERFORMS SAFETY BRIEFING.
0838		Note re cuttings from upper Rustler: upper sulfate bed (A-5) is being ground by drill bit to paste which is poorly represented. Drilling rates are more indicative of stratigraphic units of forty-niner Member. Returns generally became cleaner from Magenta and deeper.
0845	± TMC	5-MILES OFFSITE. M. CHAPIN COMPLETES THE DAILY GENERATOR CHECK AND THE FUEL REPORT / OK.
0846		(SBD) DECREASES THEIR DRILLING RATE TO MITIGATE CHANCES OF HITTING THE SALADO FM. - STILL DRILLING W/ FRESH H ₂ O.
1020		R. BASCON ONSITE TO REFUEL GENERATOR AND TO WORK ON TRAILER DOOR LATCH.
1055		R. BASCON OFFSITE.
1100		(SBD) SHUTS DOWN DRILLING - WAITING TO CONTINUE W/ BRINE.
1130		D. POWERS OFFSITE. (SBD) DRILLING CREW SHIFT CHANGE.
1140		JIM FROM (BLM) ONSITE.
1230		JIM FROM (BLM) OFFSITE.
1320		D. CURNUTT (MOSAIC) ONSITE TO DISCUSS PROGRESS.
1340		D. CURNUTT OFFSITE.

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12/19/10		
<u>t</u>	<u>DMC</u>	<u>ACTION / OBSERVATION</u>
1830		(B+R) TRUCKING DELIVERING BRINE H ₂ O HOLDING & RECIRCULATION TANKS ONSITE. PAD TOWER LIGHTS ARE ON AND (SBD) CREW PREPARES FOR THE NIGHT'S DRILLING ACTIVITIES. [B+R TRUCKING IS THE CO. NAME].
1900		PRE-DRILL ACTIVITIES CONTINUE; WAITING FOR BRINE.
2025		(SBD) CONTINUES TO WAIT FOR THE BRINE DELIVERY.
2030		S. MILES ONSITE.
2040		M. CHAPIN OFFSITE.
* 2320	SM	First Water truck on site, pump brine water into mud tank.
2340		Stop pumping to fix a leak in the hose fitting.
2400		Finished pumping brine, water truck off site. 130 barrels of brine pumped.

* 12/20/10		
<u>t</u>	<u>DMC</u>	<u>ACTION / OBSERVATION</u>
0300		Drillers prepare to mix mud
0330		Begin Mud mixing
0410		Second Water truck arrives with brine water (130 bbls)
0505		Water truck off site, mixing mud.
0602		Begin run in hole (RIH)
0636		Begin Circulating mud
0639		Start drilling @ 795'

* SCOTT MILES MADE THIS ENTRY(S) AND IS NO LONGER ON PROJECT. Continued on Page 13

12/20/10 INITIAL ENTRY INITIALED BY PI DMC, Read and Understood By

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12/19/10 - 12/20/10
Date

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Date

12/20/10	ACTION / OBSERVATIONS
± DMC	
0810	M. CHAPIN ONSITE.
0815	S. MILES PERFORMS SAFETY MEETING / BRIEFING.
0820	M. CHAPIN PERFORMS THE DAILY GENERATOR CHECK + FUEL REPORT. /OK
0905	M. SCHUHEN ONSITE.
0915	M. SCHUHEN OFFSITE.
0920	(SBD) @ 900' BGS - DRILLING IS NOW BELOW THE CULEBRA FM. + THE ANHYDRITE A1. SAMPLE IS ALMOST COMP. GYPSUM.
1040	(SBD) @ 960' BGS - CUTTINGS SAMPLE C-111.
1130	(SBD) @ 1010' BGS - CUTTINGS SAMPLE C-116. FIRST SIGNS OF CRYSTALLINE HALITE IN THE SALADO FM. - WEAKENOW CONTENT W/ THE COLLECTION OF SAMPLES AND WILL CONTINUE COLLECTING A FEW MORE AND THEN BREAK DOWN CAMP.
1140	(SBD) DRIVERS PERFORM SHIFT CHANGE.
1142	BREAKING DOWN CAMP + PREPARING TO DEMOBILIZE.
1157	COLLECT THE LAST CUTTINGS SAMPLE NO. C-118 @ A DEPTH OF 1030' BGS.
1215	FINISHING CAMP BREAKDOWN

Continued on Page 14

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Date

12/20/10

T DMC

ACTION / OBSERVATION

1255

R. RASCON ONSITE TO BRING TRAILER BACK TO (SNL).

1345

M. CHAPIN, S. MILES & R. RASCON OFFSITE.

DMC
12/20/10

Continued on Page N/A

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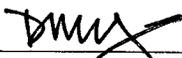
12/20/10
Date

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01/01/11	DVC	ACTION / OBSERVATION
1000		DANIEL CURNUTT OF MOSAIC CONFIRMS W/ (SNL) THAT STEWART BROTHERS DRILLING (SBD) WILL DEMOBILIZE FROM WELD PAD MOSAIC #20 ON THE MORNING OF 01/01/11 AND 01/01/11 DVC WILL AUGER THE HOLE FOR THE SURFACE CASING LATER IN THE DAY, ON 01/01/11. M. CHAPIN PREPARES TO MOBILIZE TO THE WELD PAD OF MOSAIC #21 TO BEGIN THE COLLECTION OF FORMATION CUTTINGS / SAMPLES. M. CHAPIN CONDUCTS SAFETY BRIEFING.
1330		M. CHAPIN ONSITE PAD OF MOSAIC #21 AND UNLOADING GEAR. (SBD) DRILLING RIG + DOGHOUSE (TOOLHOUSE) ONSITE.
1350		JUSTIN BARRIS (SBD) ARRIVES ONSITE. J. BARRIS IS THE DRILLING SUPERVISOR FOR THE DRILLING OF MOSAIC #21. * J. BARRIS - TOOLPUSHER - (505) 240-0499: <u>mobile phone #</u>
1530		(SBD) DRILLING CREW ARRIVES W/ PIPE TRUCK, 20 KW HACKER GENERATOR, HI-REACH FORK LIFT + PUMP / BENTONITE / CEMENT / HOSE TRUCK.
1625		(SBD) RIGGING UP OVER HOLE POSITION. RIG BOOM IS ON THE RISE.
1700		RIG BOOM IS VERTICAL + LOCKED. RIG IS HAVING ENGINE PROBLEMS; FUEL LINE, FUEL FILTERS + GEN. MAINTENANCE.
1730		(SBD) STILL PERFORMING MAINTENANCE.
1750		(SBD) HAS FINISHED MAINTENANCE - PREPARES TO LEVEL RIG + SET AUGER BIT TO INSTALL SURFACE CASING.
		AUGER BIT SET BY (SBD).
1835		DRILLING COMMENCES.

