REPORT

for the
Meetings of the

API SUBCOMMITTEE ON DRILLING FLUID MATERIALS (SC13)

at the
2001 Standardization Conference
of the
Upstream Department
American Petroleum Institute

Hyatt Regency Hotel
Calgary, Alberta, Canada
June 25 – 29, 2001

C.L. Stark, Chair
S.C. Polnaszek, Vice-Chair
R.G. Bland, Secretary

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The following meetings are scheduled during the conference:

1. **Work Group on Polymer Testing (TG4/WG1)**
   - Monday, June 25, 2001
   - 8:30AM – 11:00AM
   - Tom Sifferman, Chair

2. **Work Group on Oil Mud/Elastomer Compatibility (TG3/WG2)**
   - Monday, June 25, 2001
   - 11:00AM – 12:00 Noon
   - Bill Reid, Chair

3. **Work Group on Oil Mud Chemical Analysis (TG3/WG1)**
   - Monday, June 25, 2001
   - 1:00PM – 3:00PM
   - Marty Smith, Chair

4. **Task Group on Revision of RP 13D (TG7)**
   - Monday, June 25, 2001
   - 3:00PM – 5:00PM
   - Keith Morton, Chair

5. **Task Group on Testing of Drilling Fluids (TG 4)**
   - Tuesday, June 26, 2001
   - 8:00AM – 10:00AM
   - J.C. Estes, Chair

6. **Task Group on Oil Mud Testing Procedures (TG 3)**
   - Tuesday, June 26, 2001
   - 10:00AM – 12:00 Noon
   - Ron G. Bland, Chair

7. **Task Group on Publications (TG 2)**
   - Tuesday, June 26, 2001
   - 1:00PM – 3:00PM
   - Ryen Caenn, Chair

8. **Work Group on Iron Contamination (TG6/WG1)**
   - Tuesday, June 26, 2001
   - 3:00PM – 4:00PM
   - Mike Freeman, Chair

   - Tuesday, June 26, 2001
   - 4:00PM – 5:00 PM
   - Paul Javora, Chair

10. **Subcommittee on Drilling Fluid Materials (SC 13)**
   - Wednesday, June 27, 2001
   - 8:30AM – 12:00 Noon
   - C. L. Stark, Chair
The meeting began with the presentation of Citation of Service Awards to Cheryl Stark and Ron Bland by James A. Heimer, Chair of API Upstream Executive Committee.

1. Call To Order

Cheryl Stark called the meeting to order. Cheryl followed with an acknowledgment of the service companies for hosting the cocktail party the previous evening at the Villa Firenza Italian restaurant and in particular MI Drilling Fluids L.L.C. for organizing it. Cheryl pointed out that a good time was had by all. Cheryl also reminded members to contact Del Son if interested in organizing the winter meeting cocktail party in Albuquerque. Cheryl also acknowledged Baker Hughes INTEQ Drilling Fluids and Cameron, Cooper Cameron Corporation for sponsoring coffee/refreshment breaks, Hunting Oilfield Services for sponsoring lanyards and badgeholders, Prudential Steel Ltd. & Maverick Tube for the welcome reception and Shell Exploration & Production Company for sponsoring Tuesday’s General Session breakfast. A sign-in sheet was circulated and is included (see Appendix A for all sign up sheets). A roll call of voting members revealed 18 of 25 members were present, which made a quorum.

2. Review and Approve Previous Meeting Minutes

Ron asked if the 2001 Winter Meeting minutes as mailed out in the agenda were acceptable as written. The consensus of the SC was yes, Del Son so moved, Tom Shumate seconded, and the motion carried unanimously.

3. New Work Item (NWI) Proposals & Prioritization

There were no new NWIs.

4. Research Projects

There are no research projects currently funded, Cheryl noted that the 2002 API Research budget had just been settled and asked for new proposals for 2003.

5. Task Group Reports

A. International TG1, David Brankling, Chair

Mario Ferrari reported for David who could not attend. Minutes to TG1’s September, 2000, meeting were included in the SC13 minutes to the 2/13/2001 SC13 meeting previously distributed to SC members. Mario reported that a NWI had been drafted on methods to measure the particle size distribution (PSD) of barite. A NWI on lubricity had been submitted but little work has been done to date and Mario didn’t know if it would proceed. A NWI was submitted on wellbore cleaning and will be discussed at the next meeting. There was considerable discussion of Mario’s proposal that a strong need exists to detect starch
in PAC & CMC as many samples are adulterated (NW1 SC1301-3 Attached). This was introduced in the TG4 meeting on Monday and discussed at length there as well. Tim Wilkin noted that an Australian company submitted a laser-light scattering proposal a few years ago to measure barite PSD, but it was declined due to restraint of trade concerns. Tim suggested inviting the company to address the SC to resubmit their proposal.

Cheryl reviewed the previous timeline for WGs in TG1 and Mario indicated they would slip by 12 months.

B. Publications TG2, Ryen Caenn, Chair

Tim Wilkin reporting for Ryen. Tim held a TG meeting yesterday and distributed copies of Annexes D & F for ISO 13500 (RP13A) which are included in the TG2 Minutes Attachment. Annex D deals with packaging which moves auditable Section 6 into the Annex that is not auditable and is there for information purposes only. “Shalls” are converted into “mays”. Annex F deals with revision to technical specifications to the sieve calibration procedure to eliminate the proprietary sieves needed for calibration. Tim is proposing to remove the existing procedure and insert a procedure used in a previous RP but using an ASTM E161 screen instead of the previously recommended E11 screen. The E161 is a little more delicate but much more precise than the E11 screen. Some additional details needed to be worked out but should see a letter ballot in a few months.

API RP13K on chemical analysis of barite is up for review. Tim asked for comments from analytical labs at the last meeting. Tim recommended that a WG look into updating the document to include new technology as alternative techniques and believes a draft could be written by next February. Tim has two tentative WG members and is looking for others.

The Formation Damage Report was circulated for comment, as were the Guidelines for Mud Engineers; but Tim is not aware of any comments received. All SC13 members have a copy of the Guidelines for Mud Engineers and Cheryl asked when we would see a ballot item. Tim noted he had some more work to do. Cheryl mentioned that Tim was on track for a 13500 revision for June 2002. The Technical Report on Formation Damage is due to be voted on by February 2002, which appears to be on track.

C. Oil Mud Testing Procedures (TG 3), Ron Bland, Chair

TG3 has two active work groups.

The Oil-Based Mud/Elastomer Compatibility Testing WG chaired by Bill Reid has agreed upon standardized testing procedures, two standardized elastomers, two testing temperatures, and two testing fluids—one aggressive and one non-aggressive. Bill has not completed a Letter Ballot item, but no additional laboratory testing is anticipated. The Chair will inform Bill to prepare the draft and submit it to SC13 by the winter meeting.

The Oil Mud Chemical Analysis WG chaired by Marty Smith submitted two letter ballot items to SC13 last summer. Both passed Letter Ballot unanimously with only one technical comment by Steve Hennigan, who questioned the gas for charging the cells. The WG has recommended not using carbon dioxide as an air source. The TG will submit this by July 01 for publication as a Supplement to RP 13B-2. Other issues were determined to be open and will be addressed in the work group. These issues included problems with the alkalinity test, no problem with chloride testing, and several other small issues.

D. Testing of Drilling Fluids (TG4), Jack Estes Chair

Jack reported that a draft ballot item on heat aging of polymer muds was circulated to SC13 and moved to accept it as a ballot item. Steve Polnaszek seconded and the motion carried unanimously. Several items
were discussed in the TG4 meeting on Monday. Marvin Pless suggested a NWI on improving the accuracy of water determination in OBM but will wait to see if the Retort WG successfully addresses this need. Larry Mitchell reported the wide variation in temperatures of retorts his company has checked. Jack noted that there is a discrepancy between specific gravity of hematinites being used in volume calculations and API specifications. Mario Ferrari brought up adulteration of CMC and PAC, and Dodie Ezzat reported that high levels of salt were detected in some samples of CMC. Primary sources of these off-spec materials are smaller local distributors. There are no API specifications for pure grade CMCs where salt levels are typically limited. Dodie had also mentioned problems with xanthan gum for which no specifications and insufficient test procedures exist. Dodie mentioned that Aramco’s specifications and procedures were public, and he would submit a copy to be included in the minutes. Jack also clarified the responsibilities of API for API Logo products vs. non-API Logo products. Cheryl reviewed the timeline for Jack’s WGs. Retort WG ballot item due June ’04 and HPHT Thermocouple WG ballot item due by June, 2003.

E. Solids Control Equipment (TG5), Chaired by Leon Robinson

TG5 had hoped to make minor modifications to RP 13C and RP13E and to incorporate them into a single document reflecting current solids control practices and methods of evaluation, but the reality turned out that major revision was required. RP13E addressed screen characterization using a procedure Amoco developed. TG5 has completed a first draft of changes, additions, and deletions to definitions in Article 2. MMS/EPA is now requiring gravimetric measurements on offshore rigs, and Leon asked if anyone in SC13 has a pycnometer method for determining drilled solids in OBM. Leon reported that the current WBM procedure uses a pressure balance, and Leon was concerned that the pressure might change the density of oil and thereby change results. Keith Morton asked what kind of pycnometer was being considered, and Leon reported that they cut the beam off a Haliburton pressurized mud balance and used the mud chamber. Leon submitted a copy of the WBM procedure to be circulated to SC13 (Attached with TG5 minutes). Leon also asked if the API intended to include a procedure in 13B. TG5 is also working on Article 7, “Practical Operation Guidelines,” which they have edited and separated into Design and Operating sections. 13E, Article 1, addresses screen labeling; and ISO doesn’t recognize “mesh,” so the merged document will include “mesh” as an alternate designation. TG5’s primary screen designation procedure will use a ROTAP test with a progressive stack of standard ASTM screens with a test screen in-between (A, B, Test Screen, C and D). The test screen is moved up or down in the stack until the test screen separates ≥70% of the sand size between screens B&C and <70% between B&C when test screen is positioned above the next finer screen. The test screen will then be rated as sieve C. TG5 prefers dry screening but will have to use a wet method for ≥200-250 mesh. This procedure eliminates optical procedures that are not as practical. Article 3 of 13E addresses conductance issues that TG5 wants to include. The existing procedure requires sub-psi pressure drop measurements in an isothermal bath. TG5 is working on a technique to measure the time to flow standard oil through the screen similar to a Marsh funnel. One member company is trying to keep a constant velocity across the screen with oil on both sides and will compare both approaches. The next meeting is scheduled for August 9, 2001, at Derrick Equipment. Proceeds from the AADE conference will be used to fund the following meeting scheduled for September 10, 2001, at South Padre Island. Leon asked if they could solicit funds from member companies for testing. Cheryl noted that the earliest year API Research funds would be available would be 2003.

Leon disclosed that TG5 would try to follow ISO guidelines in drafting their final document as they only wanted to do this work on documents once in the foreseeable future. Leon also noted their website www.AADE-WM.com has a discussion on waste management that has relevance to solids control.

Cheryl inquired about likely dates for ballot items and Leon believed that it would take a while before they reach that milestone. Cheryl noted that any document that takes longer than seven years will be automatically dropped.
F. Testing of Heavy Brines (TG6), Chaired by Steve Hennigan

Paul Javora reported for Steve Hennigan who was absent. The TG met the previous day. Round robin testing was conducted on pH procedures for incorporation into 13J. The best results were with a 1:1 dilution with followed by results with neat brine. The worst results were obtained with a solid state ion selective field effect transistor probe. The procedure has been reviewed and edited, and a revised draft circulated for comments by July 22nd. The WG will meet again on July 27th and will also collect information on buffering. The Iron WG sent out a report form and a second set of iron samples, and Mike Freeman is collecting results. The Iron WG should have a report by the winter meeting. Most probable delivery dates for Ballot Items have been pushed back 1 year.

G. Revision of RP 13D – Hydraulics and Rheology (TG7), Chaired by Keith Morton

Keith Morton reported that TG7 had held two TG meetings to date. Keith has seen a good correlation between the University of Tulsa measurements on fluid flow in pipe and annuli during laminar flow but has not seen as good a correlation in annuli during turbulent or transitional flow. TG7 is incorporating corrections (typos) to the existing document and is working with equipment manufacturers to update the equipment section. TG7 is on schedule for a letter ballot item.

6. 5-Year Publication Review (reaffirm or withdraw or request 2-year extension to update)

Cheryl noted that RP13C, 13E, 13J and 13K are up for review and suggested that we reaffirm. No one objected.

7. Old Business

a. Calibration materials.
   Tim Wilkin said that all WG members have samples of barite and bentonite, barite analysis results are due by September 20th, and bentonite results due by October 5th.

b. Letter from Max Duncan of Integrity Industries
   Ron Bland stated that he had offered to allow Integrity Industries to present their data documenting the influence of heat-up phase pressure on oil mud HPHT FL during the TG3 meeting, but they declined. Ron extended the invitation one more time for the 2002 winter meeting.

8. New Business

a. Marty Smith asked about reviving 13A to look at specs for additional products. Cheryl mentioned that there were procedures missing, and that a revision would be the best place to start.

b. Leon Robinson received an e-mail on viscoelastic properties of completion fluids. Keith Morton had received it also, but no one knew which SC it came from. Leon will try to find it and submit a copy to SC13.

9. Adjournment

Cheryl asked for a motion to adjourn, Del Son so moved, Tom Shumate seconded, and the motion passed unanimously.
**API Exploration & Production (E&P) Standards Committee**  
**NEW WORK ITEM (NWI) PROPOSAL FORM**

Type or legibly print all information requested on the form. Failure to provide all information requested may result in rejection or delayed consideration. Submit the form to the applicable API standards subcommittee if known, or to: API E&P Department, 1220 L Street, NW, Washington, DC 20005.

Consult Subcommittee Chair, Secretary or API Staff if uncertain of information for this block.

- **NWI Proposal Number:** SC1301-3 (unique identifying number); **API Subcommittee:** 13; **API Committee:** 3
- **Category of Standard:** A, API/ISO X; B, ISO only; C, API only (Ref. API S1, ¶ 5.2.1.4)
- **Sales History:** (API staff enter sales data for affected or similar API standard as indication of industry usage.)

<table>
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<tr>
<th>Related ISO Standard Number, Title and Date:</th>
<th>ISO10416 / API 13I</th>
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  - Is the proposed work on ISO work plan? _NO_ 
  - Is ISO project active? _X_ 
  - ISO SC and WG number:

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<th>ISO Stage Number</th>
<th>ISO Project Leader</th>
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### Title of Proposal: QUALITATIVE STARCH DETERMINATION IN WATER SOLUBLE POLYMERS

- **Affected API Standard:** New Standard? _X_ 
  - Revision? _X_ (If a revision, fully identify current standard.)

| Title: 
| Edition: 
| Effective Date: 
| Date & Number of Supplement(s): |

### Relationship to any other standards:

- **a.** List related or existing API, ISO or other SDO’s standard: NONE KNOWN
- **b.** Identify and justify any potential duplication of this work with above standards: NO DUPLICATION

### Work Description and Justification: (Describe scope of new standard or specific revisions proposed for an existing standard. Justify this work by identifying its value to industry. Be specific; use attachment if needed.)

SEE LETTER ATTACHED

THE “QUALITATIVE STARCH DETERMINATION IN WATER SOLUBLE POLYMERS” ONCE APPROVED AS RECOMMENDED PRACTICE, CAN BE REFERENCED IN:

- API SPECIFICATION 13A SECTION 9 AND 10 (ISO 13500 § 14 & 15) for CMC-LVT and CMC-HVT
- API RECOMMENDED PRACTICE 13I § 22 & 23 (ISO 10416 § 23 & 24) for PAC-HV and PAC-LV

### Proposed Project Leader: (Include: Name, Company, Mailing and Street (if different) Address, Telephone, FAX numbers (with country dialing code) and qualification to lead this work. This person will be accountable for the quality and timeliness of the work.) NOTED: Committees cannot consider NWI proposals unless this section is complete.

MARIO FERRARI
LAMBERTI SPA, VIA MARSALA 38, 21013 GALLARATE, ITALY, TEL: +39 0331 715857, FAX: +39 0331 715880,

FORMER CHAIRMAN OF THE API WG ON CMC THAT LED TO THE PUBLICATIONS OF THE API 13A SECTION 9 AND 10.
Resource Requirements:

a. Number of task group or work group members needed: 5-8 (must include at least two user participants)

b. Names of volunteers for this work (attach roster if proposing assignment to an existing task group or work group):

FEW POSITIVE ANSWERS HAVE BEEN ALREADY RECEIVED. GROUP WILL BE DEFINED DURING THE NEXT API SUBCOMMITTEE 13 INTERNATIONAL TASK GROUP MEETING IN OCTOBER.
OTHER REPLIES WITH WILLINGNESS TO JOIN THE GROUP WILL BE HOPEFULLY RECEIVED AFTER THE MEETING IN CALGARY.

c. Expected number of meetings 2-3

d. Total member meeting days (a times c) 10-24

e. Describe any unusual resource requirements: NONE KNOWN

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<th>Milestone Target Dates</th>
<th>Date</th>
<th>Comments</th>
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<td>Assumed start date (After approved and assigned to Work Group (WG) or Task Group (TG))</td>
<td>OCT. 2001</td>
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<tr>
<td>Working Draft agreed by TG to proceed to Subcommittee (SC) (ISO Stage 20.99)</td>
<td>OCT. 2002</td>
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<td>Draft approved by SC for formal ballot (ISO Stage 30.99)</td>
<td>FEB. 2003</td>
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<tr>
<td>Publication of Standard (ISO Stage 60.60)</td>
<td>FEB. 2004</td>
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Indicate significance to this proposal of following considerations by entering numerical ratings as follows: 1 = Very Low/No; 2 = Low; 3 = Medium; 4 = High; 5 = Very High/Yes. Provide a brief explanation in the space provided.

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<td>Particular Environmental, Safety, and/or Health aspects? (If YES, state what)</td>
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<td>Document affects user’s Capital Expenditures? (If YES, provide supporting information)</td>
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<td>Document affects user’s Operating Expenditures? (If YES, provide supporting information)</td>
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<td>Is there widespread industry need for document? (If YES, provide supporting information)</td>
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<td>Is the applicable knowledge developed and available for this work? (If YES, state where)</td>
<td>5</td>
<td>THE TEST IS ALREADY PERFORMED BY THE INDUSTRY</td>
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Total Rating 13

Is the equipment, process or design considered non-proprietary (not patented)? Yes X No

Proposal submitted by:
Name: MARIO FERRARI  Company: LAMBERTI SPA
Phone Number: +39 0331 715857  Date Submitted: 3th JULY 2001

Submitted on behalf of:
(If applicable, identify above the sponsoring API, ISO or other work group, task group, etc.)
To: addressee as per the attached list

15th June 2001

API Specification 13A for Technical Grade High Viscosity CMC (CMC-HVT) and Technical Grade Low Viscosity CMC (CMC-LVT)

Dear Sirs,

I am writing with regards to one of the key issues that were raised during the last API SUB-COMMITTEE 13 - INTERNATIONAL TASK GROUP held at Malpensa on 6th April 2001.

The issue in question is related to the existing API Specification 13A for Technical Grade High Viscosity CMC (CMC-HVT) and Technical Grade Low Viscosity CMC (CMC-LVT), where it is felt that there is a need for an improved definition.

The following is the product description for CMC-HVT (similar description is for CMC-LVT) on Spec 13A, Section 10:

10.1 Description
"a. Technical-grade high-viscosity carboxymethylcellulose (CMC-HVT) (an alkali metal salt of carboxymethylcellulose) is cellulose that is modified chemically to obtain a water-soluble polymer............"

Comments were made that whilst the existing API Specifications 13A are already widely accepted for Technical Grade CMC, there are some interpretations of the specification that can lead to quality issues and field problems.