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<u>01/01/11</u> TMC	<u>ACTION / OBSERVATION</u>
<u>t</u>	
1845	<u>C-1</u> COLLECTED : 0-5' BGS.
1855	(B+R) ONSITE TO DELIVER MUD CIRCULATING TANK.
1915	(B+R) OFFSITE.
1920	AUGERING CONTINUES.
1930	<u>C-2</u> COLLECTED : 5-10' BGS.
1940	(SBD) HAS PROBLEMS W/ SOFT SEDIMENT @ SURFACE. AUGERING STOPS + CREW DECIDING ON FINISHING WORK FOR THE EVENING.
2030	(SBD) DRILLING CREW BREAKING DOWN CAMP.
2050	M. CHAPIN OFFSITE.

<u>01/02/11</u> TMC	<u>ACTIONS / OBSERVATION</u>
<u>t</u>	* (SBD) USING ONE (1) SHIFT CREW @ ± 12-14 hr. SHIFTS.
0800	J. BARRIS (SBD) CONTACTS M. CHAPIN AND DISCUSSION CONCLUDES THAT DRILLING WILL NOT COMMENCE UNTIL 01/03/11.
0900	<u>C-3</u> COLLECTED : 10-15' BGS. } COLLECTED BY (SBD).
0930	<u>C-4</u> COLLECTED : 15-20' BGS }
1140	(SBD) FINISHES AUGERING & PREPARES TO SET SURFACE CASING.

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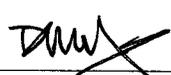
01/01/11 - 01/02/11
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01/02/11	DWC	<u>ACTION / OBSERVATION</u>
<u>t</u>		
1215		SURFACE CASING SET @ 25' BGS.
1300		(B+R) ARRIVES ON SITE TO DELIVER 2ND MUD CIRCULATION TANK. M. CHAPIN ENDS DISCUSSION W/ J. BARRIS (SBD) AND WILL CONTINUE WORK ON 01/03/11.
<hr/>		
01/03/11	DWC	<u>ACTION / OBSERVATION</u>
<u>t</u>		
0700		M. CHAPIN CONDUCTS SAFETY BRIEFING.
0755		M. CHAPIN ONSITE OF PAD MOSAIC #21.
0811		(SBD) WARMING UP RIG + PREPARING TO MIX DRILLING FLUID/MUD.
0910		(SBD) CONTINUES TO MIX DRILLING MUD.
0925		(SBD) CONTINUES TO MIX DRILLING MUD.
1010		(SBD) CIRCULATING DRILLING MUD.
1120		(SBD) PUTTING FINISHING TOUCHES ON RIG - PREPARATIONS TO START DRILLING ARE ALMOST COMPLETE.
1125		(SBD) BEGINS DRILLING - CUTTINGS SAMPLES WILL NOW BE COLLECTED STARTING W/ SAMPLE C-5; 5' INTERVALS.
1335		(SBD) @ 145' BGS ∴ DRILLING RATE ≈ 60 ft·hr ⁻¹ (1 ft·min ⁻¹)
1403		(SBD) @ 180' BGS - CUTTINGS SAMPLES NOW WILL BE COLLECTED EVERY 10'.
1415		(SBD) CRUISING' RIGHT ALONG.

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01/03/11	<u>ACTION / OBSERVATION</u>
<u>t</u>	
1420	(SBD) CIRCULATES FLUID AND STOPS DRILLING TEMPORARILY.
1424	(SBD) ADDS A JOINT TO STEM @ 206' BGS.
1540	(SBD) @ A DEPTH OF 290' BGS. LATEST DRILLING RATE SINCE 1335 = @ 145' BGS.
	$\left\{ \begin{array}{l} @ 1335 = 145' \text{ BGS} \\ @ 1540 = 290' \text{ BGS} \end{array} \right. = 145' \text{ in } 125 \text{ min}$ $\therefore 1.2' \text{ per minute} = \underline{70 \text{ ft-hr}^{-1}}$
1715	SUNSET + DUSK.
1816	(SBD) @ 400' BGS.
1830	(SBD) KELLY DOWN - LAST CUTTINGS SAMPLE RETRIEVED @ 1827: SAMPLE C-59 @ 410' BGS DMC 1/3/11
1835	CAMP BREAKDOWN. (SBD) IS FINISHED DRILLING FOR TODAY.
1915	M. CHAPIN OFFSITE.

01/04/11	<u>ACTION / OBSERVATION</u>
<u>t</u>	
0720	M. CHAPIN + S. MILES ONSITE.
0730	M. CHAPIN CONDUCTS SAFETY BRIEFING; THE DRILLING OF MOSAIC #21 RESUMES TODAY.

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01/04/11	TAMC	<u>ACTION / OBSERVATIONS</u>				
<u>±</u>						
0800		(SBD) CIRCULATING DRILLING FLUID/MUD + @ 412' BGS.				
0820		(SBD) CONTINUES TO CIRCULATE DRILLING FLUID.				
0822		CUTTINGS SAMPLE <u>C-60</u> @ 420' BGS COLLECTED - THE DRILLING OF MOSAIC #21 RECOMMENCES.				
0845		M. CHAPIN DISCUSSION W/ M. SCHULTEN - CLOG SHOULD BE EN-ROUTE TO LOG MOSAIC #21.				
0920		(SBD) STOPS DRILLING TO WORK ON A POWER PROBLEM.				
0932		(SBD) RETURNS TO DRILLING MOSAIC #21.				
1041		(SBD) @ 550' BGS - SAMPLE <u>C-73</u> .				
DRILLING RATE THIS MORNING:						
<table border="0"> <tr> <td data-bbox="500 1259 636 1302">C 0822</td> <td data-bbox="678 1259 906 1302">@ 420' BGS</td> </tr> <tr> <td data-bbox="500 1302 636 1344">C 1041</td> <td data-bbox="678 1302 912 1344">@ 550' BGS</td> </tr> </table>			C 0822	@ 420' BGS	C 1041	@ 550' BGS
C 0822	@ 420' BGS					
C 1041	@ 550' BGS					
∴ 139 min : 130' = 0.94 ft. min ⁻¹ = <u>56 ft. hr⁻¹</u>						
1229		DRILLING HAS SLOWED CONSIDERABLY (RELATIVE TERM). POSSIBLE DEWEY LAKE / RUSTLER FM. CONTACT IS AT ≈ 630-660' BGS. GYPSUM HAS INCREASED SIGNIFICANTLY THROUGHOUT THIS 30' ZONE.				
1239		CUTTINGS SAMPLE <u>C-89</u> @ 710' BGS IS APPROX. 70% CaSO ₄ . THIS APPEARS TO BE THE UPPER MAGENTA CONTACT, W/ THE A4- ANHYDRITE ?? MIXING ZONE? DEFINITE LITHOLOGY CHANGE.				

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01/04/11	DMC	<u>ACTION / OBSERVATION</u>
± =		
1255		<p>✱ CORRELATION BETWEEN MOSAIC #20 AND MOSAIC #21 DRILL CUTTINGS SAMPLES: ~60' DIFFERENCE DUE TO FORMATION DIP + ELEVATION GAIN.</p>
		<p><u>MOSAIC #20</u> vs <u>MOSAIC #21</u></p>
		<p>a.) 660' BGS (660'-670' BGS) 700' BGS (710'-720' BGS) • DRILLING RATE HAS SLOWED W/ INCREASED CaSO₄ - ANHYDRITE A4 POSSIBLE? LITHOLOGY + FACIES CHANGE - MAGENTA + A4 CONTACT POSSIBLE?</p>
		<p>b.) (680'-690' BGS) vs. (740'-750' BGS) • TOP OF MAGENTA FM.?</p>
		<p>c.) (720'-730' BGS) vs. (770' BGS)? - 780' BGS? • BOTTOM OF MAGENTA FM. + A3 HORIZON?</p>
1415		(SBD) DRILLING CREW CHANGE. (SBD) PERFORMING MINOR MAINTENANCE ON RIG.
1425		(SBD) @ 780' BGS - CUTTINGS SAMPLE C-96: DOLOMITE, ANHYDRITE, GYPSUM, MUDSTONE/SILTSTONE.
1438		(SBD) NOT DRILLING - CIRCULATING DRILLING FLUID/MUD. COLLECTING SAMPLE C-97 - (SBD) @ 790' BGS; A3, A2? DEFINITELY ANHYDRITE + GYPSUM.
1443		(SBD) MUD ENGINEER ONSITE.
1515		(SBD) MUD ENGINEER OFFSITE.
1631		(SBD) @ 850' BGS - POSSIBLE TOP OF CULEBRA FM.? OVERLAIN BY APPROX. 60'-70' OF ANHYDRITE W/ SILTY-SANDSTONE TO SANDY-SILTSTONE CLASTS: CUTTINGS SAMPLE C-103.

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01/04/11	TMC	<u>ACTION / OBSERVATION</u>
1701	TMC	(SBD) @ 860' BGS - CUTTINGS SAMPLE C-104: LITHOLOGY CHANGE - RED SILTY MUDSTONE ~ 50% OF SAMPLE.
1730	TMC	(SBD) RIG IS HAVING CHAIN PROBLEMS.
1833	TMC	(SBD) @ 900' BGS - CUTTINGS SAMPLE C-108. (SBD) WILL NOW "TRIP OUT" OF THE HOLE IN PREPARATION OF COLOG'S ARRIVAL. COLOG SHOULD ARRIVE THIS EVENING & WILL MEET (SNL) IN THE MORNING OF 01/05/11 TO RUN (4) LOGGING TOOLS DOWNSHOLE.
1900	TMC	M. CHAPIN + S. MILES OFFSITE.

01/05/11	TMC	<u>ACTION / OBSERVATION</u>
0700	TMC	M. CHAPIN MEETS AL (COLOG) @ (SNL) IN PREPARATIONS OF LOGGING MOSAIC #21. COLOG IS OUT OF LAKEWOOD, CO.
0815	TMC	M. CHAPIN + COLOG ARRIVE ONSITE OF MOSAIC #21.
0820	TMC	M. CHAPIN PERFORMS SAFETY BRIEFING.
0915	TMC	COLOG BEGINS LOGGING MOSAIC #21 - (E-Log).
0945	TMC	K. KUHLMAN, K. BARNHART + B. MALAMA ONSITE TO OBSERVE.
1000	TMC	D. CURNUTT (MOSAIC) ONSITE.
1015	TMC	D. POWERS ONSITE TO OBSERVE COLOG

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01/05/11 DMC ±	<u>ACTION / OBSERVATION</u>
1120	COLOG CONTINUES TO LOG MOSAIC #21.
1123	M. SCHULTEN ONSITE TO OBSERVE; W. DEYONGE ONSITE.
1130	D. CURNUTT (MOSAIC) OFFSITE.
1145	K. KUTLUMAN, K. BARNHART + B. MALAMA OFFSITE.
1220	M. SCHULTEN + W. DEYONGE OFFSITE.
1230	COLOG LOGGING HOLE W/ 3-ARM CALIPER. COLOG HAS COMPLETED THE GUARD (SPOT RESISTIVITY) + GAMMA LOG.
1445	D. POWERS OFFSITE.
1520	COLOG COMPLETE - BREAKING DOWN.
1530	M. CHAPIN + COLOG OFFSITE.

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COLOG COMPLETED THEIR LOGGING ASSIGNMENT AND (SNL) RECEIVED THE FINISHED LOGS. COPIES OF THESE LOGS HAVE BEEN SUBMITTED TO THE SNL-RECORDS CENTER:

A. MOSAIC 21 NATURAL GAMMA COMPENSATED DENSITY
1-ARM CALIPER / ERMS 555112.

B. MOSAIC 21 NATURAL GAMMA NORMAL RESISTIVITY FOCUSED
RESISTIVITY 3-ARM CALIPER / ERMS 555113.

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Logging and Management of Cuttings and Other Rock Samples at the Surface