Despite the fact that the statement on the nature of the product is very clear, and that it refers only to CMC, there are several cases of misuse of the specifications. Some examples can be found in the appendix attached, where it is clear that a blend of CMC and low cost starch has been provided, yet the product is being offered as a CMC.
The key issue is not whether these blends, or starches are suitable under certain drilling conditions, but the fact that if a CMC is requested, the final user should be assured that it is CMC that he receives, and not something else.

The proposal to avoid this problem is to consider the attached "Qualitative Starch Determination in Water Soluble Polymers Method" as part of the specification. A further improvement is the addition of the Degree of Etherification and Moisture as per the attached flow chart.

Also in the RP13I for High Viscosity (Regular) Polyanionic Cellulose (PAC HV) and Low Viscosity (Lovis) Polyanionic Cellulose (PAC LV) the product description is very clear (see section 22.1 and 23.1) and blended material should not be tested as PAC.

The purpose of this letter is to:

✔ Verify your interest in having the above Specification/Recommended Practice improved/upgraded.
✔ Receive comments on the above considerations and proposals
✔ Assess your interest in joining a work group which objective is the improvement of the existing CMC Specifications and RP for PAC's.

Your feedback will be greatly appreciated, and I look forward to hearing from you soon.

Best regards.

Mario Ferrari

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Tim Wilkin, Acting Chair (for Ryen Caenn)

1. Tim Wilkin asked who the members of the Task Group were; three of the seven were present.
2. Tim read the minutes from the Winter meeting and asked and got approval by acclamation.
3. Discussion Items:
   a. Formation Damage Report*
   b. Guidelines for Mud Engineers*
   c. Formation Damage Report*
   d. 13K revision
   e. Tim read some of Mark Churan’s comments on 13K revision (see Attachment, MCMemo62001)

*No update on this topic was received by Tim Wilkin from Ryen Caenn for the meeting.

Tim suggested that some of the service companies may volunteer to review the 13K document. Volunteers thus far included Tom Shumate (Baroid), Tim Wilkin (M-I), and Del Son (Champion Technologies).

f. Annex D is an informative draft on packaged material which describes, in detail, packaging, containers, and shrink wrapping. Too many auditable possibilities, to which many manufacturers objected, were present when this was within the body of Spec 13A. Tim made the information an annex so that the section becomes non-auditable. A copy is attached (APID). Tim asked that comments on the document be sent to him by email.

g. Annex F is informative; Tim pointed out a major technical flaw in 13A that is addressed in Annex F. Annex F addresses the problem with sieve testing of the weighting materials.

Tim discussed ASTM E11 which measures rectangular openings in the sieve and is reported as an average value. It has been determined to be inadequate for the 75 µm and 45 µm sieves used in determining residues retained by these screen sizes for several products contained in the standard. 13A specifies “certified centerline value sieve”, the term “centerline” is a registered trademark of a sieve manufacturer and is not defined by the standard. ASTM E161, an alternative sieve standard, has been determined to be more suitable.

In Annex F, replace the existing procedures for 45 µm and 75 µm sieves with an ASTM E161 sieve. For residues greater than 75 µm, the values are calculated. Tim mentioned that the 14th edition does not specify the sieve.

E161 sieve costs from $200-250, so extra expenses will be incurred. Electroformed ASTM E161 sieve openings are ±2 µm. Tim said that he still has to replace the wording in ISO 13500 to reflect this.

Discussion:
   Wayne Stewart asked what the Electroformed E161 is. Electroforming is a process where the machine puts precise holes in sieves. There are several manufacturers, Gilson being one.

   Cheryl Stark asked if Annex F informative or normative. Tim said that the steering committee did not specify, but he thinks it is more informative.
Annex E is informative for API, a monogram issue. F is informative.

Tim would like to bring it to the subcommittee for review. It will be an e-mail ballot item.

Tim mentioned that the most frequent complaint about barite is the portion which is retained with the 75-µm sieve. It is better to write a more rigorous standard; the cost of the extra sieves is not much.

There are no specs in 13A for sieves used for CMC and other materials with particles much larger than 75 microns (µm).

Wayne Stewart asked who ultimately benefits from the extra cost of the sieves, and Tim replied that both suppliers and end users would benefit.

Cheryl asked if there are sufficient copies of the Annexes for tomorrow’s meeting. Tim has 40 copies and asked attendees to please review them for comments in tomorrow’s meeting.

4. Old Business: Guidelines for Mud Engineers. Steve Polnaszek has a copy and Cheryl Stark will have copies made. Steve said that interest has not been great. Only Ryen Caenn and Tom Carter have shown much enthusiasm in moving this issue forward and neither one is here to speak on behalf of the proposed guidelines.

5. New Business: ISO report, which will be done tomorrow. Cheryl asked about the certified center line sieve designation issue was coming along. Tim said that this technical point and the new document are tied together.

6. Action Items:
   a. Re-adoption of ISO 13500 as 13A
   b. Single point pH calibration

   Tim mentioned that the problem with converting an API document to an ISO document is that changes continue to occur in the API document. The Cement Group (SC10) solved the problem by making the API work group automatically ISO work group members. Tim will propose to the Steering Committee that this be adopted in Subcommittee 13.

   ISO 10416 is almost ready, probably by August (see attachment SC13DOC).

7. Steve Polnaszek made a motion for adjournment, Wayne Stewart seconded, and the meeting was adjourned without opposition at 2:10 p.m.

Minutes Taken by: A. J. Son
6/26/01
## Sub-Committee 13 Documents

<table>
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<th>NUMBER</th>
<th>TITLE</th>
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<tr>
<td>13B-1/ISO10414-1</td>
<td>Recommended Practice Standard Procedure for Field Testing Water-Based Drilling Fluids</td>
<td>1997</td>
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<td>13C/ISO13501</td>
<td>Recommended Practice for Drilling Fluid Processing System Evaluation</td>
<td>1996, in revision</td>
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<td>Recommended Practice on the Rheology and Hydraulics of Oil-Well Drilling Fluids</td>
<td>1995, in revision</td>
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<td>13E</td>
<td>Recommended Practice for Shale Shaker Screen Cloth Designation</td>
<td>To be included in 13C</td>
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<tr>
<td>13I/ISO10416</td>
<td>Recommended Practice Standard Procedure for Laboratory Testing Drilling Fluids</td>
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<tr>
<td>13J/ISO13503</td>
<td>Testing of Heavy Brines</td>
<td>1996, in revision</td>
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<tr>
<td>13K</td>
<td>Recommended Practice for Chemical Analysis of Barite</td>
<td>1996, now due</td>
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</table>
The following comments and suggestions are what I found in the API RP 13K Second Edition:

**Contents:**

- Might want to consider additon of:
  a. Caustic Soluble Carbonates and Sulfides
  b. Bentonite Contamination – Cation Exchange Capacity Test For
  c. Determination of Floatation Agent, if present
  d. Greasing of Barite – Causes
  e. Cadmium and Mercury analyses for Offshore Gulf of Mexico Discharge
  f. Other Heavy Metals, RCRA – Ag, As, Cr, Se (in addition to Cd, Pb, and Hg)
  g. Other Environmental Metals – B, V, Ni (in addition to RCRA and Cu, Ni, Zn).
  h. Total Heavy Metals versus TCLP

**3.1 General Description:**

Need to consider adding ICP (Inductive Coupled Plasma) as an alternative to Atomic Absorption (AA). AA is used in many of these tests and the sections that describe test methods.

**3.2 Barium Sulfate and Strontium Sulfate:**

This section is OK, but we do not use because it is very time consuming. This is probably the most accurate method for barium and strontium determinations.

**3.3 Silica and Alumina:**

We have used this several times, but have substituted using AA for the color metric determinations in sections 3.3.4. and 3.3.5.. In order to use AA we need to keep final dilution to 500 mL in Section 3.3.3.8.

**3.4 Hydrochloric Acid Soluble Metals:**
This section is OK, we used up to 5.0 grams of sample to get lower detection limits for some element (mostly Pb).

3.5 Hydrofluoric, Sulfuric, Nitric, Perchloric Acid Soluble Metals:
We have not used this.

3.6 Alternative Methods for Iron:
We have not used these. Have used Aqua Regia Digestion in beaker for pyrite.

3.7 Water Soluble Materials in Barite:
This section is OK.

3.8 Water-Soluble Chlorides:
Section 3.8.3.1 – "Pipette one or more cm³ of filtrate........." (from where – since this is a new section should refer back to filtrate prepared in Section 3.7.3.6.
We would use ion chromatography for low level chlorides.

3.9 Water-Soluble Sulfates:
We use ion chromatography for sulfates. Section 3.9.3.2.1 “Pipette 15 cm³ of sample (barite water leachate) .......” From where – refer back to Section 3.7.3.6.

3.10 Water-Soluble Carbonates, Bicarbonates, and Hydroxyl Ions:
This section is OK.

3.11 Water-Soluble Phosphates:
OK, We use Ion Chromatography for ortho phosphate. For total inorganic phosphates we use sulfuric acid treatment in Section 3.11.3.1.2, then ion chromatography.

3.12 Loss On Ignition:
OK

3.13 Siderite Content:
We have not used this.

3.14 Zinc Carbonate and Lead Carbonate:
OK. Instead of acid sometimes caustic soluble zinc and lead is an indication of high viscosity problem in mud.

3.15 Total Carbonate
Why this and not Garrett Gas Train and Dräger Tube for Carbonates?

3.16 Acid-Soluble Sulfides:
Need to insert Errata for Table 2 and calculation changes for “newer” Sulfide Dräger Tubes.

3.17 Calcium Hydroxide (Lime) or Cement:
This section is OK. High levels of cement or lime can be confirmed by X-ray Diffraction.

4 X-ray Fluorescence Analysis
We use the Pressed Powder Method (Section 4.3.5.1) for our samples. Have tried Fusion and Glass Disc, but very time consuming.

Regards,
Marc Churan
Section 2 – Complete listing and status of projects

<table>
<thead>
<tr>
<th>ISO no.</th>
<th>Title</th>
<th>Actual stages</th>
<th>Proposed new targets</th>
<th>WG/PL</th>
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<tr>
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<td>Field testing of drilling and completion fluids. Part 1: Water-based fluids</td>
<td>DIS: 99/02</td>
<td>FDIS: 00/11 ISO: 01/04</td>
<td>WG1/ B. Van Der Linden</td>
<td>ISO 10414-1 published 2001-03-15.</td>
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<td>10414-2</td>
<td>Field testing of drilling fluids. Part 2: Oil-based fluids</td>
<td>DIS: 99/10</td>
<td>FDIS: 00/11 ISO: 01/04</td>
<td>WG1/ Bart Van Der Linden</td>
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<td>10416</td>
<td>Drilling fluids. Laboratory testing</td>
<td>-</td>
<td>DIS: 00/10 FDIS: 01/12 ISO: 02/05</td>
<td>WG1/T. Wilkin</td>
<td>DIS voting terminates 2001-08-29.</td>
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<td>13501</td>
<td>Drilling fluid processing systems evaluation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>FROZEN, API SC13 TG 5 draft document available 2001-03-01</td>
</tr>
</tbody>
</table>

Section 3 – Specific areas of concern

3a Resource needs
WG1 has ongoing needs for active members with experience in drilling fluid chemistry, laboratory testing, field application and processing. Current projects include technical review and editing of documents in all of the above areas, and as these projects are completed new work items will be proposed in these and other areas related to drilling fluids products and services.

3b Need for Project Leaders
I will nominate Dr. Leon Robinson, who has acted as API SC13 TG5 work group leader for the revision of API RP 13C and RP 13E, as WG1 work group leader when a NWI is submitted to ISO.

3c Other concerns and reasons for delays, if any

3d Progress made since last meeting


Notification of DIS vote with no negative comments on ISO WD 10414-2 was received 2000-03-12 from SC3 Secretary. ISO DIS 10414-2 has undergone technical review by WG1 under the direction of Bart Van Der Linden in Los Angeles, and has been transferred to Neil Reeve for editorial comment and corrections prior to submitting to the Central Secretariat for FDIS vote.

DIS 10416 now has been circulated for voting. Voting terminates on 2001-08-29.

4b Date and location of future meetings

A brief WG1 meeting will take place at the API Summer Standardization Conference in Calgary, Alberta, Canada on June 25th from 8:00am-12:00 to discuss status of editorial revision of ISO DIS 10414-2, and to review status of API TG 5 in preparing a NWI (previously listed as 13501) for consideration by WG1.

I realize that this notification arrives too late for those not already planning to attend the API meeting in Calgary, but the need to convene a meeting of all WG1 members was not necessary in this case.


Roster includes new members added since the June 2000 WG1 meeting in Los Angeles.

Yours sincerely,

Timothy V. Wilkin
Convenor, WG1

WG1 Status report 2001-06-15.doc
## JAN 2000 – MAR 2002 PLAN

### REVISED 2001-06-15

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### KEY:
- **FROZEN**: Freezing
- **FDIS**: FDIS
- **ED COM**: ED COM
- **PUBLISH**: Publish
- **DIS**: DIS
Annex D
(Informative)

Clause 6 has been editorially revised to make the instructions informative rather than normative. The following wording replaces the entire text of ISO 13500 clause 6:

6 Packaged materials

6.1 Description

6.1.1 Packaging of palletized goods should safeguard the means of safe handling, transport, storage, and identification, and minimize damage and spillage. Packed material should be inside the dimensions of the pallet although some overhang is allowed.

6.1.2 This procedure applies to products covered by this International Standard. The main intention is to improve the possible recycling of all packaging materials, including dry powdered or granular materials, not covered under this International Standard, used in drilling fluids, completion fluids and oil well cements.

6.2 Apparatus — Pallets

6.2.1 The preferred pallet design and construction should be in accordance with ISO 6780 or APME 1993.

6.2.2 Preferred sizes for wooden pallets include:

a) 1200 mm × 1000 mm (47 in × 39 in) CP6;

b) 1140 mm × 1140 mm (45 in × 45 in) CP8/CP9/CP3;

c) 1219 mm × 1219 mm (48 in × 48 in);

d) 1118 mm × 1321 mm (44 in × 52 in);

e) 1067 mm × 1321 mm (42 in × 52 in) equivalent to CP4/CP7;

f) 1016 mm × 1219 mm (40 in × 48 in).

NOTE CP is the size in accordance with ISO 6780.

6.2.3 Other pallet sizes and details concerning design and construction may be agreed upon by the manufacturer and the customer.

6.2.4 The maximum outside dimensions of the total package may be in accordance with the applicable pallet size plus a maximum overhang of 3 cm (1.2 in). The overall height shall not exceed 203.2 cm (80 in).

6.2.5 The maximum net mass should not exceed 2 000 kg (4 409 lb).
6.3 Apparatus — Bags

6.3.1 The manufacturer filling the bag may take reasonable steps to ensure bag construction capable of safe handling, transport and storage.

6.3.2 The manufacturer may take reasonable steps to select bags that will minimize waste and provide recycling possibilities of the packaging material.

6.3.3 The manufacturer may consider humidity-barrier capabilities of the bags against the needs of the particular product when selecting bags.

6.4 Marking — Pallets

Markings may include the following where applicable and as specified by individual contracts:

a) product name;

b) gross/net mass, in kilograms or pounds.

6.5 Marking — Bags

Markings may include the following where applicable and as specified by individual contracts:

a) name of the material in print script at least 13 mm in height;

b) mass of the material in letters, or numbers and letters, at least 6 mm in height. The mass may be listed in kilograms;

c) lot/batch number in print script and/or numbers at least 3 mm in height, traceable to manufacturer's country of origin;

d) identification as recyclable;

e) safety information.

6.6 Pallet covers

6.6.1 Each pallet may have a cover made of at least one of the following:

a) Polyethylene (PE) shrink or wrapped film.

b) PE bonnet type.

c) Polypropylene (PP) bonnet type.

6.6.2 All plastics may be UV-stabilized, unless otherwise requested. Cardboard, carton, or wood covers may be used in place of the above. If appropriate, a bottom layer of cardboard, PE sheet or plywood may be connected to the cover to unitize the overall package.

6.7 Storage

The manufacturer may advise on storage upon request.

6.8 Recycling
6.8.1 General

If appropriate, recycling of the remaining materials after using the contents may be done in accordance with the guidelines given below. All recycling should be done in accordance with local instructions as well as with the administration concerned.

6.8.2 Pallets

General recovery and recycling, provided that pallet description is in accordance with ISO 6780 or APME 1993.

6.8.3 Cover

Selection for PE, PP or carton and recycle accordingly.

6.8.4 Bags

Use of high performance paper quality results in less packaging materials and less waste for recycling. After separation of the various components, recycle accordingly.

NOTE When handling chemicals, reduction in the volume of packaging materials can be obtained by application of containers in a dedicated container scheme.
Annex F
(Informative)

Technical revisions to ISO 13500 regarding sieve calibration are necessary in this national annex because the term centerline in the term “certified centerline value sieve” referred to in clause 5.5 and other clauses referencing sieves is a registered trademark of a sieve manufacturer, and the term is not defined by the standard. The ASTM E-11 standard in force at the time of the publication of the document has been determined to be inadequate for the 75μm and 45μm sieves used in determining residues retained by these screen sizes for several products contained in the standard. An alternate sieve standard, ASTM E161 has been determined to be more suitable.

Tolerances for electroformed ASTM E161 sieve openings are ±2μm. Tolerances for ASTM E11 screens are from two to ten times these limits over a range of comparable sizes.

Normative references in clause 2 should include:
ASTM E161, Specification for Precision Electroformed Sieves (1997)

Clause 5.2.4 shall be replaced by the following:

5.2.4 Sieves conforming to ASTM E11 and ASTM E161

Approximate dimensions are 76 mm diameter and 69 mm from top of frame to wire cloth. Barite (clause 7) and haematite (clause 8) manufacturers shall calibrate 75 μm sieves using API Test Calibration Barite with established values for residue retained. Haematite (clause 8) manufacturers shall calibrate 45 μm sieves using a suitable quantity of uniform haematite. Bentonite (clause 9), OCMA grade bentonite (clause 11), attapulgite (clause 12) and sepiolite (clause 13) manufacturers shall calibrate 75 μm sieves using API Test Calibration Bentonite. No sieve calibration is available for CMC-Low Viscosity Technical Grade, CMC-High Viscosity Technical Grade and starch, as no reference material and sieve calibration has been established.

Clause 5.5 shall be replaced by the following:

5.5 Calibration procedure — Sieve 75 μm (5.2.4) for barite, haematite, bentonite, attapulgite and sepiolite

NOTE Bentonite is tested by this calibration procedure with the following changes noted:

a) Take at least three samples of approximately 10 g Test Calibration Bentonite per 9.8.

b) Test each sample per 9.8 using the ASTM E161 sieve described in 5.5.1.

c) Continue procedure outlined in 5.5.4 through 5.5.9.

5.5.1 Obtain a 75-μm sieve with a conforming to ASTM E161.

5.5.2 Take at least three samples of approximately 50 g dry API Test Calibration Barite (TCB).

5.5.3 Test each of the samples per 7.9 using the sieve described in 5.5.1

5.5.4 Calculate % residue, R, for each sample by:
5.5.5 Calculate average % residue, $S$, of test calibration material on ASTM E161 sieve:

$$R_a = \frac{R_1 + R_2 + R_3 + \ldots}{N}$$

where

$R_1 + R_2 + R_3$ is the sum of each individual test result

$N$ is the number of samples tested

Individual sample values shall agree within ± 0.2 of their average. If not, review test procedure technique and equipment operation for sources of error. Make corrections where needed and repeat.

5.5.6 Obtain standard value from % residue from API TCB certificate or bucket label. Designate this value as $S$.

Determine sieve correction factor ($C$) as the difference between the TCB value ($S$) and the average test value ($R_a$).

$$C = R_a - S$$

**NOTE** The sieve correction as specified is number to be subtracted from the value obtained on a test sample.

Example of sieve correction determination.