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Appendix A

ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log			Form Number: SP 13-4-1		
		Sheet <u>1</u> of <u>5</u>					
Hole ID: <u>MOS-20</u>		Location: <u>TOWNSHIP 22 - RANGE 31 - SECTION 10</u>					
Drill Date: <u>12/17-20/ 2010</u>		Drill Method: <u>Mud Rotary</u>		Drill Make/Model: <u>N/A</u>			
Drill Crew: <u>Stewart</u>		Hole Diameter: <u>5 1/8" (20'-TD)</u>		Barrel Specs: <u>N/A</u>			
<u>Brothers' Drilling</u>		Hole Depth: <u>1030' BGS</u>		Drill Fluid: <u>Water-Based/Brine Mud</u>			
		Hole Orient: <u>Vertical</u>		Core Preserv: <u>Cuttings</u>			
Logged by: <u>Scott Miles</u>			Date: <u>02/04/2011</u>		Scale: <u>N/A</u>		
		Northing		Easting		Elevation	
Survey Coordinate: (Ft)		N/A		N/A		N/A	
Comments: All times are Mountain Standard Time (MST). All depths are measured Below Ground Surface (BGS). Color descriptions are moist unless specified as dry. Casing Joint = JNT. Pull Out Of Hole = POOH. Slight offset from geophysical logs due to cuttings.							
Run Number	Depth (ft.)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks	
C-1	5	2300	N/A	0-20'	SILTY, VERY FINE TO FINE SAND: 2.5YR4/6 (red); 10% sub-rounded, moderately calcareous, medium to coarse sand; 5% sub-rounded fine gravel.	12/17/2010	
C-2	10	2300					
C-3	15	2300					
C-4	20	2300			@ 15': increasing silt & very fine sand; decreasing fine to medium sand; decreasing, white, coarse dolomitic/calclitic grains.	20' conductor casing 12/18/2010	
C-5	25	0904			@ 20': 80% very fine sand.		
C-6	30	0909					
C-7	35	0912		20-55'	SILTY, VERY FINE TO FINE SANDSTONE: 2.5YR5/6 (red); 10% medium sand, abundant white, well-cemented, coarse sand particles of calcite and/or dolomite.	JNT @ 45' (0916)	
C-8	40	0914					
C-9	45	0916					
C-10	50	1022					
C-11	55	1023		55-75'	SILTY, VERY FINE TO FINE SANDSTONE: 2.5YR4/6 (red); 10% clay, 15% micaceous, well-cemented, fine to medium sandstone - 2.5YR6/4 (light, red-brown).	JNT @ 67' (1030)	
C-12	60	1025					
C-13	65	1029					
C-14	70	1045					
C-15	75	1047		75-80'	FINE TO MEDIUM SANDSTONE: 2.5YR4/6 (red); 10% very fine sand, well cemented.		
C-16	80	1048		80-85'			
C-17	85	1049		85-90'	SILTY CLAYSTONE: 2.5YR4/4 (red-brown); 10% v.fn sand, 10% fn sand.	JNT @ 89' (1051)	
C-18	90	1109		90-100'	VERY FINE TO FINE SANDSTONE: 2.5YR4/6 (red), 15% medium sand, 5% silt, 20% white, poorly cemented fine sand, trace of dolomite, highly calcareous.		
C-19	100	1151					
C-20	105	1156		100-			
C-21	110	1159		115'	SILTY VERY FINE TO FINE SANDSTONE: 2.5YR4/6 (red); 5% clay, 5% medium sand, 2% white/gray dolomitic fine gravel, poorly cemented.	JNT @ 111' (1203)	
C-22	115	1217		115-	SILTY-DOLOMITE: white to light gray; w/ 30% silt as above.		
C-23	120	1223		120'	CLAYSTONE (CARBONACEOUS) <i>DMC 4/30/11</i>		
C-24	125	1230		120-	CLAYEY SILTSTONE: 2.5YR5/6 (red); 10% very fine sand, highly calcareous.	JNT @ 129' (1235)	
C-25	130	1247		130'			
C-26	135	1253		130-	SILTY CLAYSTONE: 2.5YR4/4 (red-brown), 10% very fine sand, 5% fine sand, well-indurated, non-calcareous, common gray reduction spots.		
C-27	140	1258		170'			
C-28	145	1304			@140-145' SILTY-DOLOMITE: 50% silt, 15% clay, trace very fine sand.	JNT @ 149' (1307)	
C-29	150	1315			CLAYSTONE (CARBONACEOUS) <i>DMC 4/30/11</i>		

* NOTE: PROFILE (ROCK TYPE) = DEPTH INTERVAL (ft.)

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ACTIVITY/ PROJECT SPECIFIC Sandia PROCEDURE National Laboratories		Core/Cuttings Log (Continuation Sheet)			Form Number: SP 13-4-1		
Hole ID: MOS-20		Location: TOWNSHIP 22 - RANGE 31 - SECTION 10			Sheet 2 of 5		
Logged by: Scott Miles				Date: 02/04/2011			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks	
C-30	160	1323		160-	<i>CLAYSTONE (CARBONACEOUS) <i>DWC</i> 4/30/11</i> SILTY DOLOMITE: 2.5Y8/1 (white); 30% reduction spots.	12/18/2010	
C-31	165	1329		165-		SILTY DOLOMITE: 2.5Y8/1 (white); Decreasing gray-white reduction spots.	JNT @ 168' (1329)
C-32	170	1340		170'		<i>CLAYSTONE (CARBONACEOUS) 4/30/11</i>	
C-33	180	1345		170-	VERY FINE, SANDY SILTSTONE: 2.5YR4/4 (red-brown); 15% clay; well indurated, slightly calcareous; 5-10% siltstone w/ gypsum - 2.5YR5/1 (red-gray).	JNT @ 188' (1351)	
C-34	190	1400		240'		JNT @ 208' (1410)	
C-35	200	1408				JNT @ 228' (1445)	
C-36	210	1426				JNT @ 248' (1525)	
C-37	220	1435				JNT @ 268' (1607)	
C-38	230	1453		240-		CLAYEY SILTSTONE: 2.5YR4/6 (red); 10% very fine sand, slightly calcareous, well-indurated.	
C-39	240	1510		270'		NO SAMPLES COLLECTED.	
C-40	250	1538					
C-41	260	1555					
C-42	270	1620		288-		CLAYEY SILTSTONE: 2.5YR4/6 (red); 10% very fine sand, slightly increasing clay content; non-calcareous and well-indurated.	SBD increases mud visc. and works on circulating pump - JNT @ 308' (2040)
C-43	280	1634		310-	CLAYEY SILTSTONE: 2.5YR4/6 (red); 5% very fine sand; 5% increase in gypsum; non-calcareous and well-indurated.	JNT @ 328' (2105)	
C-44	288	1650		350-		JNT @ 348' (2130)	
C-45	310	2038		390'	VERY FINE, SANDY SILTSTONE: 2.5YR4/6 (red); 10% clay; 10% fine sand; moderately gypsiferous; well-indurated.	JNT @ 368' (2204)	
C-46	320	2056					
C-47	330	2113					
C-48	340	2122					
C-49	350	2139					
C-50	360	2151					
C-51	370	2212					
C-52	380	2222					
C-53	390	2230		390-	VERY FINE, SANDY SILTSTONE: 2.5YR4/6 (red); 10% clay; 10% fine sand; moderately gypsiferous, well-indurated, highly calcareous, interbedded with ~30% silty limestone and/or dolomite.	JNT @ 390' (2230)	
C-54	400	2244		400'			

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log (Continuation Sheet)				Form Number: SP 13-4-1		
Hole ID: <u>MOS-20</u>		Location: <u>TOWNSHIP 22 - RANGE 31 - SECTION 10</u>						
Logged by: <u>Scott Miles</u>				Date: <u>02/04/2011</u>				
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks		
C-55	410	2332	N/A	400 - 480'	SILTSTONE: 2.5YR4/6 (red); 10% clay, 5% very fine sand, trace of gypsum w/ crystals up to 4mm in length 7.5YR7/1 (light gray), non-calcareous, argillaceous, to slightly indurated.	12/18/2010 JNT @ 410' (2256)		
C-56	420	2307						
C-57	430	2317						
C-58	440	2332						
C-59	450	2353						
C-60	460	0002						
C-61	470	0009						
C-62	480	0024				480 - 610'	SILTSTONE: 2.5YR4/6 (red); 10% clay, trace of gypsum 7.5YR7/1 (light gray); non-calcareous, poorly cemented, argillaceous and slightly indurated.	12/19/2010
C-63	490	0033						
C-64	500	0047						
C-65	510	0052						
C-66	520	0108						
C-67	530	0113						
C-68	540	0130						
C-69	550	0138						
C-70	560	0152						
C-71	570	0156						
C-72	580	0211						
C-73	590	0235						
C-74	600	0304	600 - 610' 610 - 670'	Increasingly calcareous.				
C-75	610	0338						
C-76	620	0418						
C-76	630	0445						
C-77	640	0507						
C-78	650	0516		CLAYEY SILTSTONE: 2.5YR4/6 (red); 5% fine sand, minor gypsum, slightly calcareous and slightly indurated.	JNT @ 654' (0518)			

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log (Continuation Sheet)			Form Number: SP 13-4-1 Sheet 4 of 5	
Hole ID: MOS-20		Location: TOWNSHIP 22 - RANGE 31 - SECTION 10				
Logged by: Scott Miles			Date: 02/04/2011			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks
C-79	660	0534	N/A			12/19/2010
C-80	670	0544		670 -	SILTY GYPSUM AND ANHYDRITE: 2.5YR4/4 (red-brown), 10YR3/1 (very dark gray), 7.5YR8/2 (pinkish white); 40% silt, mod. calcareous.	JNT @ 675' (0551)
C-81	680	0614		680 -	SILTY GYPSUM AND ANHYDRITE: 10R7/4 (pale red) to 7.5R8/1 (white), minor 7.5R5/1 (reddish gray); 20% silt, moderately calcareous.	Magenta Fm. from 685'
C-82	690	0632		690 -	As above but with increased dolomitization.	JNT @ 695' (0639)
C-83	700	0655		700 -	DOLOMITIC SILT: 2.5YR4/4 (reddish brown); 60% silt, 2.5YR6/2 (pale red); some minor gypsum, 7.5R6/1 (gray).	710' and 715' have little Magenta, top of A3(?)
C-84	710	0710		710 -	DOLOMITE: As above, less silt, overall color 10R6/4 (pale red), dry = 5YR8/2 (pinkish white); 5% gypsum - 5YR5/1 (gray).	JNT @ 715' (0726)
C-85	720	0739		730 -	GYPSIFEROUS ANHYDRITE: 2.5YR6/2 (pale red); 5% dolomite.	JNT @ 735' (0808)
C-86	730	0759		740 -	GYPSIFEROUS ANHYDRITE: 2.5YR5/1 (reddish gray).	JNT @ 755' (0833)
C-87	740	0816		762'		
C-88	750	0828				
C-89	755					
C-90	762	0915		762 -	GYPSUM: 2.5YR5/1 (reddish gray) to 2.5YR5/4 (reddish-brown); 5% anhydrite 7.5YR6/1 (gray).	JNT @ 775' (0953)
C-91	770	0940		770 -	GYPSUM: 2.5YR6/3 (light reddish brown) to 2.5YR4/2 (weak red), 7.5YR8/2 (pinkish white); 15% anhydrite.	
C-92	783	1020		800'		
C-93	790	1040				POOH @ 795' (1045) to prepare for brine mud. 12/20/2010
C-94	795					
C-95	800	0647		800 -	GYPSUM 2.5YR8/1 (white); blocky, microcrystalline.	
C-96	810	0652		810 -	DOLOMITE 2.5Y7/1 (light reddish gray); with 5% gypsum 7.5R6/1 (gray) and 5% silt/clay 2.5YR4/8 (red).	JNT @ 817' (0659)
C-97	820	0709		830'		
C-98	830	0714		830 -	GYPSIFEROUS ANHYDRITE: 10YR7/2 (light gray); with ~40% silt/clay 2.5YR4/8 (red), trace of dolomite.	JNT @ 830' (0727)
C-99	840	0740		840 -	As above except 10% red silt/clay.	
C-100	850	0753		850 -	DOLOMITE: 10YR6/2 (light brownish gray); massive, microcrystalline.	JNT @ 852' (0802)
C-101	860	0813		880'		
C-102	870	0817				JNT @ 878' (0822)
C-103	880	0832		880 -	CLAYEY SILTSTONE: 2.5YR4/4 (reddish brown); 40% anhydrite and gypsum 7.5YR9.5/1 (white); trace very fine sand.	
C-104	890	0852		890 -	ANHYDRITE AND GYPSUM: 2.5YR7/2 (pale red) to 10YR6/2 (light brownish gray); microcrystalline, some minor silt 2.5YR4/4 (reddish brown).	JNT @ 898' (0908)
C-105	900	0920		910'		

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE		Core/Cuttings Log (Continuation Sheet)				Form Number: SP 13-4-1	
Sandia National Laboratories						Sheet <u>5</u> of <u>5</u>	
Hole ID: <u>MOS-20</u>		Location: <u>TOWNSHIP 22 - RANGE 31 - SECTION 10</u>					
Logged by: <u>Scott Miles</u>				Date: <u>02/04/2011</u>			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks	
C-105	900	0920	N/A			12/20/2010	
C-106	910	0925		910 - 960'	SILTSTONE: 2.5YR3/4 (dark reddish brown); 10% clay, 5% very fine sand, 5% anhydrite/gypsum - 7.5YR9.5/1 (white); non-calcareous.	JNT @ 918' (0932)	
C-107	920	0953				JNT @ 938' (1012)	
C-108	930	1000				JNT @ 958' (1032)	
C-109	940	1019				JNT @ 978' (1056)	
C-110	950	1026				JNT @ 998' (1121)	
C-111	960	1040		960 - 990'	SILTSTONE: 10YR5/1 (gray); 10% clay, 5% very fine sand, moderately well indurated, non-calcareous.	JNT @ 1019' (1140)	
C-112	970	1046				TD @ 1030' (1157)	
C-113	980	1056			50%/50% mix of above and below formations. ANHYDRITE, GYPSUM, AND CRYSTALLINE HALITE: 2.5YR4/6 (red) to 2.5YR3/3 (dark reddish brown), clear to 7.5YR8.5/1 (white); mixed with 10% clayey silt.		
C-114	990	1110		990 - 1000'			
C-115	1000	1127		1000 - 1030'			
C-116	1010	1130					
C-117	1020	1152					
C-118	1030	1157					