% Residue on 75\(\mu\)m sieve:

API TCB standard value
(from certificate API TCB 002) $S = 2.3$

% Residue on sieve being calibrated
API TCB actual value (from test) $R_a = 2.0$
Difference $C = R_a - S = -0.3\%$

Example of sieve correction application.

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<tr>
<th>Sieve correction</th>
<th>$C = -0.3%$</th>
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<tbody>
<tr>
<td>Test sample residue</td>
<td>$R_a = 2.2%$</td>
</tr>
<tr>
<td>Corrected % residue</td>
<td>$R_c = 2.2 - (-0.3)$</td>
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<tr>
<td></td>
<td>$R_c = 2.5%$</td>
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5.6 Calibration procedure — Sieve 45 \(\mu\)m (5.2.4) for haematite

5.6.1 Obtain a 45-\(\mu\)m ASTM E161 sieve.
5.6.2 Obtain a suitable quantity of uniform haematite sufficient to last six months or longer. Mix thoroughly and store in a closed container. Identify this as "uniform haematite for 45-µm sieve calibration." Take at least three samples of approximately 50 g dry haematite.

5.6.3 Test each of the samples per 8.9 using the ASTM E161 sieve described in 5.6.1.

Calculate % residue, $R$, for each sample by:

$$\% \text{ Residue, } R = 100 \frac{\text{mass of residue, } g}{\text{mass of sample, } g}$$

Calculate average % residue, $S$, of test calibration material on the ASTM E161 sieve by:

$$\frac{R_1 + R_2 + R_3 + \ldots}{N} \quad \text{where}$$

$R_1 + R_2 + R_3$ is the sum of each individual test result

$N$ is the number of samples tested

Individual sample values shall agree within ± 0.5 of their average. If not, review test procedure technique and equipment operation for sources of error. Make corrections where needed and repeat. Manufacturer may use data recorded from above from measurements of "uniform haematite for 45µm sieve calibration" to gauge sieve integrity. No sieve correction is possible on 45 µm sieves because a standard reference material has not been developed or tested.

References to sieves

In addition to the changes in procedures listed above, the following references to ASTM E11 sieves should be replaced with references to ASTM E161 as follows:

7.8.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

8.8.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

8.8.8 Replace with: 45-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

9.7.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

11.7.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

12.4.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

13.4.7 Replace with: 75-µm sieve, conforming to requirements of ASTM E161, of approximate dimensions 76 mm diameter and 69 mm from top of frame to wire cloth.

NOTE: Supplier’s verification that sieve conforms to ASTM E161 is satisfactory evidence of compliance.

Calculated residue values
The following references to residue calculations should refer to correction values calculated by the calibration procedure referenced in this Annex. Replace as listed below.

7.10 Residue of diameter greater than 75 μm — Calculation

Residue, mass fraction (%) of diameter greater than 75 μm = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C

where C is the correction factor as calculated from Annex D.

Record calculated value.

Residue of diameter greater than 75 μm — Calculation

Residue, mass fraction (%) of diameter greater than 75 μm = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C

where C is the correction factor as calculated from Annex D.

Record calculated value.

Residue, mass fraction (%) of diameter greater than 45 μm diameter = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C

where C is the correction factor as calculated from Annex D.

Record calculated values for % residues greater than 75 μm and 45 μm.

9.9 Residue of diameter greater than 75 μm — Calculation

Residue, mass fraction (%) greater than 75 μm diameter = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C

where C is the correction factor calculated from Annex D.

Record calculated value.

11.9 Residue of diameter greater than 75 μm — Calculation

Residue, mass fraction (%) greater than 75 μm diameter = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C

where C is the correction factor calculated from Annex D.

Record calculated value.
Residue of diameter greater than 75 \( \mu m \) — Calculation

\[
\text{Residue, mass fraction (\%) greater than 75 \( \mu m \) diameter} = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C
\]

where \( C \) is the correction factor calculated from 5.5.

Record calculated value.

Residue of diameter greater than 75 \( \mu m \) — Calculation

\[
\text{Residue, mass fraction (\%) greater than 75 \( \mu m \) diameter} = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C
\]

where \( C \) is the correction factor calculated from 5.5.

Record calculated value.

13.6 Residue of diameter greater than 75 \( \mu m \) — Calculation

\[
\text{Residue, mass fraction (\%) greater than 75 \( \mu m \) diameter} = 100 \left( \frac{\text{mass of residue, g}}{\text{mass of sample, g}} \right) + C
\]

where \( C \) is the correction factor calculated from 5.5.

Record calculated value.
1. Call to order – 10:25 a.m.
   Roll Call – Eight of the ten voting members (including 1 alternate) were present.
   The “Record of Meeting Attendance” was circulated for sign in.

2. Review and Approve Minutes
   The February 13, 2001, Fort Worth, Texas, TG3 meeting minutes were included in the circulation
   of the C3/SC13 minutes and were referenced. There were no comments from either the Task
   Group or visitors.
   Marty Smith moved to accept the minutes as read. Adelina Son seconded the motion and it
   carried unanimously.

3. Discussion Items
   3A. Work group on Elastomer/Oil Mud Compatibility – Chairman: Bill Reid
       Due to travel constraints Bill Reid was not able to attend or chair a work group session.
       The charge of the work group, to identify and select the most appropriate procedures for
       evaluating oil-based mud/elastomer compatibility, was completed. All objectives have been met.
       Methods have been selected along with reference fluid IRM 903 as a recommendation for use as a
       non-aggressive reference fluid. Reference fluid Service Liquid 101 was selected as the
       recommended aggressive reference fluid.
       The charge to identify the most appropriate test procedure has been fulfilled and is as follows:

       1) Section 11 and 15 from ASTM D47-96 were selected as procedures.
       2) It is suggested that the elastomer specimens be stressed at 180°F.
       3) ISO 13226 NBR and HNBR formulations were selected.
       4) Two test temperatures, namely, 150 and 212°F, were selected.

       Ron Bland will contact Bill Reid to request that the Letter Ballot Item be prepared by the winter
       meetings.

   3B Work group on Oil Mud Chemical Analysis – Chairman: Marty Smith
   A Letter Ballot Item was submitted to all voting members of the Task Group on April 24, 2000.
   The Ballot Item passed unanimously and was submitted for publication after modification of the
   new filtration step to allow air as the pressure source and noted that small amounts of CO₂ (such
   as found in air) would not be detrimental to test results.

   The work group reviewed in detail the revisions to the Oil Mud Chemical Analysis Procedures as
   developed by the work group. Seven pending work items were discussed; and it was agreed that
   these seven items should be investigated and a decision should be made as to whether these items
   would stay in the work group on Oil Mud Chemical Analysis and which items, if any, would be
   more appropriate in another work group. The Task Group previously decided that the work group
   on Oil Mud Chemical Analysis should continue its efforts since there is more work to be done.
The eighteenth work group meeting was held at the Hyatt Regency Hotel in Calgary, Alberta, Canada, on June 25, 2001. The minutes from the previous work group meeting were reviewed and approved. The purpose of the work group meeting was to develop a list of factors to consider for improving the alkalinity (lime) test and to discuss future round robin testing on alkalinity and the use of pH meters. Since the last winter meetings, Marty held two additional work groups. The 16th WG meeting was held at ExxonMobil on May 3, 2001. This session was used to discuss the seven pending WG items and to design and initiate round robin (RR) test VII to investigate the accuracy of the revised chemical analysis procedures on low water content oil mud. The 17th WG meeting was held at Baker Hughes Inteq on June 7, 2001, and was used to review the results of RR VII and agree on conclusions. Additionally, future activities for the work group were discussed including additional work on alkalinity determination and the use of a pH meter in the test.

3B.1 Accuracy of the new procedures on low water (0 to 3%) content non-aqueous fluid:

The issue was raised as to the effectiveness of the adopted procedures for a reduced water content (0 to 5.0% water) non-aqueous drilling fluid. The work group employed RR VII testing to generate data that would conclude the effectiveness of the chemical analysis procedures in a 0 to 5.0% water content non-aqueous fluid.

Conclusions from RR VII are that the current chloride procedures are accurate even when used to titrate chlorides in low water content muds. Data was presented showing that there was less then 10% deviation in results when determining chlorides in three different low water content muds. Six laboratories participated in the testing.

- In a 95:5 OWR mud the chlorides were determined to be 10,486 (average) with a 9% standard deviation.
- In a 100% oil mud (containing 3% sodium chloride to simulate solids) the chlorides were determined to be 19,361 (average) with a 6% standard deviation.
- In a 97:3 OWR mud the chlorides were determined to be 18,639 (average) with a 7% standard deviation.

(Please refer to the attachments for complete data.)

Based on this data the work group concluded that the accuracy and reproducibility of data generated from the latest chloride determination procedures in low water content non-aqueous fluids is well within the acceptable limits.

Although the current letter balloted oil mud analysis procedural improvements should go forward and be published and moved to the field in a timely manner, there is a need to further improve the alkalinity test and lime measurements in oil muds.

Data was presented showing that there was greater then 20% deviation in results when determining alkalinity in low water content muds. Six laboratories participated in the testing.

- In a 95:5 OWR fluid the excess lime was determined to be 0.92 (average) with a 30.6% standard deviation. Five lb/bbl of lime was incorporated in this system.
- In a 100% oil mud (containing 3% sodium chloride to simulate solids) the excess lime was determined to be 0.8 (average) with a 7.9% standard deviation. Two lb/bbl lime was incorporated in this fluid.
- In a 97:3 OWR fluid the excess lime was determined to be 0.54 (average) with a 22.9% standard deviation. Two lb/bbl lime was incorporated in this fluid.

(Please refer to the attachments for complete data.)

Based on this data the work group concluded that the accuracy and reproducibility of data generated from the latest alkalinity determination procedures in low water content non-aqueous fluids is not within the acceptable limits.

During the 17th WG meeting brainstorming led to seven concepts for improving the measurement of alkalinity. During the 18th WG meeting a couple of additional concepts were added.
3B.2 Utility of a pH meter in OBM alkalinity titration:
At the end of each alkalinity determination (RR VII) the pH of the fluid was taken. The indicator endpoint is 8.3. The pH values measured were averaged to be 8.41, 8.56, and 8.22 in the three muds referenced above. The standard deviations were 7.2%, 7.6%, and 8.3%, respectively.

Based on this data the work group concluded that the accuracy and reproducibility of data generated from measuring the pH of the fluid after completing the alkalinity titration is well within the acceptable limits.

3B.3 Retort Concerns:
The work group is concerned that water content determination is critical to the accuracy of determining salinity and that the present retort procedures is not accurate enough to provide acceptable results. Marty Smith pointed out that a 1% water determination error results in a 25,000 ppm error in salinity. A 2% water determination error would result in a 50,000 ppm error in salinity. These errors in salinity determination can lead to mis-managing the drilling fluid, which, in turn, could result in significant hole stability problems.

The primary concerns of the Retort WG are that the temperature be adequate to give complete distillation and that the potential for evaporation be eliminated. Marty Smith reiterated that during the RR testing for salinity, the ability to reproduce retort data surfaced as a real problem. Although there was very good reproducibility from laboratory to laboratory and person to person for the titration data, the reproducibility of retort data was very poor. This lack of reproducibility led to the conclusion that significant retort problems exist.

Data from RR VII showed that the average percent water as measured from retorting was 3.4% (in the 95:5 OWR fluid) with a standard deviation of 28.4%. In the 100% oil mud the average percent water as measured from retorting was 0.33% with a standard deviation of 154.9%. In the 97:3 OWR oil mud the average percent water as measured from retorting was 2.21% with a standard deviation of 44.4%.

Based on this data the work group concluded that the accuracy and reproducibility of data generated from measuring the percent water of an oil mud using the present retort procedures are not within the acceptable limits.

Since there is a retort work group within Jack Estes’ Task Group on Testing of Drilling Fluids, chaired by Tom Carter, the retort reproducibility concerns were discussed as where best to be addressed. The idea of two WGs conducting water content analysis in parallel was discussed, and it was agreed that the likelihood of overlap would be very strong. Larry Mitchell suggested that there would probably be at least two Retort WG meetings which may provide additional information by the time of the winter meetings. Marty Smith offered to discuss the issue with his work group and raise this issue again at the Subcommittee meeting (June 26th).

Discussions continued and included questioning the accuracy of the receiver, adding water to the sample to improve accuracy, evaporation, the distinction between standard deviation in low numbers (1%) versus higher water content fluids (20%), and the probability of the present retort being accurate to less than 1%.

Marty thanked all of his work group members for the fine work, as well as BHI for supplying the drilling fluid, and Fann and OFI for supplying reagents.

3B.4 Integrity Industries HTHP Filtration Concerns:
Max Duncan from Integrity Industries sent a request to Marty Smith that his WG consider increasing the pressure from 100 psi during the heat up steps in the HTHP fluid loss procedures for oil muds. Max suggested that a pressure of greater than 200 psi would minimize solids
settling and therefore better simulate downhole conditions. (Please refer to a copy of the letter attached to the minutes from the June, 2000, meetings for details.) A second letter was sent to Ron Bland requesting the same consideration. (Refer to a copy of the letter attached to the minutes from the February 13, 2000, Fort Worth meetings for details.) Max was invited to present data at this API summer meeting to strengthen his request. Since Max was unable to attend the API summer meeting or provide the data, the audience was polled as to the occurrence of this problem. After some discussions on this issue, Keith Morton offered to supply data on oil muds that were submitted to Chevron for a tender a few years ago. The data includes rheological properties as well as fluid loss (HTHP) after the mud was subjected to either 500 psi (500°F static aging for 72 hr) or 18,000 psi (Cameron Bomb) conditions. Ron Bland offered to defer a decision until the next (winter) API meetings where Keith Morton’s data can be reviewed.

4. **Old Business**

N/A

5. **New Business**

Marvin Pless will discuss with his work group the recommendation from Jack Estes to submit a new WG item for water analysis.

6. **Action Items**

- Keith Morton will supply HTHP data from oil-based fluids subjected to 5,000 and 18,000 psi.
- Ron Bland will contact Bill Reid to request that the Letter Ballot Item be prepared by the winter meetings.

7. **Adjournment**

Robert McNeil made a motion to adjourn. Larry Mitchell seconded the motion, which passed without opposition.
AGENDA
WORK GROUP ON OIL MUD CHEMICAL ANALYSIS

Sixteenth Work Group Meeting
ExxonMobil GP4 Rm 951
May 3rd, 2001
10 a.m. - 2 p.m.

Purpose:
The purpose of this meeting is to discuss pending WG work items, prioritize the items, and to plan our next phase of round robin testing.

**TOPIC**

I. Come-to-order and welcome

II. Read minutes from fifteenth WG meeting and approve

III. Review / prioritize pending work items list

   **LUNCH**

IV. Develop forward testing plan(s)

**TIME (end)**

10 min (10:10)

10 min (10:20)

55 min (11:15)

-11:15- (12:00)

60 min (1:00)

-Adjourn-
Work Group on Oil Mud Chemical Analysis

Minutes of
Sixteenth Work Group Meeting
ExxonMobil Greenspoint IV Rm 951
May 3rd, 2001

Attendees: Don Weintritt, Paul Scott, Ben Bloys, Randy Ray, Fred/Frank/Ed Growcock, Marty Smith, Marvin Pless, Brent Estes, and Tom Shumate

M. Smith opened the meeting and presented and discussed the agenda for the meeting. Copies of the previous meeting minutes were handed out and read. T. Shumate motioned to accept the minutes, seconded by R. Ray, and all approved.

Seven work items were identified and listed in handouts by M. Smith (1 new item added from letter ballot comment by S. Hennigan on clarification of pressure source for the filtration step).

A listing of the workgroup membership was distributed for corrections. Brent Estes, new API workgroup alternate for M. Smith, was introduced.

Discussion of Work Items

1. Viability of the new chemical titration modifications for low water content oil muds (0-3% by volume water) - in response to question last year from D. Ezzat. Workgroup discussion centered on the retort accuracy problems. Data provided by Baroid showed low water activity values for oil muds with up to 3% water content and no salt present in the formulations. Further discussion for round-robin testing delayed to later in the meeting.

2. Use of pH meter for determining alkalinity endpoint instead of indicator/filtration. Further discussion for round-robin testing delayed to later in the meeting.

3. Retorting Error in calculating water content. P. Scott indicated EPA study showed extremely good accuracy using the gravimetric method and 50 ml retort and calibration check. M. Pless indicated old Baroid studies showed minimal differences between 10, 20, and 50 ml retorts. M. Smith commented that Never-Seeze coating of retort chamber threads eliminated a lot of vapor loss which had contributed to accuracy problems in the past. It was affirmed that technique was extremely critical. P. Growcock stated that instrument variances were also problematic. The workgroup decided the retort issue, although critical to mud analysis, was not a charge of this workgroup.

4. Reporting of oil mud salinity. It was decided that a reference to calculation procedure be placed at the end of the reporting section of the oil mud salinity titration and to standardize how oil mud salinity is reported. (AI) M Smith will contact C. Stark or R. Caenn on the schedule for revising the API mud report form and if early revisions can be made.
5. Use of PNP solvent. The workgroup discussions confirmed that PNP solvent should not be changed but modifications in the procedure could be possible to insure emulsion breakage and layer separation. Stirring modifications and solvent to sample ratio increases were possible points to address in a second round-robin.

6. Waste chemical disposal issue. The workgroup confirmed that the API Publications workgroup should inherit this issue and write-up. M. Smith will contact R. Bland to expedite the general chemical waste disposal guideline incorporation.

7. CO2 pressure source issue. S. Hennigan comment on the ballot indicated that compressed air contained CO2 and the wording in the new titration/filtration procedure could imply that compressed air is not allowed for filtration. R. Bland’s letter to M. Smith requested the workgroup to consider this problem. M. Smith responded with letter to R. Bland with editorial changes in wording to resolve this ambiguity. M. Pless asked if the workgroup should list acceptable pressure sources. Workgroup consensus was not to list and M. Smith’s response was appropriate.

**Discussion on Round-Robins**

Round-Robin VII-Low water content oil mud alkalinity and salinity titrations and use of pH meter to determine alkalinity endpoint (issues 1 and part of 2). After some discussion by the workgroup, three low/no water content oil mud formulations were selected that would be suitable to evaluate results of the new titration procedure modifications in these mud types. The 14 lb/gal formulations were:

A) 95/5 oil/water ratio, 25% by wt CaCl2 water phase salinity, 5 lb/bbl lime
B) Zero water added, 3.0% by vol. NaCl (representative of drlg massive salt) and 2 lb/bbl lime
C) 97/3 oil/water ratio, 3.0% by vol. NaCl, 2 lb/bbl lime

M. Pless agreed to mix and distribute the three muds. T. Shumate agreed to contact Pann to provide the titrating chemicals. M. Smith will contact K. Morton to provide the worksheets and collate the data. Baroid, Inteq, M2, Chevron, and Westport (?) will participate in the testing. Triplicate tests will be performed on the muds for whole mud chloride, alkalinity, and alkalinity endpoint using a pH meter. A single retort test will be performed on each mud. Time frames for the project are:

1) Titrating chemicals to M. Pless by May 14th.
2) Procedure with worksheets e-mailed to participating labs by K. Morton by May 15th.
3) Muds and titrating chemicals distributed by M. Pless on May 15th.
4) Test data on worksheets e-mailed back to K. Morton by May 31st.
5) Data collated and summarized for next workgroup meeting on June 7th.

**Round-Robin VII-Emulsion breaking technique modifications and pH meter use.**

1. F. Growcock to do literature search on use of pH meter suitability with probes in contact with organic solvents and contact pH meter/probe vendors. Will present preliminary info at next workgroup meeting. Discussions on RR VIII tabled until the next meeting.
Conclusion

T. Shumate listed the Action Items identified in the meeting. The next meeting was scheduled for June 7th, from 11 AM to 1 PM at either Exxon-Greenspoint or BHI (M. Smith will advise members in advance). A motion by M. Pless to adjourn was seconded by F. Growcock and approved by all.
API Task Group on Oil Muds

Work Group on Oil Mud Chemical Analysis

May 15, 2001

Instructions and Data Sheets for Round Robin VII Test Program

Purpose: Round Robin VII of this Work Group is designed to investigate how well the revised oil mud chemical analysis procedures accurately measure whole mud alkalinity and chlorides on low water content oil muds (three different formulations). In addition, a single retort on each of the three supplied mud samples should be conducted.

The alkalinity and chloride procedures to be used are the recently revised ones currently up for letter ballot within the API and are attached (these include additional potassium chromate for chlorides, different stirring techniques, etc). No filtering step should be used for the alkalinity tests. At the end of the alkalinity titration using phenolphthalein, use a pH meter to measure sample pH and record this pH. The attached data sheets describe the steps in each procedure. Each titration should be done in triplicate, but the retort test on each sample should only be done one time.

Plan: Marvin Pless and the BHI team have prepared three 14 ppg lab muds as follows:

1. 95 / 5 OWR with 25 wt% calcium chloride and 5 ppb lime
2. 100% oil with 3 vol% sodium chloride
3. 97 / 3 OWR (fresh water) containing 2 ppb lime and 3 vol% sodium chloride

Tom Shumate (Baroid) and Jim Berger (Fann Instruments) have provided PNP solvent and titrating reagents. Each participating lab should provide the following data on each sample. Ensure the 2.0 ml mud sample volumes are carefully measured as API prescribes.

Triplicate tests:
1. Whole mud Alkalinity (triplicate for each mud sample)
2. pH of the final phenolphthalein alkalinity endpoint measured with a properly calibrated (slope adjusted with 2 buffers) pH meter
3. Whole mud Chlorides (triplicate for each mud sample)

Single tests:
1. Sample density (mud weight: ensure sample is carefully stirred to reincorporate any settled solids, without entraining air)
2. Retort volume % water
3. Retort volume % oil
**Data sheets:** Forms for data recording (with brief instructions) are attached. **Technicians are encouraged to comment** on each test in the space provided or on a separate sheet. Please complete the testing and return the data by May 31, 2001. When data sheets are completed, please E-mail the results to Keith Morton at ekmo@chevron.com and to Marty Smith at marty.v.smith@exxonmobil.com.
Data Sheet – Round Robin VII

Using the oil mud and reagents provided, please follow the instructions below. For the tests you will need a total of 48 mL of mud and 900 mL PNP. Run the alkalinity, alkalinity pH measurement, and chlorides in triplicate. Measure mud weight and run the retorts only once. Record the data in the table below and make comments on the attached comment sheet. Carefully follow the revised section 7.0 Oil Mud Chemical Analysis procedures, attached. No filtering prior to the alkalinity titration will be required.

Series 1: 95 / 5 OWR Mud – Titrations and alkalinity pH measurement

<table>
<thead>
<tr>
<th>STEP #</th>
<th>ALKALINITY, P_{om}</th>
<th>1-Alk</th>
<th>2-Alk</th>
<th>3-Alk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OBM, mL</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
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<td>2</td>
<td>PNP, mL</td>
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<td>100</td>
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<td>3</td>
<td>Water, mL</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>Phenolphthalein</td>
<td>15 drops</td>
<td>15 drops</td>
<td>15 drops</td>
</tr>
<tr>
<td>5a</td>
<td>Sulfuric Acid, mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5b</td>
<td>2\textsuperscript{nd} End Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5c</td>
<td>3\textsuperscript{rd} End Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_{om}</td>
<td>(&quot;5c&quot;/2)</td>
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</tr>
<tr>
<td>pH</td>
<td>pH meter</td>
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<table>
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<th>CHLORIDE, Cl_{om}</th>
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<th>3-Cl</th>
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<td>More Sulfuric Acid, mL</td>
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<td>Potassium Chromate, mL</td>
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<td>Silver nitrate, mL</td>
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<td>(&quot;8&quot;/2) x 10,000</td>
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95 / 5 OWR Mud - Retort

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<tbody>
<tr>
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<td>Sample weight, ppg</td>
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<tr>
<td>10</td>
<td>Volume % Water</td>
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<tr>
<td>11</td>
<td>Volume % Oil</td>
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### Series 2: 100% Oil – Titrations and alkalinity pH measurement

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<th>STEP #</th>
<th>ALKALINITY, $P_{om}$</th>
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<th>2-Alk</th>
<th>3-Alk</th>
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<td>Water, mL</td>
<td>200</td>
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<td>200</td>
</tr>
<tr>
<td>4</td>
<td>Phenolphthalein</td>
<td>15 drops</td>
<td>15 drops</td>
<td>15 drops</td>
</tr>
<tr>
<td>5a</td>
<td>Sulfuric Acid, mL</td>
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<td></td>
</tr>
<tr>
<td>5b</td>
<td>2$^{nd}$ End Point</td>
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<td></td>
</tr>
<tr>
<td>5c</td>
<td>3$^{rd}$ End Point</td>
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<td>$P_{om}$</td>
<td>(&quot;5c&quot;/2)</td>
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<td>pH</td>
<td>pH meter</td>
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<td>CHLORIDE, $C_{om}$</td>
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<td>2-Cl</td>
<td>3-Cl</td>
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<td>7</td>
<td>More Sulfuric Acid, mL</td>
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<td>8</td>
<td>Potassium Chromate, mL</td>
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<tr>
<td>9</td>
<td>Silver nitrate, mL</td>
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Cl$_{om}$ ("8"/2) x 10,000

### 100% Oil - Retort

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<tbody>
<tr>
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<td>Sample weight, ppg</td>
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<tr>
<td>10</td>
<td>Volume % Water</td>
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<td>11</td>
<td>Volume % Oil</td>
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### Series 3: 97 / 3 OWR Mud – Titrations and alkalinity pH measurement

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<td>1</td>
<td>OBM, mL</td>
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<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>PNP, mL</td>
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<td>200</td>
<td>200</td>
<td>200</td>
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<td>15 drops</td>
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</tr>
<tr>
<td>5a</td>
<td>Sulfuric Acid, mL</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5b</td>
<td>2$^{nd}$ End Point</td>
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<tr>
<td>5c</td>
<td>3$^{rd}$ End Point</td>
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<tr>
<td>$P_{om}$</td>
<td>(“5c”/2)</td>
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<table>
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<tr>
<th>CHLORIDE, $Cl_{om}$</th>
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</tr>
<tr>
<td>7</td>
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<tr>
<td>$(Cl_{om})$ (“8”/2) x 10,000</td>
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### 97 / 3 OWR - Retort

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<tbody>
<tr>
<td>9</td>
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<tr>
<td>10</td>
<td>Volume % Water</td>
</tr>
<tr>
<td>11</td>
<td>Volume % Oil</td>
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</table>
COMMENTS

Series 1: 95 / 5 OWR Mud

Series 2: 100% Oil Mud

Series 3: 97 / 3 OWR Mud
# Round Robin VII: Alkalinity/Chlorides

## Series 1: 95/5 OWR Mud

<table>
<thead>
<tr>
<th>Labs</th>
<th>1-Alk</th>
<th>2-Alk</th>
<th>3-Alk</th>
<th>Avg-Alk</th>
<th>1-Ci</th>
<th>2-Ci</th>
<th>3-Ci</th>
<th>Avg-Ci</th>
<th>Mud Weight</th>
<th>% Water</th>
<th>% Oil</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.5</td>
<td>0.5</td>
<td>0.6</td>
<td>0.53</td>
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<td>9000</td>
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</tr>
<tr>
<td>MI</td>
<td>0.75</td>
<td>0.55</td>
<td>0.6</td>
<td>0.63</td>
<td>10000</td>
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<td>10500</td>
<td>10667</td>
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<td>70</td>
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<tr>
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<td>1.2</td>
<td>0.95</td>
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<td>10750</td>
<td>10250</td>
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</tr>
<tr>
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<td>1.15</td>
<td>1.05</td>
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<td>10000</td>
<td>10000</td>
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<tr>
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<td>1.18</td>
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<tr>
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<td>0.80</td>
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<tr>
<td>Avg</td>
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<td>0.88</td>
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<td>0.33</td>
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<td>736</td>
<td>932</td>
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<td>0.9</td>
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<tr>
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## Series 2: 100 % Oil Mud

<table>
<thead>
<tr>
<th>Labs</th>
<th>1-Alk</th>
<th>2-Alk</th>
<th>3-Alk</th>
<th>Avg-Alk</th>
<th>1-Ci</th>
<th>2-Ci</th>
<th>3-Ci</th>
<th>Avg-Ci</th>
<th>Mud Weight</th>
<th>% Water</th>
<th>% Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHI</td>
<td>0.8</td>
<td>0.85</td>
<td>0.85</td>
<td>0.83</td>
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<td>18000</td>
<td>18000</td>
<td>18000</td>
<td>13.95</td>
<td>0</td>
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<tr>
<td>MI</td>
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<td>0.85</td>
<td>0.78</td>
<td>21500</td>
<td>19000</td>
<td>21000</td>
<td>20500</td>
<td>13.6</td>
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<td>72.5</td>
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<td>0.75</td>
<td>0.8</td>
<td>0.75</td>
<td>18500</td>
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<td>19000</td>
<td>18750</td>
<td>14.0</td>
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<td>Westport (2)</td>
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<td>0.7</td>
<td>0.8</td>
<td>0.75</td>
<td>19000</td>
<td>18500</td>
<td>19500</td>
<td>19000</td>
<td>14.0</td>
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<td>0.79</td>
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<td>19250</td>
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<tr>
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<td>0.90</td>
<td>0.92</td>
<td>20000</td>
<td>21000</td>
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<td>21000</td>
<td>13.70</td>
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</tr>
<tr>
<td>Avg</td>
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<td>0.79</td>
<td>0.83</td>
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<td>1,143</td>
<td>0.17</td>
<td>0.52</td>
<td>1.97</td>
</tr>
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<td>6</td>
<td>7</td>
<td>6</td>
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## Series 3: 97/3 OWR Mud

<table>
<thead>
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<th>Labs</th>
<th>1-Alk</th>
<th>2-Alk</th>
<th>3-Alk</th>
<th>Avg-Alk</th>
<th>1-Ci</th>
<th>2-Ci</th>
<th>3-Ci</th>
<th>Avg-Ci</th>
<th>Mud Weight</th>
<th>% Water</th>
<th>% Oil</th>
</tr>
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<tbody>
<tr>
<td>BHI</td>
<td>0.5</td>
<td>0.45</td>
<td>0.45</td>
<td>0.47</td>
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<td>16000</td>
<td>16000</td>
<td>16000</td>
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<td>0.33</td>
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<td>18500</td>
<td>19000</td>
<td>19000</td>
<td>13.9</td>
<td>2</td>
<td>71</td>
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<td>20500</td>
<td>18000</td>
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<td>14.0</td>
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<td>0.75</td>
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<td>19000</td>
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<td>0.54</td>
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<td>0.15</td>
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<td>7</td>
<td>0.4</td>
<td>44.4</td>
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</table>
### Round Robin VII

**pH of The Final Phenolphthalein Alkalinity Endpoint**

#### Series 1: 95/5 OWR Mud

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<thead>
<tr>
<th>Labs</th>
<th>1-pH1</th>
<th>2-pH2</th>
<th>2-pH3</th>
<th>Avg-pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHI</td>
<td>8.4</td>
<td>8.3</td>
<td>8.34</td>
<td>8.35</td>
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<tr>
<td>MI</td>
<td>See Notes</td>
<td>See Notes</td>
<td>See Notes</td>
<td></td>
</tr>
<tr>
<td>Westport (1)</td>
<td>7.4</td>
<td>7.6</td>
<td>8.5</td>
<td>7.83</td>
</tr>
<tr>
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</tr>
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<td>9.50</td>
<td>8.72</td>
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</tr>
<tr>
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<td>8.40</td>
<td>8.80</td>
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<tr>
<td><strong>Avg</strong></td>
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<td><strong>8.41</strong></td>
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#### Series 2: 100 % Oil Mud

<table>
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<tr>
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<th>2-pH2</th>
<th>2-pH3</th>
<th>Avg-pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHI</td>
<td>8.4</td>
<td>8.3</td>
<td>8.3</td>
<td>8.33</td>
</tr>
<tr>
<td>MI</td>
<td>See Notes</td>
<td>See Notes</td>
<td>See Notes</td>
<td></td>
</tr>
<tr>
<td>Westport (1)</td>
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<td>9.1</td>
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<td>9.03</td>
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<td>9.05</td>
<td>9.05</td>
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</tr>
<tr>
<td>Baroid</td>
<td>9.10</td>
<td>8.43</td>
<td>8.92</td>
<td>8.82</td>
</tr>
<tr>
<td>Chevron</td>
<td>7.50</td>
<td>7.40</td>
<td>7.70</td>
<td>7.53</td>
</tr>
<tr>
<td><strong>Avg</strong></td>
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<td><strong>8.46</strong></td>
<td><strong>8.55</strong></td>
<td><strong>8.56</strong></td>
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<td><strong>Std Dev</strong></td>
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#### Series 3: 97/3 OWR Mud

<table>
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<th>2-pH2</th>
<th>2-pH3</th>
<th>Avg-pH</th>
</tr>
</thead>
<tbody>
<tr>
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<td>8.3</td>
<td>8.3</td>
<td>8.30</td>
</tr>
<tr>
<td>MI</td>
<td>See Notes</td>
<td>See Notes</td>
<td>See Notes</td>
<td></td>
</tr>
<tr>
<td>Westport (1)</td>
<td>7.5</td>
<td>9.25</td>
<td>7.8</td>
<td>8.18</td>
</tr>
<tr>
<td>Westport (2)</td>
<td>8.1</td>
<td>8.1</td>
<td>8.1</td>
<td>8.10</td>
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<td>7.00</td>
<td>7.30</td>
</tr>
<tr>
<td><strong>Avg</strong></td>
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<td><strong>8.35</strong></td>
<td><strong>8.09</strong></td>
<td><strong>8.22</strong></td>
</tr>
<tr>
<td><strong>Std Dev</strong></td>
<td>0.63</td>
<td>0.96</td>
<td>0.82</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>%Std Dev</strong></td>
<td>7.7</td>
<td>11.5</td>
<td>10.1</td>
<td>8.3</td>
</tr>
</tbody>
</table>
AGENDA
WORK GROUP ON OIL MUD CHEMICAL ANALYSIS

Seventeenth Work Group Meeting
Baker/Hughes/Inteq Technical Center
June 7, 2001
10 a.m. - 12 p.m.

Purpose:
The purpose of this meeting is to review the data from Round Robin VII on low water content oil muds and formulate plans for our next phase of work.

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>TIME (end)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Come-to-order and welcome</td>
<td>10 min (10:10)</td>
</tr>
<tr>
<td>II. Read minutes from the sixteenth WG meeting and approve</td>
<td>10 min (10:20)</td>
</tr>
<tr>
<td>III. Review RRVII data and discuss</td>
<td>90 min (11:50)</td>
</tr>
<tr>
<td>LUNCH</td>
<td>30 min (12:20)</td>
</tr>
<tr>
<td>IV. Develop forward plan</td>
<td>55 min (1:15)</td>
</tr>
</tbody>
</table>

-Adjourn-
WORK GROUP ON OIL MUD CHEMICAL ANALYSIS

Minutes of Seventeenth Work Group Meeting
June 7, 2001
Baker Hughes Inteq

Purpose of Meeting: The purpose of this meeting was to review the results of the Round Robin VII tests on low water content oil muds and formulate plans for our next phase of work.

Attendees: Marty Smith, Tom Shumate, Don Weintritt, Keith Morton, John Toups, Marvin Pless, Ben Bloys and Randy Ray.

The meeting was called to order by Marty Smith and the minutes from the last meeting were discussed and accepted as written in a motion made by Ben Bloys and seconded by Don Weintritt.

Handout Items: Agenda, minutes from the 16th work group meeting, Round Robin VII results, instructions and data sheets for Round Robin VII test program, and for comparison purposes, results of Round Robin V.

Round Robin VII Overview

Good Agreement on Whole Mud Chlorides
The mud formulation used for the RRVII tests conducted with the all-oil mud sample (100/0 SWR) and the 97/3 SWR sample had an equivalent chloride content of 18,600 mg/l. The results of the various chloride titrations on these two muds had excellent agreement with the calculated amount of chlorides based on the amount of sodium chloride used in the formulation.

The group concluded that the current chloride procedure is very adequate even when used to titrate the chlorides in low water content oil mud.

Alkalinity Issues

Standard Deviation
Marty Smith reviewed the results of Round Robin V. We discussed the consistency among the various labs in RRV achieving our target standard deviation of less than 10% for the chloride determination, in contrast to the alkalinity test which was somewhat higher at 12.6%. In this latest round robin, RRVII, we were once again having difficulty obtaining a standard deviation of less than 10% for the alkalinity test.

Endpoint Determination and Problems with Measuring Total Lime Added
There was discussion on options for determining the alkalinity endpoint: with the indicator or with a pH meter. Based on comments from the technicians performing the tests in the round robin there was also discussion about why in some instances the alkalinity endpoint kept reappearing (color change from clear back to the pink color). This was also confirmed by one lab when the pH measured by their pH probe was greater than 8.3. In addition, none of the tests measured the amount of lime that should have been titrated based on the amount of lime added.

The group concluded that there is a need to further improve the alkalinity test and lime measurement in oil muds. This need exists regardless of water content in the mud.
Ideas to Improve the Alkalinity Procedure

There was considerable discussion on what is the best method for determining the correct amount of lime that is present in a lab prepared oil mud. Several ideas were put forth, including:

1) Retort a sample of mud and with the solids left in the retort chamber, disperse in water and run the alkalinity on these solids.
2) Use a more vigorous mixing method to achieve better dispersion of the lime. It was postulated that the lime is still oil wet and cannot be contacted by the acid.
3) Titrate a lab prepared mud using the current alkalinity procedure and then add a known amount of lime to the mud and titrate again to see if the incremental amount of lime can be measured.
4) Increase the amount of PNP solvent to ensure all of the lime is water wet.
5) Decrease the amount of mud sample used in the titration.
6) Titrate a known amount of lime added to calcium chloride brine.
7) Look at adding triethanolamine, or other solvents such as terpenes, EGMBE, n-butanol, etc that may allow for more accurate measurement of alkalinity (lime).

Retort Data

This round robin included retorts of the lab sample. The results again indicate that there is a need for improvements to the retort procedure/apparatus. In these tests oil content was fairly consistent and the standard deviation was less than 10%. Water content, however, was considerably higher than 10%.

Conclusions

1. The current chloride procedure is very adequate even when used to titrate the chlorides in low water content mud

2. Although current letter balloted oil mud chemical analysis improvements should move forward and be published and moved to the field as quickly as possible, there is a need to further improve the alkalinity test and lime measurement in oil muds. This need exists regardless of water content in the mud

Future WG Activities

Items for consideration for future work group work include:

1. Improve the alkalinity procedure so it will accurately measure both dissolved and undissolved alkaline material. If that material is lime, produce a more consistent and predictable result as compared to known additions of lime to the mud.
2. Continue to investigate the use of the pH meter for determining the alkalinity endpoint, especially for red-colored muds such as hematite weighted fluids.

A motion to adjourn was made by Ben Bloys and seconded by Marvin Pless.

KM/MS
Olm-wg29-17*wg-minutes
6/22/01
AGENDA

WORK GROUP ON OIL MUD CHEMICAL ANALYSIS

Eighteenth Work Group Meeting
Hyatt Regency Calgary
June 25, 2001
1 p.m. - 3 p.m.