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Appendix A

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE Sandia National Laboratories		<h2 style="margin: 0;">Core/Cuttings Log</h2>			Form Number: SP 13-4-1	
Hole ID: <u>MOS-21</u>		Location: <u>TOWNSHIP 22 - RANGE 31 - SECTION 11</u>				
Drill Date: <u>1/1-3/11 4/11</u> Drill Crew: <u>Stewart DMC</u> <u>Brothers' Drilling 5/4/11</u>		Drill Method: <u>Mud Rotary</u> Hole Diameter: <u>5 1/8"</u> Hole Depth: <u>900' BGS</u> Hole Orient: <u>Vertical</u>		Drill Make/Model: <u>N/A</u> Barrel Specs: <u>N/A</u> Drill Fluid: <u>Water-Based/Brine Mud</u> Core Preserv: <u>Cuttings</u>		
Logged by: <u>Scott Miles</u>			Date: <u>02/04/2011</u>		Scale: <u>N/A</u>	
		Northing	Easting		Elevation	
Survey Coordinate: (Ft)		N/A	N/A		3140' AMSL	
Comments: All times are mountain standard time (MST). All depths are below ground surface (BGS). Slight offset from geophysical logs due to cuttings. Color descriptions are moist unless specified as dry. Casing joint = JNT. Pull Out of Hole = POOH.						
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks
C-1	5	1845	N/A	0-10'	FINE TO MEDIUM SAND: 2.5YR4/6 (red); 15% caliche @ 0-5',	(1/1/11)
C-2	10	1930			5% silt, 5% very fine sand, highly calcareous.	
C-3	15	0900		10-15'	As above with 5% clay 2.5YR4/4 (red-brown); very highly calcareous.	(1/2/11)
C-4	20	0930		15-20'	Same as 5-10'.	0-20' = conductor casing
C-5	25	1125		20-25'	SILTY, VERY FINE TO FINE SANDSTONE: 2.5YR4/4 (reddish brown),	(1/3/11-11:25)
C-6	30	1127			dry= 10R6/4 (pale red); 10% clay, 5% medium sand, non-calcareous,	
C-7	35	1129			10% gray staining-reduction spots.	
C-8	40	1131		25-45'	FINE TO MEDIUM SANDSTONE: 2.5YR3/4 (dark reddish brown), dry=	JNT @ 44' (1135)
C-9	45	1150			10YR6/3 (pale red); 10% very fine sand, 5% silt, 5% coarse sand.	
C-10	50	1153		45-50'	As above with increasing medium sand, micaceous.	
C-11	55	1156		50-65'	SILTY CLAYSTONE: 2.5YR4/4 (reddish brown), dry= 2.5YR5/6 (red);	
C-12	60	1200			10% medium sand, 5% coarse sand, non-calcareous, 30% reduction	JNT @ 66' (1206)
C-13	65	1204			spots 2.5YR8/1 (white) decreasing w/ depth, moderately well cemented.	
C-14	70	1218			@ 60': no reduction spots.	
C-15	75	1222		65-70'	FINE TO MEDIUM SANDSTONE: 2.5YR4/4 (reddish brown); 5% silt,	
C-16	80	1224			10% very fine sand, very well cemented, non-calcareous.	
C-17	85	1226		70-85'	SILTY CLAYSTONE: 2.5YR4/6 (red); 10% fine sand, 5% medium sand,	JNT @ 86' (1230)
C-18	90	1242			non-calcareous, moderately well cemented.	
C-19	95	1244		85-115'	VERY FINE TO MEDIUM SANDSTONE: 2.5YR4/4 (reddish brown);	
C-20	100	1246			10% silt, very well cemented, non-calcareous, slightly micaceous.	
C-21	105	1248				JNT @ 106' (1250)
C-22	110	1258		115 -	SILTY CLAYSTONE: 2.5YR4/4 (reddish brown); 5% very fine sand,	
C-23	115	1302		125'	5% medium sand, non-calcareous, very well cemented, moderately	
C-24	120	1305			micaceous.	
C-25	125	1309		125 -	SILTY CLAYSTONE: 2.5YR6/2 (pale red); 10% very fine sand,	
C-26	130	1324		130'	abundant reduction with white-gray coating outside grains, micaceous.	JNT @ 126' (1313)
C-27	135	1327		130 -	SILTY VERY FINE TO FINE SANDSTONE: 2.5YR4/4 (reddish-	
C-28	140	1330		140'	brown); 10% clay, 10% medium sand, micaceous.	
C-29	145	1332		140 -	Same as 125-130'	JNT @ 146' (1335)
C-30	150	1344		150'		