Purpose:
The purpose of this meeting is to review the data and discuss conclusions from Round Robin VII which focused on low water content oil muds, and discuss plans for investigating further improvements to the oil mud alkalinity determination.

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>TIME (end)</th>
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<tbody>
<tr>
<td>I.  Come-to-order and welcome</td>
<td>10 min (1:10)</td>
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<tr>
<td>II. Read minutes from the seventeenth WG meeting and approve</td>
<td>10 min (1:20)</td>
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<tr>
<td>III. Review RRVII data and conclusions</td>
<td>40 min (2:00)</td>
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<tr>
<td>IV. Review alkalinity issues and plan next round robin</td>
<td>55 min (2:55)</td>
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-Adjourn-
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<tr>
<th>NAME</th>
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REPORT OUT TO THE
OIL MUD TASK GROUP
BY THE

API OIL MUD CHEMICAL ANALYSIS WORK
GROUP

API Standardization Conference, June 26, 2001
Calgary

I. Sixteenth Work Group Meeting held at ExxonMobil on May 3, 2001

➢ Discussed and distilled 7 pending WG items

➢ Designed and initiated Round Robin VII to investigate accuracy of revised chemical analysis procedures on low water content oil mud

II. Seventeenth Work Group Meeting held at Baker/Hughes/Inteq on June 7, 2001

➢ Reviewed results of Round Robin VII and agreed upon conclusions

➢ Discussed future activities for the Work Group, including additional work on alkalinity determination and use of pH meter in the test

III. Eighteenth Work Group Meeting held at Hyatt Regency Calgary on June 25, 2001

➢ Developed list of factors to consider for improving alkalinity (lime) test

➢ Discussed plans for future round robin on alkalinity and use of pH meter
Conclusions from Round Robin VII

- The current chloride procedure is accurate even when used to titrate chlorides in low water content mud

- Although current letter-balloted oil mud chemical analysis procedural improvements should go forward and be published and moved to the field as quickly as possible, there is a need to further improve the alkalinity test and lime measurement in oil muds.
1. Jack started the meeting by asking the attendees to sign the attendance roster.
2. A discussion of the charges (general and specific) by Jack followed:
   a. Marvin Pless suggested that the charges of the work group on retort analysis be expanded to include the water content determination.
   b. Paul Javora noted that this may not be a broad choice; if water is to be included, the choice is really narrow.
3. Steve Polnaszek reported on the Work Group on Polymer Testing
   a. Accomplishments: (1) The proposed revision to RP 13I was e-mailed to members for review. No corrections were offered before or at work group meeting held on June 25, 2001; thus, it was proposed that the revision be approved by the TG members for submission as a letter-ballot item. (2) Revisions of or comments from WG members and interested parties on the accessory paper on polymer fluid aging, drafted by John Toups, based upon the Westport research work done for the WG, are due by July 27. The group is anticipating that the revised paper is to be put on letter ballot by next year, with the intent of publishing it in an industry journal so that the data and insights developed by the group can have wide availability in the fluids industry.
   b. Points from Steve’s report from Tom Sifferman’s polymer WG and the associated, extensive discussion:
      - Mario Ferrari of Lamberti reported on the work done with some apparently adulterated CMCs and PACs and is asking that the group look at method to detect adulteration with starch. Dodie Ezzat of Aramco has detected as much as 45% salt adulteration and proposed that specs, under API, be developed to ensure that only high quality material be sold in the industry.
      - Steve Polnaszek asked the suppliers how they felt about Mario’s issues and developing methods for detecting adulteration. They was no outcry of opposition.
      - Dodie mentioned that most materials in the Middle Eastern market are supposedly sold to API specs but not with the API logo.
      - Steve differentiated between materials with API specs with API logo where the API is responsible for enforcement and those without the API logo where the buyer is responsible for enforcement.
      - Dodie reported that Aramco set up a $1MM quality control program and was able to reject $9MM worth of substandard drilling and completion fluid materials.
      - If additional specifications are really necessary, is this the task group to work on this matter, or does a 13A TG need to be reformed to handle this?
      - Dodie Ezzat classified materials into three groups of materials:
         - Large volume commodity materials/minerals like barite, bentonite, etc.
         - Specialty materials like foamers which are sold in small volumes (many do not need specs).
         - Intermediate volume materials like biopolymers and PACs which he feels really do need specs.
      - A question was raised for biopolymers used in relatively small volumes: Is it worth the effort to set the specs? Harry Dearing responded that, for critical operations like deep water, it is worth it to set the specs.
      - Keith Morton reminded the meeting attendees that end users can check quality with the COA supplied with the products.
      - Current API specs for hematite calls for SG of 5.05, which is no longer available or available with difficulty. An SG range of 4.9-5.0 is probably more reasonable. Ron Bland said that SG 5.05 is available in the U.S., but people do not want to pay the price.
Jack Estes asked Steve if any new work items came out of the work group meeting. Steve said that he was not sure if this is the group to take the work item. Jack responded that test procedures to determine the contaminants in polymers belong to this group. However, setting of specs should go to the subcommittee (for 13A).

Mario Ferrari said that methods, as discussed in a meeting in Milan, on testing CMC with starch as adulterants belong to the RP. Steve declared that setting the specs does belong to this group but analytical enforcement methods are appropriate here.

Marty Smith of ExxonMobil asked how specs can be set without testing? Bentonite specs and testing were done in 13A. Jack Estes said that we currently do not have a TG on 13A matters, so Steve may have to set up such a TG. Marty said that ExxonMobil will support this effort.

Steve Polnaszek asked if there is a better chance to set up specs for biopolymers now when there are two major biopolymer manufacturers, Kelco and Archer-Daniels-Midland. Dodie Ezzat responded that new, smaller suppliers are trying to learn everything they can in order to compete. The hoped-for future specs on biopolymers will help them. As an end-user, he wants to see the testing. Steve wondered if another effort to set specs for PACs would be any more successful than before.

Marty Smith brought up the fact that end-users must do monitoring of quality through spot checks and to set product specs.

Mario Ferrari was given the floor and he presented the results of his work on API Specification 13A for technical grade, high viscosity and low viscosity CMC. CMC characterization is recommended before going to the performance tests, the iodine test, moisture content, etc. Data was presented that listed adulterated CMC and PAC samples. The adulterants were starches. The table listed the origin, type of adulteration (starch), type of CMC/PAC, the degree of etherification, the total polymer content on a dry basis, the pH, and whether API specs were passed or failed.

Dodie Ezzat asked about the salt content, which was found to be as high as 45%. Mario Ferrari answered that specs on salt content have only been set for technical grade CMC and required compliance with performance tests. His current work is for technical grade CMC. Therefore, salt content in high grade CMC is not regulated.

At Steve’s request, Mario explained that degree of etherification refers to the number of anionic units in the CMC, sometimes referred to as degree of substitution.

Dodie Ezzat asked Jack Estes if, based on his years of experience with API, does he think that API has failed us in this product quality issue? Jack replied that big oil companies have cut back on staff to monitor the quality of supplied materials. With no or minimal technical support groups to check product quality, the buying is based on price. What is important in Mario’s report is the fact that the contaminant is starch, which degrades at high temperature. What has not been done is that specs have not been set for the high grade material. In the past, Jack said that the SC13 adopted the OCMA specs; hence, it may be time to address that in 13A.

Harry Dearing asked what to do about the starch substituted for PAC/CMC. Mario Ferrari replied that his company is preparing literature on testing that will detect the substituted starch as adulterant. Marty Smith asked if Mario is proposing that a spec be created that will prevent blended materials or should specs be created for other polymers that do not exist? Should there be a spec for minimum polymer content? We do not currently have performance tests for the different polymers.

Jack commented that, possibly, there is a new work item in this for this group on contamination of polymeric products. Marvin Pless recommended that an ad hoc committee be put together (under 13A) to take a look at the specs of polymeric products. Jack commented that since there is no longer a 13A Task Group, the Steering Committee needs to take this on.

Steve Polnaszek formally moved that the revision to RP 13I Section 19 be approved by the task group for presentation to the subcommittee tomorrow. Ron Bland
The Chairman called the August 9th meeting to order at 9:00 AM at Derrick Equipment Company. Mike Morgenthaler took the minutes with the following in attendance:

- Terry Baltzer
- Bill Cagle
- Tim Calhoon
- Mark Charette
- Lawrence Childress
- Bob DeWolfe
- Matt Frankl
- Brent Griffiths
- Tim Harvey
- Jerry Haston
- Mike Kargl
- Bob McKenzie
- James Merrill
- Federico Mezzatesta
- Mark Morgan
- Mike Morgenthaler
- Ron Morrison
- Nace Peard
- Mike Richards
- David Shulte
- Tim Sneider
- Leon Robinson

The Chairman handed out the following agenda for the August 9th Meeting.

I. AGENDA FOR AUGUST 9TH

A. API RP 13C – RP FOR DRILLING FLUIDS SYSTEM EVALUATION

1. SCOPE
   a) [Unchanged]
2. REFERENCES –
3. DEFINITIONS AND ABBREVIATIONS
4. REQUIREMENTS
5. DRILLED SOLIDS REMOVAL – SYSTEM PERFORMANCE
   a) [Stays as written]
6. SECTION 5.3 PROCEDURE/CALCULATIONS
   a) [Editorial Change of Equation 1 is the only edit]
7. RIGSITE EVALUATION OF DRILLED SOLIDS MANAGEMENT EQUIPMENT
   a) [Mike Morgenthaler and Gene Bouse plan to write a procedure for evaluating the performance of hydrocylones and centrifuges using capture calculations. The deadline is the September 9th meeting.]
8. PRACTICAL OPERATIONAL GUIDELINES
   a) [Has anyone edited these guidelines that were revised by Morgenthaler, Peard, and Bouse?]
9. APPENDIX A – PARTICLE SIZE BY WET SIEVE ANALYSIS
   a) [This will be retained in the revised document]
10. APPENDIX B – PARTICLE SIZE DISTRIBUTION BY DIFFRACTION
    a) [This will not be included in the revised document]

B. API RP 13E - RP FOR SHALE SHAKER SCREEN CLOTH EVALUATION

1. SECTION 1 SHAKER SCREEN LABELING
   a) [See notes below]
2. SECTION 2 SHAKER SCREEN SEPARATION POTENTIAL
   a) [To be replaced by Rotap procedure]
   b) [We need a wet-sieve procedure for alternative screen designations higher than 170, i.e. smaller than 90 microns? See Appendix A in current 13C]
3. SECTION 3 CONDUCTANCE
   a) [Report on the two methods]
4. SECTION 4 CALCULATION OF TOTAL NON-BLANKED AREA OF SCREEN PANEL
a) [No changes]

5. APPENDIX A – NEW PROCEDURE WITH PYCNOMETER ACCEPTED AT THE LAST MEETING WILL BE INCLUDED
   a) [Procedure is needed to enable pycnometer method to be used with non-aqueous fluids.]
   b) [Is there a way to determine oil/water ratios without volume measurements?]

C. Tim Wilkin is ISO/API liaison and plans to help write our documentation in ISO/API format. Richard Vernotzy with J. P. Kenny is the new technical coordinator on the Houston AADE Steering Committee.

D. Can we finish all tasks in time to make a final copy at our S. Padre Meeting?

MEETING MINUTES

RE: Glossary
Bill Cagle suggested that terms be defined for:
- positive deck angle
- negative deck angle
- non-blanked area

Also, suggested made to redefine:
- “API Sand “ as 75 micron in glossary
- barite (much discussion, no decision reached)

Chairman encouraged all members to read and review the glossary before next meeting because all definitions will be revisited.

RE: Drill Solids Removal – System Performance
It was decided that the capture calculation will be included as an Appendix. It provides “snapshot” information only.

Brent Griffiths suggested that the “disclaimer” on the capture calculation should be that overall system performance is the real yardstick.

Question was asked by Chair if a motion compensating electronic balance existed for use on floaters.

Chairman noted that RP 13C Chapter 7, Practical Operation Guidelines, will be edited at the South Padre Island meeting.

RE: Existing RP 13C Appendix A – Wet Sieve Analysis
This appendix will be left in and left unedited.

RE: Existing RP 13C Appendix B – PSA by Diffraction Analysis
This appendix will be omitted from the revised document.

RE: Pycnometer Method & LGS in Oil Muds
Chairman noted that retorts are inaccurate at low water contents.

Jerry Haston commented that retorts are always inaccurate and steps taken to correct inaccuracy often compound the problem.

Is there a better method?

Brent Griffiths mentioned a “grain moisture” analyzer and also microwave methods have been tried.

Chairman suggested that the pycnometer method may only apply to the constituents of an OBM rather than to the mud as a whole.
Chairman volunteered to write procedure for use of pycnometer in non-aqueous fluids.

RE: Method for Shaker Screen Separation Potential

2.3.1.3 Suggestion was made to change temperature to 225°F for drying sand.

Ron Morrison suggested following wording changes:

2.3.11 Wording be changed to:
Silica/Quartz sand ranging from very coarse to very fine is available locally or from several suppliers of cementing, fracturing, and gravel pack sands used in the oil field.

2.3.2.3 Wording be changed to:
To ensure proper tension in the test screen samples, test screen samples can be obtained from the manufacturer and must be tensioned and mounted to manufacturers' specifications.

2.3.2.4 Wording be changed to:
Strike: Each Manufacturer will
To: Mount the cloths..

Chairman asked the question whether the separation test will be conducted on screens randomly picked off drilling rigs in the field.

Nace Peard suggested adding a disclaimer so that end users know the API Separation Potential Method is used by manufacturers to designate cloths rather than by field personnel.

Brent Griffiths: Over the years a 210 has become less than a 210. Will an “API 200” mean anything? By putting so many numbers on the label, we are wasting our time. The “alternative designation,” e.g., Rotap mesh equivalent, should be big and bold.

Matt Frankl: The tag should be the same on box as screen.

Chairman proposed the following language:

The first designation on the box and the screen will be the API number which will consist of the alternative screen designation for screen mesh (nearest Rotap mesh). The micron designation will be underneath the API number. API number must be at least double the letter height of any other designation and all letters must be the same color.

The above language was accepted by unanimous vote of the members.

All suggestions for tag layout should be brought to the South Padre Island Meeting.

RE: CONDUCTANCE

Mark Morgan demonstrated the devise for measuring conductance illustrated below.

Terry Baltzer presented a PowerPoint presentation on SW Wirecloth’s conductance apparatus.
Brent Griffiths suggested that it may be good to do with conductance what we are doing with cutpoint. If the API number for a screen is 170 then compare the conductance of that screen to a 170 US test sieve. Results could be a percentage of volume flowed between actual screen and test sieve.

Chairman: Field application may differ than lab tests on conductance do to difference between turbulent or laminar flow.

Mark Morgan will try testing with a viscous fluid. Newtonian fluids are better than non-Newtonian.

Chairman: Both methods may be included in procedure.

**NEXT MEETING**

The next meeting will be at the Radisson on South Padre Island:

**8:00 AM, Monday, September 10, 2001**

**Radisson Hotel, South Padre Island, Texas**
API/ADE 13C AND E REWRITE COMMITTEE

AGENDA
June 14, 2001

API RP 13 C Recommended Practice for Drilling Fluid Processing Systems Evaluation
1). Scope Unchanged
2). References Changes?
3). Definitions and Abbreviations Need editing
4). Requirements Changes?
5). Drilled Solids Removal – System Performance Need editing (does ‘jetting’
give 100% solids removal efficiency as stated in 5.1.3?
   A. EPA now requires gravimetric measurements on off-shore rigs.
   New Procedure with Pycnometer needs to be evaluated
   Does it need both equations to determine low gravity solids?
   B. Section 5.3 Procedure/Calculations
      Editorial change of equation (1) is the only modification.
   Evaluation of Individual Units of Solids Control Equipment.
   Can we define whether the unit is performing correctly?
7). Practical Operational Guidelines
   Review editorial Changes.
8). Appendix A Particle Size By Wet Sieve Analysis
   Does it need modification? Combine with Screen designation in 13E?
9). Appendix B – Particle Size Distribution by Diffraction Analysis
   Does it need modification or do we need this?

API RP 13E – Recommended Practice for Shale Shaker Screen Cloth
Designation.
1). Section 1. Shaker Screen Labeling
   Manufacturer’s Designation; Nearest mesh size from Rotap test;
   (microns); Conductance Number; Effective Screen Area.
   Mesh size is called alternative screen designation in the ASTM E11 document.
2). Section 2 Shaker Screen Separation Potential
   To be replace by Rotap procedure: Stack: AB, Test Screen, CD [sieve
   about 100gms of sand –two standard screens above test screen and two below.
   Move test screen up or down in stack until test screen separates 70% or more of
   sand size between screens B&C and less than 70% between B&C when test
   screen is position above next finer Sieve.] Screen will be rated as sieve C.
   Do we need a wet-sieve procedure for alternative screen designations higher than 170, i.e. smaller
   than 90 microns? See item 5 above (Appendix A in current 13C).
3). Section 3 – Conductance
   Report of new method??
4). Section 4 – Calculation of Total Non-blanked Area of a Shale Shaker Screen
   Panel. No changes.

Tim Wilkins is ISO/API liaison and plans to help write our document in ISO/API form.
Richard Vernotzy with J P Kenny is the new Technical Coordinator on the Houston
AADE Steering committee.
Proposed New API Method
to Determine Low Gravity Solids Content in a Drilling Fluid.

A pycnometer is a small container that can be pressurized and weighed. A pycnometer can be used to gravimetrically determine density of fluids, and density of non-soluble solids. The current pressurized mud balance could be considered a pycnometer. With an electronic balance or a triple beam balance to weigh material, the beam on the pressurized mud balance is not needed.

Pycnometers can be made by removing the beam from a pressurized mud balance, may be ordered special from the pressurized mud balance manufacturer, or may be machined to specifications in a machine shop.

Procedure of Using a Pycnometer to Determine Mud Weight

1. Weigh clean, dry pycnometer
2. Fill pycnometer with distilled water
3. Measure temperature of water
4. Pressurize pycnometer to about 300psig using a hand held pump filled with water
5. Re-weigh pycnometer
6. Determine weight of water in pycnometer – (subtract weight of pycnometer from weight of pycnometer and water)
7. Calculate volume of pycnometer by dividing the weight of water by the density of water at the measured temperature.
8. Dry, clean, and reweigh pycnometer
9. Fill pycnometer with drilling fluid
10. Pressurize by pumping drilling fluid into pycnometer to a pressure near 300psi
12. Determine weight of drilling fluid in pycnometer by subtracting empty weight from pressurized weight.
13. Calculate density of drilling fluid by dividing weight of drilling fluid sample by volume of pycnometer determined in step 7. Convert density to pounds per gallon by multiplying by 8.345.

Calculating Low Gravity Solids concentration from retort Data

\[
(\rho_b - \rho_{lg}) V_{lg} = 100 \rho_f + (\rho_b - \rho_f) V_s -12 \text{(MW)}
\]

Where \( \rho_b \) is the specific gravity of barite;
\( \rho_{lg} \) is the specific gravity of low gravity solids;
\( \rho_f \) is the specific gravity of filtrate;
\( V_{lg} \) is the volume percent concentration of low gravity solids;
\( V_s \) is the volume percent concentration of undissolved solids; and
MW is the mud weight in ppg.
Procedure for determining density of solids in drilling fluid
The equation to determine concentration of low gravity solids requires that the density of low gravity and barite solids be known. These densities may be determined on location with the pycnometer. Drilled cuttings can be removed from the shale shaker screen, washed and dried. The drying should be achieved in the same manner as the concentration of solids is determined. If retort solids are used, drilled cuttings should be dried in a retort; if an oven is used, drilled cuttings should be dried in an oven. The procedure described here will assume an oven will be used.

1. Remove drilled solids from shaker screen and wash excess drilling fluid from cuttings
2. Dry solids in an oven at a temperature of 250°F for 4 hours.
3. Grind solids into powder
4. Weigh clean dry pycnometer
5. Add solids to fill pycnometer about half full and weigh
7. Add some water to pycnometer and stir gently to wet all solids in pycnometer
8. Fill pycnometer with water, measure water temperature, and pressurize pycnometer to about 300 psi with water,
9. Weigh pressurized pycnometer
10. Calculate volume of water in pycnometer by subtracting the solids weight from the solids plus water weight and dividing by the appropriate water density
11. Determine volume of solids by subtracting volume of water added from volume of pycnometer
12. Divide weight of solids by volume of solids to determine density of solids.
Method of Determining Solids Content in a Drilling Fluid.

A pycnometer is a small container that can be pressurized and weighed. A pycnometer can be used to gravimetrically determine density of fluids, and density of non-soluble solids. The current pressurized mud balance could be considered a pycnometer. With an electronic balance or a triple beam balance to weigh material, the beam on the pressurized mud balance is not needed.

Pycnometers can be made by removing the beam from a pressurized mud balance, may be ordered special from the pressurized mud balance manufacturer, or may be machined to specifications in a machine shop.

Procedure of Using a Pycnometer to Determine Mud Weight

1. Weigh clean, dry pycnometer
2. Fill pycnometer with distilled water
3. Measure temperature of water
4. Pressurize pycnometer to about 300 psig using a hand held pump filled with water
5. Re-weigh pycnometer
6. Determine weight of water in pycnometer – (subtract weight of pycnometer from weight of pycnometer and water)
7. Calculate volume of pycnometer by dividing the weight of water by the density of water at the measured temperature.
8. Dry, clean, and reweigh pycnometer
9. Fill pycnometer with drilling fluid
10. Pressurize by pumping drilling fluid into pycnometer to a pressure near 300 psi
12. Determine weight of drilling fluid in pycnometer by subtracting empty weight from pressurized weight.
13. Calculate density of drilling fluid by dividing weight of drilling fluid sample by volume of pycnometer determined in step 7. Convert density to pounds per gallon by multiplying by 8.345.
Procedure for determining low-gravity solids concentration in a water-base drilling fluid

The water in a water-base drilling fluid may be removed with either a retort or an oven. In either case, the density of the solids in the fluid must be determined by heating the solids (drilled solids and weighting agent) in the same devise.

Procedure using an Oven for drying sample:

1. Determine the density of the drilling fluid with the pycnometer as previously described.
2. Weigh a metal or heat-resistant glass dish.
3. Add a quantity of drilling fluid into the metal or heat-resistant glass dish and weigh
4. Determine the weight of the drilling fluid by subtracting the weight of the container from the weight of the container and the drilling fluid
5. Determine the volume of drilling fluid by dividing the sample weight by the density of the drilling fluid
6. Dry the drilling fluid in an oven at 250°F for at least four hours. Organic material can be eliminated by heating the solids to 1000°F for four hours in a muffle furnace. Weigh remaining solids after cooling container.
7. Add the solids to the clean dry pycnometer and weigh
8. Subtract the weight of the pycnometer from the weight of the solids and the pycnometer to determine the weight of solids.
9. Slowly add a small amount of water to the pycnometer and stir gently to wet all solids and remove as much air as possible.
10. Fill pycnometer with water and pressurize with water to about 300psi
11. Weigh pressurized pycnometer containing the water.
12. Subtract the weight of the dry solids and pycnometer (step 7) from the weight of the pressurized water, solids, and pycnometer to determine weight of water added.
13. From standard temperature charts determine the density of water in the pycnometer
14. Divide the weight of water added (step 12) by the density of water (step 13) to determine the volume of water added.
15. Subtract the volume of water added (step 14) from the volume of the pycnometer (previously determined) to determine the volume of solids in the pycnometer.
16. Divide the weight of solids in pycnometer (step 8) by the volume of solids (step 9) to determine the density of solids in pycnometer.
17. Determine the volume percent low gravity solids from the equation:

\[ V_{lg} = \frac{100 \left( \rho_b - \rho_s \right)}{\left( \rho_b - \rho_{lg} \right)} \]  

Where \( \rho \) is the density; \( b \) indicates barite, \( lg \) indicates low-gravity solids, and \( s \) indicates solids.
Work Group Revision of RP 13J Completion Brine Test Report Form met June 26, 2001, at the 78th Summer Standardization Conference on Oilfield Equipment and Materials at the Hyatt Regency, Calgary, Alberta. Three Members and thirteen Guests were in attendance. The session was chaired by Paul Javora. The secretary was Joel F. Carpenter.

The minutes from the Feb. 12, 2001, Fort Worth Meeting and the Mar. 12, 2001, Houston meeting were approved without comment.

Two tasks have been charged to the work group:
1. Development of Brine Report Form
2. Revising RP 13J

**pH Method for Brines.**

The results from the pH round robin testing were reviewed by Joel Carpenter. The following conclusions were reached and included in a copy of the revised method issued on April 5.

- The standard pH method will be run using neat brine, or, optionally, brine diluted 1:1 with deionized water.
- The practice of diluting the brine 10:1 with deionized water is not recommended for inorganic brines (e.g., calcium chloride, sodium bromide) as it leads to excessive inter-laboratory variability. For organic brines (e.g., cesium acetate, potassium formate), the need to assess buffer capacity may require the testing of pH at these higher dilutions.
- The pH of deionized water used for dilution has little impact on the measured pH value, so its neutralization is not required.
- Only glass electrode probes will be covered by this method. Solid state Ion Selective Field Effect Transistor probes (as shown by the M-I data) give consistently low values. These probes are also restricted to temperatures below 120°F. A note was included in the revised method highlighting these points, prescribing glass electrodes only, detailing the advantages of ISEFT probes, and indicating that further evaluation is needed.

The following action items were agreed upon:
- Carpenter will draft a second revision on the method to include a note allowing 10:1 dilutions for organic brines, and suggesting that further study is required. This will be circulated for comment, to be returned July 17th.
- Magri/Benton will test the dilution effects on pH of blends of potassium/cesium formate brines
- Magri/Benton will determine the best assay for determining buffering capacity of organic brines. These include Garret Gas train / pH and Garret gas train / titration. Baroid volunteered to assist in this effort.

**Test Report Form**

The Work Group agreed to have the Brine Test Report Form formatted to letter-sized paper (8 ½” by 11”) to make it easy to file. The fact that it may take two pages is NOT a concern. The vote was three to zero in favor of this proposal.

**Next Meeting**

The next meeting of the Work Group will be July 24th at 1 pm at the offices of Westport in Houston. The meeting was adjourned, as proposed by Benton and seconded by Shumate.

These minutes are respectfully submitted by Joel F. Carpenter, Secretary.
Work Group Brine Report Form of 13 J - Tuesday, March 12, 2001, Minutes

Work Group 13J Revision of RP 13J Completion Brine Report Form met March 12, 2001 at the Houston Sales office of OSCA. 6 Members and 1 Guest were in attendance. The session was chaired by Paul Javora. The secretary was Joel F. Carpenter.

The minutes from the 2/12/2001 Fort Worth Meeting were reviewed without comment.

Two tasks have been charged to the work group:
1. Development of Brine Report Form
2. Revising RP 13J

pH Determination.

Procedures for measuring pH are not universal across industry. A range of pH probes, dilution factors, and quality of dilution DI waters are used. To develop a common method, industry was surveyed, a common procedure drafted based on RP 13 B1 Section 9, a round robin conducted, and the data collated. Albemarle, Baroid, BHI, DSB, Cabot/Westport, M-I, OSCA, Tetra participated in this program. This was a follow up meeting to further review this data and determine next steps. The following conclusions were drawn by the work group:

- The standard pH method will be run using neat brine, or optionally brine diluted 1:1 with deionized water.
- The practice of diluting the brine 10:1 with deionized water is not recommended as it leads to excessive inter-laboratory variability.
- The deionized water has little impact on the measured pH value, so its neutralization is not required.
- Only glass electrode probes will be covered by this method. Solid state Ion Selective Field Effect Transistor probes (as shown by the M-I data) gave consistently low values. A note will be included in the method highlighting this point, prescribing glass electrodes only, detailing the advantages of ISEFT probes, and indicating that further evaluation is needed.

The work group reviewed the method line-by-line, and Carpenter agreed to incorporate these changes into a final draft method. He also agreed to provide graphic depiction of the data as a difference from the average value. Both of these are provide along with these minutes.
# Task Group 6 - Testing of Heavy Brines

## Work Group - Revision of RP 13J Completion Brine Report Form

<table>
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*June 21, 2001*

Work Group 13J Revision of RP 13J Completion Brine Report Form met February 12, 2001 at the Worthington Hotel in Fort Worth. Two Members and thirteen Guests were in attendance. The session was chaired by Paul Javora. The secretary was Joel F. Carpenter.

The minutes from the 12/5/2000 meeting were reviewed without comment.

Two tasks have been charged to the work group:
1. Development of Brine Report Form
2. Revising RP 13J

1. Development of a Brine Report Form

Art Starlipped and Mike Shaw head the effort to develop a brine report form. The purpose of this form is to create a standard reporting system to account for brine properties and quality. Essentially, this new report form is an adaptation of the API mud report form. The following actions were agreed upon:

- **Format.** It was decided that the report form could be expanded to two, standard-sized pages, instead of limited to one, legal-sized page. This would make the form more readable, and more easily filed.

- **Model Report Form.** BHI has developed their own brine report form. Hulett Evans agreed to forward a copy to Paul Javora for further consideration.

- **Density.** There is a push to report the density of brines at 60 F, not 70 F as is currently prescribed in the Recommended Practice 13J.

- **Drill-In Fluids.** A second form will be prepared that will address the properties of brine-based drill-in fluids.

- **Additional Parameters.** The following additional parameters are under consideration to include in this form:
  ✓ Viscosity
  ✓ Static Sheen
  ✓ Oil & Grease
  ✓ NDPES Discharge Information
  ✓ Water Depth
  ✓ Solids Content

Tom Jones (BHI) agreed to join the Brine Report Form Work Group.

Reports were also given by Work Groups on Iron Contamination and pH Measurement. Both of these areas requires significant developmental work.
• **Iron Contamination.** Insoluble iron salts can cause formation damage. Therefore, quantifying iron in a brine is critical. A field test is being developed that involves thiocyanate complex formation and colormetric quanitation. The round-robin results indicate agreement with the data as determined by Atomic Absorption. Earlier work focused on using a Hach Chemets assay. This failed to give reasonably accurate results in brines containing ZnBr2. Mike Freeman (M-I) will be resigning his leadership position in this effort, as he now has different responsibilities at his place of employment.

• **pH Determination.** Procedures for measuring pH are not universal across industry. A range of pH probes, dilution factors, and quality of dilution DI waters are used. To develop a common method, industry was surveyed, a common procedure drafted based on RP 13 B1 Section 9, a round robin conducted, and the data collated. Albemarle, Baroid, BHI, DSB, Cabot/Westport, M-I, OSCA, Tetra participated in this program. A follow up meeting will be held at the Houston offices of OSCA to further review this data and determine next steps. Joel Carpenter and Sandra Berry (OSCA) headed this effort.

### 2. Revision of Recommended Practice 13J

API mandates that Recommend Practices be reviewed each five years to ensure their relevance to current practices. The Work Group has embraced this and is considering adapting methods from RP 13B-1, RP 13B-2, and RP 13I for addition to RP 13J.

Minutes respectfully submitted
Joel F. Carpenter
13 J Round Robin on pH

API Meeting 6/01

Joel F. Carpenter, Albemarle
Paul Javora, OSCA
Update on Progress

- Telephone Survey of Parties (Fall/00)
- Drafted Method Based on RP 13B Section 9
- Identified and Sampled Participants (12/00)
- Reviewed Round Robin Data (3/12/01 - 4/5/01)
- Refined Method, Circulated, Solicited Comments (4/6/01)
- Finalize Method and Submit for Ballot (6/01)
Conclusions of Round Robin

- Impact of DI Water pH insignificant
- ISFET pH probe gives "different" results (M-I data)
- Best Precision with 1:1
- Operationally, Neat (undiluted) tactic most attractive
Neat Deviation from Average

![Graph showing pH deviation from average for different samples and conditions. The x-axis represents different samples (Alb, Baroid, Cabot, INTEQ, M-I, OSCA, Tetra), and the y-axis represents pH deviation from the average pH. The graph includes lines for NaCl, Zn/CaBr2, KFormate, NaBr, NaFormate, CaBr2, NaFormate(1.36), CsFormate, 13.9 Brine, and 15.6 Brine.]}
1:1 Deviation from Average

The graph illustrates the deviation of pH from the average pH for various samples. The x-axis represents different chemical compounds including NaCl, Zn/CaBr2, KFormate, NaBr, NaFormate, CsFormate, CaBr2, NaFormate(1.36), and CaCl2. The y-axis shows the pH deviation range from -1.5 to 1.5. The data points are plotted for each compound, showing how they differ from the average pH value.
1:10 Deviation from Average
Comments on Revised Method

- Necessary for an extended equilibration time (15 min) for high zinc solutions - Baroid
- Cross reference with 13l's pH method - Cabot
- Meaningfulness of pH readings in high ionic strength solution? - Cabot, Texaco
  ▶ Design parameters of electrodes
  ▶ Relative vs Absolute values
Next Steps

- Ballot
- Review Comments
- Issue


1 pH Testing Brine Fluids

1.1 DESCRIPTION

Field measurement of brine fluid pH and adjustments to the pH are fundamental to fluid control. Solubility of various components and contaminants and effectiveness of additives can be dependent on pH, as is the control of acidic and sulfide corrosion processes.

pH is a thermodynamic value equal to the negative logarithm of the hydrogen ion, H⁺, activity in aqueous solutions.

\[ \text{pH} = -\log [\text{H}^+] \]

Activity and concentration are equal only in very dilute solutions. Oilfield brines are not dilute solutions but are comprised of highly concentrated salts in solution. Consequently the measured pH value should be used in a relative sense, and the changes in pH are more useful than the absolute values.

For pure water at 75°F (24°C), the hydrogen ion activity [H⁺] is 10⁻⁷ moles/liter and pH = 7. This system is termed neutral because the hydroxyl ion activity [OH⁻] is also 10⁻⁷ moles/liter. In aqueous systems at 24°C the ion product, [H⁺] x [OH⁻], is 10⁻¹⁴ (a constant). Consequently, an increase in [H⁺] denotes a like decrease in [OH⁻]. A change in pH of one unit indicates a ten-fold change in both [H⁺] and [OH⁻]. Solutions with pH less than 7 are termed acidic, and those with pH greater than 7 are termed basic or alkaline.

The recommended equipment for pH measurement of brine fluid is with a glass electrode pH meter. This method is accurate and gives reliable pH values, being free of interferences if a high-quality electrode system is used with a properly designed instrument. Rugged pH instruments are available that automatically temperature-compensate the slope and are preferred over the manually adjusted instruments.

Note: Color matching pH paper and sticks are not recommended.

1.2 EQUIPMENT

The following equipment is needed:

a. pH meter millivolt range potentiometer calibrated to show pH units for measuring the potential between a glass-membrane electrode and a standard "reference" electrode. The instrument is (preferred) to be water-, shock-, and corrosion-resistant, and portable. Specifications are as follows:

1. The pH range: 0 to 14.
2. Electronics type: solid state (preferred).
3. Power source: batteries (preferred).
4. Operating temperature range: 32°F-150°F (0°C-66°C).
5. Readout: digital (preferred).
6. Resolution: 0.1 pH unit.
7. Accuracy: ±0.1 pH unit.
8. Repeatability: ±0.1 pH unit.
9. Adjustments
   (a) Temperature compensation of electrode system.
   (b) Slope of electrode system (preferred).
   (c) Calibration setting of readout. (An instrument with the preceding internal temperature
compensation is preferred.)

b. Electrode system: A combination system of a glass electrode for sensing H+ ions and a standard-voltage reference electrode, constructed as a single electrode is preferred. The body of this probe should be constructed of durable material. A waterproof connection to the meter is recommended.

*Note: The use of solid state ion selective field effect transistor electrodes (ISFET) is not addressed in this method. The perceived advantages of these probes include hardness, no requirements to keep moist, and shock resistance. One set of measurements using a specific ISFET probe resulted in lower pH values. We recommend that the use of these electrodes be evaluated further.*

c. Buffer solutions: three solutions to calibrate and set the slope of the pH meter prior to sample measurement.
1. The pH = 4.0: potassium hydrogen phthalate at 0.05 molar in water. Gives 4.0 pH at 75°F (24°C).
2. The pH = 7.0: potassium dihydrogen phosphate at 0.02066 molar and disodium hydrogen phosphate at 0.02934 molar in water. Gives 7.0 pH at 75°F (24°C).
3. The pH = 10.0: sodium carbonate at 0.025 molar and sodium bicarbonate at 0.025 molar in water. Gives 10.01 pH at 75°F (24°C).

*Note: Buffers may be obtained from supply houses as pre-made solution, dry powder packages, or a given formula, but must duplicate National Bureau of Standards primary or secondary buffers. Shelf life to all buffers is not to exceed the manufacturer’s recommendation or six months after opening. The date of preparation of buffer should be shown on bottles used in the field. Bottles should be kept tightly sealed.*

d. Distilled or deionized water, preferably in a spray bottle.

e. Soft tissues to blot electrodes.

f. Temperature sensing device (e.g., thermometer: 32°F-220°F (0°C-150°C)).

g. Precise volumetric measuring device, 10 mL suggested.

h. Beaker, 50-mL recommended.

i. Recommended accessory equipment:
1. Blotting tissue or soft-bristle test tube brush to clean electrode.
2. Mild liquid detergent: Ivory® or equivalent.
3. Electrode storage vial to keep electrodes moist.
4. Sodium hydroxide: 0.1 molar (approximately) to recondition electrode.
5. Hydrochloric acid: 0.1 molar (approximately) to recondition electrode.

1.3 PROCEDURE - pH MEASUREMENT

Proceed as follows to measure pH:

a. Obtain a sample of the fluid to be tested.
   i. To prepare a neat (undiluted) sample, put 20 mL of the brine into a clean, dry, beaker or equivalent. Stir thoroughly. Allow it to reach 75±5°F (24±3°C).
   ii. Optional sample preparation method: 1 : 1 Dilution. Put 10.0 mL of deionized water into a clean, dry, 50-mL beaker or equivalent. Add 10.0 mL of the sample, mix thoroughly. Allow it to reach 75±5°F (24±3°C).
Note: Dilutions of the sample 1:10 in deionized water is not permitted. This leads to unacceptably imprecise results.

b. Allow the buffer solution to also reach the same temperature as the fluid to be tested.

Note: For accurate pH measurement the test fluid, buffer solution, and reference electrode must all be at the sample temperature. The pH of the buffer solution indicated on the container label is the correct pH only at 75°F (24°C). If one is attempting to calibrate at another temperature, the actual pH of the buffer at this temperature must be used. Tables of buffer pH values at various temperatures are available from the suppliers and should be used in the calibration procedure.

c. Clean the electrodes by washing them with distilled water, and blot dry.

Note: Steps d. through k. provide a generalized calibration procedure for the pH meter. If the pH meter manufacturer has provided an alternative calibration procedure, please follow their method instead.

d. Place the probe into the pH 7.0 buffer.

e. Turn on the meter, wait 60 seconds for the reading to stabilize (See 1.5, Item a if the meter reading is not stable).

f. Measure the temperature of pH 7 buffer solution.

g. Set this temperature on the temperature knob if relevant.

h. Set the meter reading to 7.0 using the calibration knob.

i. Rinse the probe with distilled water and blot it dry.

j. Repeat the operations in 1.3, PROCEDURE - pH MEASUREMENT. Items d through i, using either a pH 4.0 or pH 10.0 buffer. Use pH 4.0 if an acidic sample is to be tested or pH 10.0 if an alkaline sample is to be tested. Set the meter to number 4.0 or 10.0 respectively, using the slope adjustment knob. (If no slope knob exists, use the temperature knob to set 4.0 or 10.0 on the meter.)

k. Check the meter with the pH 7 buffer again. If it has changed, reset it to 7.0 with the calibration knob. Repeat Items c through k. If the meter does not calibrate properly, recondition or replace the electrodes as given in 1.5, PROCEDURE - CARE OF THE ELECTRODE.