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log (Continuation Sheet)				Form Number: SP 13-4-1	
		Hole ID: <u>MOS-21</u>		Location: <u>TOWNSHIP 22 - RANGE 31 - SECTION 11</u>		Sheet <u>2</u> of <u>4</u>	
Logged by: <u>Scott Miles</u>				Date: <u>02/04/2011</u>			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks	
C-31	155	1346	N/A	150-	SILTY CLAYSTONE: 2.5YR4/6 (dark, reddish-brown); 10% very fine sand, 5% fine sand, very-well cemented, non-calcareous.	1424	
C-32	160	1349		170'		JNT @ 166' (1353)	
C-33	165	1351			CLAYEY SILTSTONE: 2.5YR4/6 (red) to 2.5YR3/3 (dark, reddish brown); 10% very fine sand, trace of gypsum - 7.5YR6/1 (gray); non-calcareous, well indurated, occasional light gray reduction spots. @ 180-190': Color change to 2.5YR4/3 (reddish-brown).	JNT @ 186' (1406)	
C-34	170	1401		170 -			
C-35	175	1402		230'			
C-36	180	1403					
C-37	190	1412					
C-38	200	1417				JNT @ 206' + circulate mud for 4 minutes (1424)	
C-39	210	1430			cuttings finer	JNT @ 226' (1435)	
C-40	220	1434					
C-41	230	1445		230 -	CLAYEY SILTSTONE: 2.5YR3/4 (dark, reddish-brown); 5% very fine sand, trace of gypsum, well-indurated, slightly calcareous.	JNT @ 246' (1455) cuttings few and finer	
C-42	240	1450		270'			
C-43	250	1503			CLAYEY SILTSTONE: 2.5YR4/6 (red); 5% very fine sand, increased gypsum (~3%).	JNT @ 266' (1514)	
C-44	260	1511					
C-45	270	1522		270 -	CLAYEY SILTSTONE: 2.5YR4/6 (red); 5% very fine sand, increased gypsum (~3%).	JNT @ 286' (1530)	
C-46	280	1526		290'			
C-47	290	1540		290-	CLAYEY SILTSTONE: 2.5YR3/4 (dark, reddish-brown), dry = 2.5YR5/6 (red); 5% very fine sand, well-indurated, non-calcareous.	JNT @ 306' (1546)	
C-48	300	1544		340'			
C-49	310	1601			As above, with increased anhydrite and gypsum (~30%); 2.5YR5/2 (weak red); dry = 2.5YR5/4 (reddish-brown); very well cemented.	JNT @ 346' (1644)	
C-50	320	1607					
C-51	330	1635			SILTY CLAYSTONE: 2.5YR3/4, (dark, reddish-brown); ~1% gypsum increases to 3% with depth; well indurated, non-calcareous, gypsum crystals up to 3mm in length observed.	JNT @ 326' (1610)	
C-52	340	1640		340-			
C-53	350	1701		350-	SILTY CLAYSTONE: 2.5YR3/4, (dark, reddish-brown); ~1% gypsum increases to 3% with depth; well indurated, non-calcareous, gypsum crystals up to 3mm in length observed.	JNT @ 346' (1644)	
C-54	360	1710		430'			
C-55	370	1732				JNT @ 366' (1715)	
C-56	380	1743				JNT @ 386' (1747)	
C-57	390	1807					
C-58	400	1816					

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log (Continuation Sheet)			Form Number: SP 13-4-1	
Hole ID: MOS-21		Location: TOWNSHIP 22 - RANGE 31 - SECTION 11				
Logged by: Scott Miles			Date: 02/04/2011			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks
C-59	405 410	1827				1/21/11 Circulate Mud and End of Shift 1/21/11 1/3/11 <i>TMC</i> 5/4/11
C-60	420	0822				
C-61	430	0829		430 - 440'	SILTY CLAYSTONE: 2.5YR4/6 (red); 2% gypsum, well-indurated, non-calcareous.	
C-62	440	0854		440 - 460'	SILTY CLAYSTONE: 2.5YR4/6 (red); 5% gypsum and anhydrite 10R7/1 (light gray); well-indurated, non-calcareous.	JNT @ 431' (0838)
C-63	450	0903				
C-64	460	0939		460 - 480'	SILTY CLAYSTONE: 2.5YR4/6 (red); 2% gypsum, well indurated, non-calcareous.	JNT @ 451' (0908) SBD makes repairs on the mast.
C-65	470	0949				JNT @ 471' (0951)
C-66	480	0959		480 - 580'	SILTY CLAYSTONE: 2.5YR4/6 (red); 1-4% gypsum increasing with depth; clear, platy, well-indurated, non-calcareous, crystals up to 3mm in length, minor dolomite.	JNT @ 491' (1005)
C-67	490	1002				JNT @ 511' (1017)
C-68	500	1011				JNT @ 531' (1030)
C-69	510	1014				JNT @ 551' (1044)
C-70	520	1025				JNT @ 571' (1058)
C-71	530	1028				JNT @ 591' (1111)
C-72	540	1037				JNT @ 611' (1122)
C-73	550	1041				JNT @ 631' (1135)
C-74	560	1052				JNT @ 653' (1148)
C-75	570	1056				
C-76	580	1106		580 - 590'	As above; ~6% gypsum content.	
C-77	590	1109		590 - 690'	SILTY CLAYSTONE: 2.5YR4/6 (red); 5% very fine sand, 1% anhydrite, 1% gypsum, well-indurated, non-calcareous.	
C-78	600	1116				
C-79	610	1121				
C-80	620	1131		620 - 630'	Increased gypsum content to 3%.	
C-81	630	1133				
C-82	640	1143				
C-83	650	1145				

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ACTIVITY/ PROJECT SPECIFIC PROCEDURE <small>Sandia National Laboratories</small>		Core/Cuttings Log (Continuation Sheet)			Form Number: SP 13-4-1	
Hole ID: MOS-21		Location: TOWNSHIP 22 - RANGE 31 - SECTION 11				
Logged by: Scott Miles			Date: 02/04/2011			
Run Number	Depth (ft)	Time (MST)	RQD	Profile (Rock Type)	Description	Remarks
C-84	660	1156	N/A			1/4/11 TMC 5/4/11
C-85	670	1159				
C-86	680	1207			@ 680 - 690': gray (5YR5/1) reduction spots (3%).	JNT @ 673' (1202)
C-87	690	1211		690 - 720'	ANHYDRITE AND GYPSUM: 2.5YR5/2 (pinkish-white) to 10R5/1 (reddish-gray) to 2.5Y8/1 (white); interbedded with very fine, sandy-siltstone, non-calcareous, slightly micaceous.	
C-88	700	1222				
C-89	710	1239				
C-90	720	1300		720 - 730'	SILTSTONE: 2.5YR4/4 (reddish-brown); 10% clay, 10% very fine sand.	JNT @ 713' (1247)
C-91	730	1312		730 - 740'	ANHYDRITE AND GYPSUM: 7.5YR8/1 (white) to 2.5YR5/1 (reddish-gray); microcrystalline.	JNT @ 733' (1314)
C-92	740	1327		740 - 760'	ANHYDRITE AND GYPSUM: 2.5YR8/1 (white) to 2.5YR5/1 (reddish-gray); platy, microcrystalline.	JNT @ 753' (1336)
C-93	750	1334				
C-94	760	1401		760 - 780'	DOLOMITE: 5YR5/1 (gray), dry = 5YR7/1 (light-gray); 5% gypsum, very hard - indurated.	JNT @ 773' (1412)
C-95	770	1410				
C-96	780	1425		780 - 820'	ANHYDRITE: 5YR6/2 (pinkish-gray); dry = 5YR8/1 (white); microcrystalline, blocky, contains minor amounts of gypsum.	JNT @ 793' (1448)
C-97	790	1438				
C-98	800	1534				
C-99	810	1545				
C-100	820	1605		820 - 840'	As above, with increasing gypsum by 5-10%.	JNT @ 833' (1615)
C-101	830	1613				
C-102	840	1624		840 - 850'	DOLOMITE: 5YR5/1 (gray) to 5YR8/1 (white); 5% silt, minor amounts of gypsum with 2mm crystals; trace anhydrite, blocky.	JNT @ 853' (1640)
C-103	850	1631		850 - 860'	SILTY, ANHYDRITE AND GYPSUM: 2.5YR4/4 (reddish-brown); crystals up to 5mm in length, some fibrous gypsum.	
C-104	860	1701		860 - 890'	DOLOMITE: 7.5YR6/3 (light-brown) to 7.5YR6/1 (gray); with minor amounts of clay and gypsum.	JNT @ 874' (1726)
C-105	870	1718				
C-106	880	1749				
C-107	890	1805		890 - 900'	DOLOMITIC SILTS AND CLAYS: 2.5YR3/4 (dark, reddish-brown); mixed with dolomite 7.5YR8.5/2 (pinkish-white) and some minor gypsum 2.5YR4/1 (dark, reddish-gray to white).	JNT @ 894' (1810) TD=900' @ 1833
C-108	900	1833				