Note: Discard daily the buffer solutions used in calibration. The meter should be fully calibrated every day, as in Items b through k, using two buffers. Check with the pH 7 buffer every three hours.

l. If the meter calibrates properly, rinse the electrode with distilled water, and blot it dry. Place the electrode in the sample to be tested and stir gently. Allow 60 seconds to 90 seconds for the reading to stabilize.

m. Record the sample pH to the nearest 0.1 pH unit and the temperature of the sample tested on the brine report form.

n. Carefully clean the electrode in preparation for the next usage. Store in a vial of pH 4 buffer or as recommended by the probe manufacturer. NEVER let the probe tip become dry.

o. Avoid storing the instrument at extreme temperatures [e.g. below 32°F (0°C) or above 120°F (49°C)].

1.4 PRECISION STATEMENT
For neat brine systems, the interlaboratory reproducibility (standard deviation) of this pH assay was shown to range between 0.1 and 0.4 pH units dependent on the type of brine being evaluated. A spectrum of pH probes were used in the round robin exercise and is most likely responsible for the observed deviations.

Similarly, for the 1:1 dilute brine systems the interlaboratory reproducibility (standard deviation) of this pH assay was shown to range between 0.1 and 0.4 pH units dependent on the type of brine being evaluated.

1.5 PROCEDURE - CARE OF THE ELECTRODE

To care for the electrode. Follow this procedure:

a. Cleaning the electrode will be necessary periodically, especially if oil or clay particles coat the face of the glass electrode. Clean the electrode with a blotting tissue or soft-bristle brush and a mild detergent.

b. Reconditioning the electrode may be necessary if plugging becomes severe, as indicated by slow response, drifting of readings or if the slope and calibration cannot be mutually set.

c. Check the owners manual of the electrode to determine the best procedure for reconditioning it. Generally, one can recondition the electrode by soaking it for 10 minutes in 0.1 M HCl, followed by rinsing in water and soaking for 10 minutes in 0.1 M NaOH, and rinsing it again.

d. Check the electrode for response by performing a calibration (see 1.3, PROCEDURE - pH MEASUREMENT, Items b through k).

e. Replace the electrode system if the preceding steps fail to recondition it.
7.4 ANALYSIS OF BINGHAM PLASTIC MODEL DATA

7.4.1 Very few fluids actually follow the Bingham plastic model over the shear rate range of interest, but the empirical significance of the constants has become so firmly entrenched in drilling fluid technology that the yield point \( (\tau_y) \), in lb/100 ft², and plastic viscosity \( (\eta) \) in cP, are two of the best known properties of drilling fluids. They are calculated from the standard concentric cylinder viscometer (see Par. 6.2) readings at 600 rpm and 300 rpm \( (R_{600} \text{ and } R_{300}) \) as follows:

\[
\eta = PV = R_{600} - R_{300} \quad (23)
\]

\[
\tau_y = YP = R_{300} - PV \quad (24)
\]

7.4.2 The average velocity of a drilling fluid in the pipe is determined by the use of the formula:

\[
V_p = \frac{0.408 Q}{D^2} \quad (25)
\]

Where:

\( V_p \) = average velocity of the fluid in the pipe (ft/sec)
\( Q \) = volumetric flow rate (gal/min)
\( D \) = inner diameter of pipe (in)

7.4.3 In the annulus, the average velocity is determined by:

\[
V_a = \frac{0.408 Q}{D_2^2 - D_1^2} \quad (26)
\]

Where:

\( V_a \) = average velocity of the fluid in the annulus (ft/sec)
\( D_1 \) = inner annulus diameter (in)
\( D_2 \) = outer annulus diameter (in)

7.4.4 An explicit expression for shear rate at the pipe wall as a function of velocity cannot be derived from the Bingham equation; but in a pipe of diameter \( (D) \), the effective viscosity can be approximated by:

\[
\mu_e = \frac{6.65 \tau_y D}{V_p} + \eta \quad (27)
\]

Where:

\( \tau_y \) = yield stress (lb/100 ft²)
\( \eta \) = plastic viscosity (cP)

7.4.5 In the annulus, the effective viscosity can be approximated by:

\[
\mu_e = \frac{5.45 \tau_y (D_2 - D_1)}{V_a} + \eta \quad (28)
\]

Note: In the above equation, the constant 5.45 is true only for a \( D_1/D_2 \) ratio of 0.5 but varies only slightly from 5.49 to 5.43 over a range of diameter ratios from 0.3 to 0.9.12

7.5 MATHEMATICAL ANALYSIS OF POWER LAW DATA

The rheological parameters \( n \) and \( K \) can be calculated from any two shear rate-shear stress data points. Since it is rare that a log-log plot of all rheological data will be a straight line, it is better to determine \( n \) and \( K \) at the shear rates that exist inside a pipe and in an annulus. Better accuracy will result from the use of \( n \) and \( K \) in the 5 to 200 sec⁻¹ shear rate range for the annulus and in the 200 to 1000 sec⁻¹ shear rate range for inside pipe.

The viscometer dial readings from a standard six-speed instrument can be used to determine the power law constants. Normal practice is to use the 3-rpm and 100-rpm readings for the low shear rate range and the 300-rpm and 600-rpm reading for the high shear rate range. If a two-speed instrument is being used, the 100-rpm reading can be estimated from the 300-rpm and 600-rpm data by use of the equation:

\[
R_{100} = R_{300} - \frac{2 (R_{600} - R_{300})}{3} \quad (29)
\]

Where:

\( R_{100} \) = Fann viscometer reading at 100 rpm
\( R_{300} \) = Fann viscometer reading at 300 rpm
\( R_{600} \) = Fann viscometer reading at 600 rpm

7.5.1 The general formulas for \( n \) and \( K \) are:

\[
n = \frac{\log(\tau_2/\tau_1)}{\log(\eta_2/\eta_1)} \quad (30)
\]

\[
K = \frac{\tau_2}{\eta_2^n} \quad (31)
\]

Where:

\( n \) = power law exponent
\( K \) = fluid consistency index (dyne sec/cm²)
\( \tau_1 \) = shear stress at shear rate 1
\( \tau_2 \) = shear stress at shear rate 2
\( \gamma_1 \) = shear rate 1
\( \gamma_2 \) = shear rate 2

7.5.2 Using data obtained at 600 rpm and 300 rpm, the parameters to be used for inside pipe calculations are:

\[
n_p = \frac{\log(R_{600}/R_{300})}{\log(1022/511)} = 3.32 \log \frac{R_{600}}{R_{300}} \quad (32)
\]

\[
K_p = \frac{5.11 R_{300}}{511^n} \text{ or } \frac{5.11 R_{600}}{1022^n} \quad (33)
\]

12Refer to Reference 22.
7.5.3 Using data obtained at 100 rpm and 3 rpm, the parameters to be used for inside pipe calculations are:

\[
\eta_s = \frac{\log(R_{100}/R_3)}{\log(170.2/5.11)} = 0.657 \log \left( \frac{R_{100}}{R_3} \right) \tag{34}
\]

\[
K_s = \frac{5.11 R_{100}}{510.2^n} \text{ or } \frac{5.11 R_3}{(510.2)^n} \tag{35}
\]

7.5.4 Using data obtained at 100 rpm and 3 rpm, the parameters to be used in calculating settling velocities are:

\[
\eta_s = 0.657 \log(R_{100}/R_3) \tag{36}
\]

\[
K_s = \frac{5.11 R_{100}}{170.2^n} \text{ or } \frac{5.11 R_3}{(510.2)^n} \tag{37}
\]

Where:

- \( V_s \) = average settling velocity (ft/sec)
- \( D_p \) = effective particle diameter (in)

7.5.5 The general power law equation for effective viscosity (cP) is:

\[
\eta_e = 100 K \gamma^{n-1} \tag{38}
\]

7.5.6 The effective viscosity (cP) in a pipe is:

\[
\eta_p \mu_p = 100 K_p \left( \frac{96 V_p}{D} \right)^{n_p-1} \left( \frac{3n_p + 1}{4n_p} \right)^{n_p} \tag{39}
\]

7.5.7 The effective viscosity (cP) in an annulus is:

\[
\eta_a = 100 K_a \left( \frac{144 V_a}{D_a - D_1} \right)^{n_a-1} \left( \frac{2n_a + 1}{3n_a} \right)^{n_a} \tag{40}
\]

7.5.8 The effective viscosities \( \eta_a \) and \( \eta_a \) can be used to determine pressure losses as outlined in Section 8.

7.5.9 The effective viscosity (cP) of fluid surrounding a settling particle is:

\[
\eta_s = 100 K_s \left( \frac{12V_s}{D_p} \right)^{n_s-1} \tag{41}
\]

7.5.10 The effective viscosity (\( \mu_a \)) can be used to determine settling velocities as outlined in Section 9.

7.6 EFFECTS OF TEMPERATURE AND PRESSURE ON VISCOSITY

7.6.1 Temperature Effect

As the temperature increases, the effective viscosity decreases. The temperature effect\(^{13}\) is described mathematically as:

\[
\eta(T) = \eta(T_1) \exp \left[ \beta \left( \frac{T_2 - T_1}{T_1 T_2} \right) \right] \tag{42}
\]

Where:

- \( \eta(T_2) = \) effective viscosity at temperature 2
- \( \eta(T_1) = \) effective viscosity at temperature 1
- \( T_1 = \) absolute temperature 1
- \( T_2 = \) absolute temperature 2
- \( \beta = \) temperature constant

This approximation holds until a thermal decomposition or transition point of any component of the drilling fluid is reached. Above this temperature, the fluid flow properties do not follow any mathematical model. The temperature constant, \( \beta \), must be determined at each shear rate for each drilling fluid. As a general rule, the temperature effect is high for oil-based fluids containing asphalt, moderate for oil-based fluids with oil-wet inorganic solids as viscosifiers, and low for water-based fluids.

7.6.2 Pressure Effect

As the pressure increases, the effective viscosity increases. The pressure effect is described mathematically as:

\[
\eta_p = \eta_p \exp \left[ \alpha (P_2 - P_1) \right] \tag{43}
\]

Where:

- \( \eta_p (P_2) = \) effective viscosity at pressure 2
- \( \eta_p (P_1) = \) effective viscosity at pressure 1
- \( \alpha = \) pressure constant
- \( P_1 = \) pressure 1
- \( P_2 = \) pressure 2

The pressure constant, \( \alpha \), must be determined for each drilling fluid. For water-based fluids, the pressure effect on shear stress is extremely small and can be neglected. However, for oil-based fluids the pressure has an appreciable effect on the effective viscosity. As a general rule, the pressure effect is greater for oil-based fluids with asphaltic viscosifiers than for those that use oil-wet inorganic solids as viscosifiers.

Note: Absolute temperature is in degrees Rankine (460 + °F). Pressure is in psig.

7.6.3 Application

The use of viscosity measurements at surface conditions for calculating hydraulics may give erroneous results.\(^{14}\) For accurate work, the viscosity of the drilling fluid should be determined at the temperatures and pressures encountered in the well. To do this requires a high temperature-high pressure viscometer for data collection and a computer to analyze the data. However, corrections can be made to surface

\(^{13}\) Refer to Reference 22 and 23.

\(^{14}\) Refer to References 17 and 31.
8.2 FRICTION LOSS IN PIPE

8.2.1 Calculation of Reynolds Number

After obtaining the effective viscosity (μ<sub>ep</sub>) as a function of the operating shear rate at the pipe wall (γ<sub>ep</sub>), the Reynolds number in the pipe (N<sub>Rep</sub>) is calculated from:

\[ N_{Rep} = \frac{928 V_p D \rho}{\mu_{ep}} \]  \hfill (44)

Note: μ<sub>ep</sub> can be calculated according to Eq. 39.

8.2.2 CALCULATION OF THE FRICTION FACTOR

a. If the Reynolds Number is less than or equal to 2100, the friction factor in the pipe is:

\[ f_p = \frac{16}{N_{Rep} N_{Rep}} \]  \hfill (45)

b. If the Reynolds Number is greater than 2100, the friction factor can be estimated from:

\[ f_p = \frac{a}{{(N_{Rep})}^b} \]  \hfill (46)

Where:

\[ a = \sqrt{\log \left( \frac{1000}{D} \right)} \times 3.93 \] \hfill \[
\frac{50}{b = \sqrt{1 - \log \left( \frac{1000}{D} \right)}} \times 7 \]

8.2.3 Calculation of Friction Loss Pressure Gradient in Drill Pipe

The appropriate friction factor, which is dimensionless, is then substituted into the Fanning equation to obtain the friction loss pressure gradient:

\[ P_{f/L_m} = \frac{f_p V_p^2 \rho}{25.81 D} \]  \hfill (47)

Where:

\[ L_m = \text{Length of drill pipe (ft)} \]

Note: Reynolds Number and friction loss must be calculated for each section of pipe having different inside diameters.

8.3 FRICTION LOSS IN AN ANNULUS

8.3.1 Calculation of Reynolds Number

The Reynolds Number in the annulus is calculated from the following equation:

\[ N_{Rep} = \frac{928 V_a (D_2 - D_1) \rho}{\mu_{ep} \mu_{eq}} \]  \hfill (48)

Note: μ<sub>ep</sub> can be calculated according to Eq. 40.

8.3.2 Calculation of the Friction Factor

a. If the Reynolds Number is less than or equal to 2100, the friction factor in the pipe is:

\[ f_a = \frac{24}{D_{Re}} N_{Rea} \]  \hfill (49)

b. If the Reynolds Number is greater than 2100, the friction factor can be estimated from:

\[ f_a = \frac{a}{{(D_{Rea})}^b} \]  \hfill (50)

Where:

\[ a = \frac{(\log \left( \frac{1000}{D_1} \right) + 3.93) \times 50}{b = (1.75 - \log \left( \frac{1000}{D_1} \right)) \times 7} \]

8.3.3 Calculation of the Friction Loss Pressure Gradient

The appropriate friction factor is then substituted in the Fanning equation for an annulus to obtain the friction loss pressure gradient (P<sub>f/L</sub>) in lb/in<sup>2</sup>/ft:

\[ P_{f/L_m} = \frac{f_a V_a^2 \rho}{25.81 (D_2 - D_1)} \]  \hfill (51)

Note: Reynolds Number and friction loss must be calculated for each section of the annulus having different annular diameters.

8.3.4 Average Friction Loss Pressure Gradient

If more than one section of annulus is present, an average friction loss pressure gradient for the well is calculated by use of the following equation:

\[ \text{Ave } P_{f/L_m} = \frac{(P_{f/L_1} L_1 + (P_{f/L_2} L_2 + \ldots)}{L_m} \]  \hfill (52)

8.4 FRICTION LOSS IN BIT NOZZLES

The friction loss (P<sub>n</sub>) in bit nozzles (assuming a nozzle efficiency of 0.95) in lb/in<sup>2</sup> is calculated by use of the equation:

\[ P_n = \frac{156 \rho Q^2}{(D_{n_1}^2 + D_{n_2}^2 + \ldots) 2} \]  \hfill (53)

Where:

\[ \rho = \text{mud density (lb/gal)} \]
\[ Q = \text{volumetric flow rate (gal/min)} \]
\[ D_n = \text{diameter of bit nozzles (1/32 inch)} \]

14Refer to References 14, 19, and 27.

17Refer to Reference 28.
Since the length of drill collars is 600 ft, the friction loss in the drill pipe is:

\[
\frac{P_s}{L_m} = \frac{0.377}{(0.5428)(600)} = 32 \text{ lb/in}^2
\]  
(A-39)

c. Total friction loss in the drill collars is the sum of friction losses in the drill pipe and drill collars.

\[
\frac{P_s}{L_m} = \frac{929 + 325 + 1254}{325} = 282 \text{ lb/in}^2
\]  
(A-40)

A.13 Friction Loss Pressure Gradient in the Annulus \((P_s/L_m)\)

\[
\frac{P_s}{L_m} = \frac{f_s V^2 \rho}{25.81 (D_2 - D_1)}
\]  
(A-41)

a. Annulus section 1

\[
\frac{P_s}{L_m} = \frac{(0.0256)(1.98)^2 (12.5)}{25.81 (8.835 - 4.5)} = 0.0112 \text{ lb/in}^2/\text{ft}
\]  
(A-42)

The length of the annulus section 1 is 3000 ft. Therefore, the friction loss is:

\[
(P_s/L_m)(L_m) = (0.0112)(3000) = 34 \text{ lb/in}^2
\]  
(A-43)

b. Annulus section 2

\[
\frac{P_s}{L_m} = \frac{(0.0230)(2.20)^2 (12.5)}{25.81 (8.5 - 4.5)} = 0.0134 \text{ lb/in}^2/\text{ft}
\]  
(A-44)

The length of the annulus section 2 is 8400 ft. Therefore, the friction loss is:

\[
(P_s/L_m)(L_m) = (0.0134)(8400) = 113 \text{ lb/in}^2
\]  
(A-45)

c. Annulus section 3

\[
\frac{P_s}{L_m} = \frac{(0.0150)(3.81)^2 (12.5)}{25.81 (8.5 - 6.5)} = 0.0527 \text{ lb/in}^2/\text{ft}
\]  
(A-46)

The length of the annulus section 3 is 600 ft. Therefore, the friction loss is:

\[
(P_s/L_m)(L_m) = (0.0527)(600) = 32 \text{ lb/in}^2
\]  
(A-47)

d. Total friction loss in the annulus is the sum of friction losses in the three sections.

\[
P_s = 34 + 113 + 32 = 179 \text{ lb/in}^2
\]  
(A-48)

e. The friction loss pressure gradient for the entire annulus is the total friction loss divided by the total depth:

\[
P_s/L_m = \frac{179/12,000 = 0.0149 \text{ lb/in}^2/\text{ft}}
\]  
(A-49)

A.14 Friction Loss in the Bit Nozzles \((P_n)\)

\[
P_s = \frac{156 \rho Q^2}{(D_3^2 + D_2^2 + D_1^2)^2}
\]  
(A-50)

\[
P_s = \frac{(156)(12.5)(280)^2}{[(121) + (121) + (144)]^2} = 1026 \text{ lb/in}^2
\]  
(A-51)

A.15 Hydrostatic Pressure Gradient \((P_n/L)\)

\[
P_s/L = 0.052 \rho
\]  
(A-52)

\[
P_s/L = 0.052 (12.5) = 0.65 \text{ lb/in}^2/\text{ft}
\]  
(A-53)

A.16 Circulating Pressure Gradient \((P_c/L)\)

\[
P_c/L = P_s/L + P_r/L
\]  
(A-54)

\[
P_c/L = 0.65 + 0.0149 = 0.6649 \text{ lb/in}^2/\text{ft}
\]  
(A-55)

A.17 Equivalent Circulating Density \((\rho_c)\)

\[
\rho_c = 19.265 \frac{P_c/L}{P_c/L} = 19.265(0.6649) = 12.81 \text{ lb/gal}
\]  
(A-56)
APPENDIX B—SETTLING VELOCITY EXAMPLE CALCULATIONS

B.1 Well Information

a. Particle equivalent diameter, \( D_e = 0.5 \text{ in.} \)
b. Particle density, \( \rho_p = 22.5 \text{ lb/gal} \)
c. Mud density, \( \rho = 12.5 \text{ lb/gal} \)
d. Mud viscosity
   1. Fann viscometer reading at 100 rpm
      a. \( \tau = 20 \text{ lb/100 ft}^2 \)
      b. \( \gamma = 170.2 \text{ sec}^{-1} \)
   2. Fann viscometer reading at 3 rpm
      a. \( \tau = 3 \text{ lb/100 ft}^2 \)
      b. \( \gamma = 5.11 \text{ sec}^{-1} \)