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Chain of Custody

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 Appendix A

ACTIVITY/ PROJECT SPECIFIC PROCEDURE		Chain of Custody				Form Number: SP 13-1-1	
Sandia National Laboratories						Page <u>1</u> of <u>1</u> Attach more forms as needed	
1. Initial Sample Custodian		D. Michael Chapin, Jr. <small>Printed Name</small>		Organization: SNL-WIPP		Date: March 7, 2011	
2. Sample Collection or Creation Information		Scientific Notebook ID: WIPP WGS-1			Sample Team Members/Organization:		
Test Plan ID: TP 06-01		Field Log ID: MOS-21 CUTTINGS			D. Michael Chapin Jr./SNL-SSA/06212		
Sample Location: Mosaic #21 Exploration Well: T22-R31-S11		i.e. borehole/core no./lab bldg. no./etc.			enter n/a if none		
3. Sample Identification	Date Collected	Container Type	Volume	Preservative	Analysis Request	Sample Description	
C-1 through C-108	1/1/2011- 4/3/2011 1/4/11 <i>DMC</i> 5/4/11	BAG	VAR.	N/A	MODAL ANALYSES	Mixed Surface, Mesalero Caliche, Gatuna Fm., Santa Rosa Fm., Dewey Lake Fm. and Rustler Fm. sedimentary rock cuttings samples (0' - 900' TD).	
enter n/a if none							
4. Sample Requirements							
Handling: HANDLE W/CARE, USING GEOLOGIC SAMPLE BAGS.							
Storage & Preservation: KEEP DRY.							
Shipping: HAND CARRIED AND TRANSPORTED IN WORK VEHICLE.							
Archive: ALL BAGGED, INTACT SAMPLES WILL BE RETAINED IN PLASTIC CONTAINERS.							
Disposition: NON-HAZARDOUS AND NON-RADIOGENIC CUTTINGS SAMPLES.							
Expiration Date: NONE.							
5. Custody Transfer		Printed Name	Signature	Organization/Company	Date-Time	Sample Condition	
a. Relinquished by:		D. Michael Chapin, Jr.	<i>DMC</i>	SNL-SSA/06212	1/1- 3/2011	4/2011 INTACT	
a. Received by:		D. Michael Chapin, Jr.	<i>DMC</i>	SNL-SSA/06212	1/1- 3/2011	4/2011 INTACT	
b. Relinquished by:						<i>DMC 5/4/11</i>	
b. Received by:							
c. Relinquished by:							
c. Received by:							
Upon sample receipt, note condition. This form (copy for your records) shall follow samples through its life, until final disposition, then send original to WIPP Records Center. For samples that are potentially hazardous & require packaging and shipping, contact Center 6700 ES&H Coordinator or see SNL ES&H Manual, Chpt. 12.							

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WGS-1 EXECUTIVE SUMMARY

Within this Scientific Notebook (SN), entitled WIPP Geologic Samples-1 (WGS-1), we have documented the successful drilling of two (2) Mosaic Potash, Inc., exploratory wells by Stewart Brothers' Drilling of Farmington/Gallup, NM. SNL geologic workers included Dennis W. Powers, Scott A. Miles and D. Michael Chapin, Jr. Daniel Curnutt of Mosaic Potash, Inc., was the mining engineer in charge for both exploratory wells. Exploratory well Mosaic #20 was drilled between December 16-20, 2010, and geologic cuttings samples were collected by SNL to a depth of 1030' (BGS). The second exploratory well, Mosaic #21, was drilled between January 1-4, 2011, and geologic cuttings samples were collected to a depth of 900' (BGS). Geologic cuttings samples were collected at 5' or 10' intervals depending upon the drilling rate and at the discretion of the onsite SNL geologist. On January 5, 2011, Colog, Inc., of Lakewood, CO, logged exploratory well Mosaic #21 and provided SNL with a Natural Gamma Compensated Density 1-Arm Caliper Log (SNL Records ERMS 555112) and a Natural gamma Normal Resistivity 3-Arm Caliper Log (SNL Records ERMS 555113). Geologic cuttings samples of Mosaic #20 and Mosaic #21 were subsequently delivered to the SNL lab, dried indoors, and then laid out sequentially (by depth) on lab benches. The geologic cuttings were then inspected, and a descriptive cuttings log was developed. Results of this geologic cuttings inspection are recorded within this scientific notebook. The geologic cuttings samples of Mosaic #20 and Mosaic #21 have been saved, stored within plastic boxes, individually stored in nylon geologic sample bags, for the purpose of future inspection, if needed.

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This document was inserted into Scientific Notebook WIPP WGS-1, on pg. 35, 03/10/2011.

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WGS-1 CLOSE-OUT STATEMENT

WIPP WGS-1 , the WIPP Geologic Samples Scientific Notebook No. 1 is closed, and contains no further scientific or technical entries. This Scientific Notebook (WIPP WGS-1) was opened on November 15, 2010, and the final scientific entry, sans Technical and/or Q/A corrections, was made on March 10, 2011.

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Document inserted on page 36 of Scientific Notebook WIPP-WGS-1 on 05/09/2011. *DWC*

A Technical Review of pages 1-35 in Scientific Notebook WIPP-WGS-1 was completed on 04/30/2011.
All comments have been resolved and are documented on a DRC.

Dennis W. Powers 05/09/2011

Dennis W Powers

A QA review for pages 1-35 was completed on 5-4-11. All comments + resolution are documented on a DRC.

Shelly R. Nielsen

Shelly R Nielsen 5-10-11

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5/10/11*

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