B.2 Power Law Constants \( (n, \gamma) \)

\[
\begin{align*}
n & = 0.657 \log \left( \frac{R_{750}}{R_3} \right) \\
& = 0.657 \log (20/3) \\
& = 0.541 
\end{align*}
\] (B-1)

B.3 Fluid Consistency Index \( (K) \)

\[
\begin{align*}
K & = 5.11 \frac{R_{750}}{(170.2)^{0.541}} \\
& = 5.11 \frac{(20)/(170.2)^{0.541}} \\
& = 6.346 
\end{align*}
\] (B-2)

B.4 Initial Settling Shear Rate Estimate \( (\gamma_1) \)

Assume: \( \dot{V}_s = 1 \text{ ft/sec} \)
\[
\begin{align*}
\gamma_1 & = 12 \frac{\dot{V}_s}{D_p} \\
& = 12(1)/0.5 = 24 \text{ sec}^{-1} 
\end{align*}
\] (B-3)

B.5 Effective Viscosity \( (\mu_{\text{eff}}) \)

\[
\begin{align*}
\mu_{\text{eff}} & = 100 \left( \frac{K}{\gamma_1} \right) \\
& = 100 \left( \frac{6.346}{24(0.541)} \right) \\
& = 148 \text{ cP} 
\end{align*}
\] (B-4)

B.6 Settling Velocity First Approximation \( (V_s) \)

\[
\begin{align*}
V_s & = 0.01294 \left( \frac{\mu_{\text{eff}}}{\rho} \left( \frac{D_p}{\gamma_1} \right) \right) \\
& \times \left( \sqrt{1 + 17106.53 \frac{D_p}{\rho}} \left( \frac{\rho_e}{\rho} \right) \left( \frac{\mu_{\text{eff}}}{\mu_e} \right) \right) \\
& \times \left( \frac{1 + 17106.53 (0.5) \left( \frac{22.5}{12.5} \right) (0.5)(0.5)}{148} \right) \\
& = 0.808 \text{ ft/sec} 
\end{align*}
\] (B-5)

B.7 Second Settling Shear Rate Estimate \( (\gamma_2) \)

\[
\begin{align*}
\gamma_2 & = 12 \left( \frac{0.808}{0.5} \right) = 19.4 \text{ sec}^{-1} 
\end{align*}
\] (B-7)

B.8 Effective Viscosity \( (\mu_{\text{eff}}) \)

\[
\begin{align*}
\mu_{\text{eff}} & = 100(6.346)(19.4)^{0.341} \text{ cP} \\
& = 163 \text{ cP} 
\end{align*}
\] (B-8)

B.9 Settling Velocity Second Approximation \( (V_s) \)

\[
\begin{align*}
V_s & = 0.01294 \left( \frac{163}{0.5(12.5)} \right) \\
& \times \left( \sqrt{1 + 17106.53 (0.5) \left( \frac{22.5}{12.5} \right) (0.5)(0.5)} \right) \\
& \times \left( \frac{1 + 17106.53 (0.5) \left( \frac{22.5}{12.5} \right) (0.5)(0.5)}{163} \right) \\
& = 0.785 \text{ ft/sec} 
\end{align*}
\] (B-9)

B.10 Third Settling Shear Rate Estimate \( (\gamma_3) \)

\[
\begin{align*}
\gamma_3 & = 12 \left( \frac{0.785}{0.5} \right) = 18.8 \text{ sec}^{-1} 
\end{align*}
\] (B-10)

B.11 Effective Viscosity \( (\mu_{\text{eff}}) \)

\[
\begin{align*}
\mu_{\text{eff}} & = 100(6.346)(18.8)^{0.341} \text{ cP} \\
& = 165 \text{ cP} 
\end{align*}
\] (B-11)

B.12 Settling Velocity Third Approximation \( (V_s) \)

\[
\begin{align*}
V_s & = 0.01294 \left( \frac{165}{0.5(12.5)} \right) \\
& \times \left( \sqrt{1 + 17106.53 (0.5) \left( \frac{22.5}{12.5} \right) (0.5)(0.5)} \right) \\
& \times \left( \frac{1 + 17106.53 (0.5) \left( \frac{22.5}{12.5} \right) (0.5)(0.5)}{165} \right) \\
& = 0.782 \text{ ft/sec} 
\end{align*}
\] (B-12)

This numerical iteration method is repeated until the settling velocities of two successive calculations are equal. In the example in this Appendix, the third and fourth approximations are equal. The calculated settling velocity is 0.782 ft/sec.
APPENDIX A

Record of Meeting Attendance
**RECORD OF MEETING ATTENDANCE**

GROUP: API STANDARIZATION C/6 C13  CHAIRMAN: Cheryl Stark

MEETING: Drilling: completions Time: 8:30 AM Date: 6/22/01

**COMMITTEE MEMBERS SHOULD MAKE CHANGES TO THEIR PERSONAL RECORD ON THE ATTACHED ROSTER. VISITORS ADDING NAMES TO ROSTER WILL NOT AUTOMATICALLY BECOME MEMBERS OF THE COMMITTEE.**

Indicate BEFORE YOUR NAME if you are:

- (M) Member of the Committee in session
- (R) Representing a Committee Member (if so, state member’s name)
- (V) Visitor – ONLY voting members or their Representatives may vote
- (S) Staff

<table>
<thead>
<tr>
<th>NAME (Please Print)</th>
<th>COMPANY/PHONE or email</th>
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<tr>
<td>Mollie Melbouci</td>
<td>Aqualon Oilfield: <a href="mailto:mmelbouci@hrec.com">mmelbouci@hrec.com</a></td>
</tr>
<tr>
<td>Bruce Smiley</td>
<td>Aqualon Oilfield: <a href="mailto:bsmiley@hrec.com">bsmiley@hrec.com</a></td>
</tr>
<tr>
<td>Bell Weidehhausen</td>
<td>Hiba Specialty Chemicals - <a href="mailto:Bell@weidehhausen.com">Bell@weidehhausen.com</a></td>
</tr>
<tr>
<td>Bruce Hanshaw</td>
<td>Chemstarr: <a href="mailto:hanshaw@chemstarr.com">hanshaw@chemstarr.com</a></td>
</tr>
<tr>
<td>Brad Bellinger</td>
<td>API <a href="mailto:bellingerh@API.org">bellingerh@API.org</a></td>
</tr>
<tr>
<td>Neil Reeve</td>
<td>neil.p.t.m. <a href="mailto:reeve@opc.shell.com">reeve@opc.shell.com</a></td>
</tr>
<tr>
<td>Tom Shumate</td>
<td>Baroid: <a href="mailto:tom.shumate@halliburton.com">tom.shumate@halliburton.com</a></td>
</tr>
<tr>
<td>William Benton</td>
<td>Cabot Specialty Fluids: <a href="mailto:william.benton@cabot.corp">william.benton@cabot.corp</a></td>
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</table>

**THIS FORM MUST BE RETURNED TO THE API STAFF TO SATISFY LEGAL REQUIREMENTS**

**FOR API USE ONLY:**

- TOTAL COMMITTEE MEMBER ON ROSTER: 
- TOTAL API CORPORATE MEMBERS ON ROSTER: 
- TOTAL COMMITTEE MEMBERS PRESENT: 
- TOTAL API CORPORATE MEMBERS PRESENT: 
- API MEMBERS MEETING MAN DAYS:
<table>
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<tr>
<th>NAME (Please Print)</th>
<th>COMPANY/PHONE or email</th>
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<tr>
<td>Bob Miner</td>
<td>Shell</td>
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<td>Marty Smith</td>
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<tr>
<td>Marvin Pless</td>
<td>INTER Dr. Fluids</td>
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<tr>
<td>David Dino</td>
<td>Elements</td>
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<td>Westport Technology</td>
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<tr>
<td>Bob S. Herring</td>
<td>Integrity Ind</td>
</tr>
<tr>
<td>Mario Ferrari</td>
<td>LAMBERTI</td>
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<tr>
<td>Stephen Polnaszek</td>
<td>Texaco</td>
</tr>
<tr>
<td>Wayne Stewart</td>
<td>Phillips Drilling</td>
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<tr>
<td>Adelina Son</td>
<td>Champion Technologies</td>
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<tr>
<td>DeDe Ezrat</td>
<td>S. Aramco</td>
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<tr>
<td>Harry Dearing</td>
<td>OGS Laboratory</td>
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### June 2001 SUBCOMMITTEE 13 ROSTER

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<tr>
<th>COMPANY</th>
<th>MEMBER</th>
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<tr>
<td>BP</td>
<td>Cheryl Stark (O)</td>
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<tr>
<td>Texaco</td>
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<td>Baker Hughes Inteq</td>
<td>Ron Bland (M)</td>
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<td>Burleigh Consulting</td>
<td>Ray Burleigh (G)</td>
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<td>Tekrite</td>
<td>Ryen Caenn (G)</td>
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<tr>
<td>Rheox</td>
<td>David Dino (M)</td>
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<td>Ciba Specialties</td>
<td>Brian Dymond (M)</td>
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<td>Jack Estes (G)</td>
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<td>Saudi Aramco</td>
<td>Dodie Ezzat (O)</td>
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<td>Petroleum Eng. Int.</td>
<td>Steve Hennigan (G)</td>
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<tr>
<td>Hercules – Aqualon Div.</td>
<td>Herbert Juppe (M)</td>
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<td>Adelina Son (M)</td>
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<tr>
<td>Chevron</td>
<td>Keith Morton (O)</td>
<td></td>
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<tr>
<td>SKW Trostberg</td>
<td>Johann Plank (M)</td>
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<tr>
<td>Int’l Drilling Consultants</td>
<td>Leon Robinson (G)</td>
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<tr>
<td>Marathon</td>
<td>Paul Scott (O)</td>
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<td>Baroid</td>
<td>Tom Shumate (M)</td>
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<td>ExxonMobil</td>
<td>Marty Smith (O)</td>
<td></td>
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<tr>
<td>Phillips Petroleum</td>
<td>Wayne Stewart (O)</td>
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<td>Westport Technology Ctr.</td>
<td>John Toups (G)</td>
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<td>Tongliang Wang (O)</td>
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<td>Weintritt Consulting</td>
<td>Don Weintritt (G)</td>
<td></td>
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<tr>
<td>Chemstar</td>
<td>Paul Werler (M)</td>
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<tr>
<td>MI Drilling Fluids</td>
<td>Tim Wilkin (M)</td>
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**Total Manufacturers (M):** 9

**Total Operators (O) + General Interest (G):** 16

**13 Members needed for a Quorum**

Number of Members in Attendance: 18
RECORD OF MEETING ATTENDANCE

GROUP: C75C13/T63  CHAIRMAN: Ron Blenod
MEETING: 0:1 Mud Testing  TIME: 10:00 AM  DATE: 6/26/2001

COMMITTEE MEMBERS SHOULD MAKE CHANGES TO THEIR PERSONAL RECORD ON THE ATTACHED ROSTER. VISITORS ADDING NAMES TO ROSTER WILL NOT AUTOMATICALLY BECOME MEMBERS OF THE COMMITTEE.

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(R) Representing a Committee Member (if so, state member’s name)
(V) Visitor – ONLY voting members or their Representatives may vote
(S) Staff

<table>
<thead>
<tr>
<th>NAME (Please Print)</th>
<th>COMPANY/PHONE or email</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Ron Blenod</td>
<td>Brethnek INTEQ Oil Fluids  <a href="mailto:ron.blenod@brethnek.com">ron.blenod@brethnek.com</a></td>
</tr>
<tr>
<td>M Dave Dima</td>
<td>Ecomeva</td>
</tr>
<tr>
<td>M Tom Shumate</td>
<td>Baroid</td>
</tr>
<tr>
<td>M Marty Smith</td>
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<td>Champion Tech</td>
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<td>M John Toups</td>
<td>Westport Tech</td>
</tr>
<tr>
<td>V Harry Dearing</td>
<td>OGS Laboratory</td>
</tr>
<tr>
<td>V Bob G. Herring</td>
<td>Environment Inc</td>
</tr>
<tr>
<td>V Wayne Imparato</td>
<td>Casnam Inc.</td>
</tr>
<tr>
<td>V Keith Morton</td>
<td>Chevron</td>
</tr>
<tr>
<td>V Jim Berger</td>
<td>Fann</td>
</tr>
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<td>V Stephen Polnasek</td>
<td>Texaco</td>
</tr>
<tr>
<td>V Marvin Pless</td>
<td>INTEQ Oil Fluids</td>
</tr>
<tr>
<td>V Joel Carpenter</td>
<td>Alhambra</td>
</tr>
<tr>
<td>V Paul Javora</td>
<td>OSCA Inc.</td>
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<tr>
<td>M Larry Mitchell</td>
<td>OPT Testing</td>
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<tr>
<td>M Bob McNeil</td>
<td>Shell</td>
</tr>
<tr>
<td>V DODIE EZZAT</td>
<td>SARMCO <a href="mailto:ezzetam@rsarmco.com">ezzetam@rsarmco.com</a></td>
</tr>
</tbody>
</table>

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TOTAL API CORPORATE MEMBERS ON ROSTER: 
TOTAL COMMITTEE MEMBERS PRESENT: 
TOTAL API CORPORATE MEMBERS PRESENT: 
API MEMBERS MEETING MAN DAYS: 
Indicate BEFORE YOUR NAME if you are: C3/5C13/763

(M) Member of the Committee in session
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</tr>
</thead>
<tbody>
<tr>
<td>V JERRY REIMER</td>
<td>FarmInstrumetCompany <a href="mailto:JRaimer@Farin.com">JRaimer@Farin.com</a></td>
</tr>
</tbody>
</table>
## RECORD OF MEETING ATTENDANCE

**GROUP:** 13/5513/1634/WG1  
**CHAIRMAN:** Marty Smith  
**MEETING:** Oil Mud Chem. Analysis  
**TIME:** 1-3p  
**DATE:** 1/25/21

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<tbody>
<tr>
<td>√ Ben ARENT</td>
<td>SHELL TECHNOLOGY CENTER, HOUSTON</td>
</tr>
<tr>
<td>√ Karl Heizler</td>
<td>Clariant GmbH, Frankfurt, <a href="mailto:Karlheinz.heizler@clariant.com">Karlheinz.heizler@clariant.com</a></td>
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<tr>
<td>M Larry Mitchell</td>
<td>OPTI TESTING EQUIP, <a href="mailto:lmitchell@opti.com">lmitchell@opti.com</a></td>
</tr>
<tr>
<td>V Rick Lukay</td>
<td>OPTI TESTING EQ INC, <a href="mailto:rlukay@opti.com">rlukay@opti.com</a></td>
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<tr>
<td>√ James Imlah</td>
<td>CAVANAUGH EQUIPMENT SERVICES INC</td>
</tr>
<tr>
<td>V Jim Berger</td>
<td>FANN INSTRUMENT COMPANY, <a href="mailto:Jimberger@fann.com">Jimberger@fann.com</a></td>
</tr>
<tr>
<td>V Jerry Reiner</td>
<td>FANN INSTRUMENT COMPANY, <a href="mailto:Jreiner@fann.com">Jreiner@fann.com</a></td>
</tr>
<tr>
<td>V Bart van der Linden</td>
<td>SHELL INT. E&amp;P, B.H.J van der <a href="mailto:Linden@sep.shell.com">Linden@sep.shell.com</a></td>
</tr>
<tr>
<td>M Marvin Pless</td>
<td>INTEQ drilling fluids, <a href="mailto:marvin.pless@inteq.com">marvin.pless@inteq.com</a></td>
</tr>
<tr>
<td>V John Ewanek</td>
<td>MT LLC - <a href="mailto:jewanek@midf.com">jewanek@midf.com</a></td>
</tr>
<tr>
<td>V Larry J. Remont</td>
<td>MT LLC - <a href="mailto:lremont@midf.com">lremont@midf.com</a></td>
</tr>
<tr>
<td>V Bob C. Herring</td>
<td>Integrity Ind. - BCH/927 @Gateway.net</td>
</tr>
<tr>
<td>V Noel Carpenter</td>
<td>Alovmark - <a href="mailto:joel.carpenter@alovmark.com">joel.carpenter@alovmark.com</a></td>
</tr>
<tr>
<td>√ Paul Jaworski</td>
<td>OSCA Inc, <a href="mailto:pjaworski@OSCA.com">pjaworski@OSCA.com</a></td>
</tr>
<tr>
<td>M Ron Weintzmann</td>
<td>Weintzmann Consultants et al.</td>
</tr>
<tr>
<td>V William Beutin</td>
<td>CRAB Spec. Fluids, <a href="mailto:william.beutin@crab-corp.com">william.beutin@crab-corp.com</a></td>
</tr>
<tr>
<td>V David Dino</td>
<td>ELEMENTS - <a href="mailto:DAVID.DINO@ELEMENTS-USA.COM">DAVID.DINO@ELEMENTS-USA.COM</a></td>
</tr>
<tr>
<td>V Harry Deering</td>
<td>OAS Laboratory, <a href="mailto:haryd@oaslab.com">haryd@oaslab.com</a></td>
</tr>
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<tr>
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<td>Westport Technology</td>
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<td>Bob McNeil</td>
<td>Shell</td>
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<td>Halliburton</td>
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<td>M-I-L.C.</td>
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<td>Chevron</td>
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<td>Dodie Ezrat</td>
<td>ARM Co</td>
</tr>
<tr>
<td>Marty Smith</td>
<td>ExxonMobil</td>
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**RECORD OF MEETING ATTENDANCE**

**GROUP:** WG 6  **Testings of Henry, Barnes**
**CHAIRMAN:** P. JAVORA

**MEETING:** WG 13J  **TIME:** 4:00  **DATE:** 9/26/01

Committee Members should make changes to their personal record on the attached roster. Visitors adding names to roster will not automatically become members of the committee.

Indicate BEFORE YOUR NAME if you are:

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</thead>
<tbody>
<tr>
<td>v Neal Majri</td>
<td>Westport Technology/Neal.majri@westport.com</td>
</tr>
<tr>
<td>v Bob McNeil</td>
<td>Shell/rimenila@shell.com</td>
</tr>
<tr>
<td>m William Benton</td>
<td>CSF <a href="mailto:william.benton@cabot-corp.com">william.benton@cabot-corp.com</a></td>
</tr>
<tr>
<td>v Harry Drainie</td>
<td>OBS Laboratories/harryd@obslab.com</td>
</tr>
<tr>
<td>v Keith Horton</td>
<td>Chevron/keith.horton@chevron.com</td>
</tr>
<tr>
<td>v Jack C. Estes</td>
<td>Esters Consulting Corp/estersconsultinggroup@estesconsultinggroup.com</td>
</tr>
<tr>
<td>v Jim Berger</td>
<td>Fann Instrument Co./jberger@fann.com</td>
</tr>
<tr>
<td>v Jerry Reimer</td>
<td>Fann Instrument Company/jreimer@fann.com</td>
</tr>
<tr>
<td>v Bill Wernsman</td>
<td>Ciba Specialty Chemicals/bill.wernsman@dsbec.com</td>
</tr>
<tr>
<td>v Karl Hein Helfen</td>
<td>Clariant/Karl.helfen@clariant.com</td>
</tr>
<tr>
<td>v Bob G. Herring</td>
<td>Integrity Ltd./BCH/1997@integrity.net</td>
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<tr>
<td>v DODIE EPPER</td>
<td>S.ARAMCO</td>
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<tr>
<td>v Tom Shumate</td>
<td>Baroid/tom.shumate@halliburton.com</td>
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<td>Chemtura Technologies/adeline.sen@chemtura.com</td>
</tr>
<tr>
<td>m Paul H. Javora</td>
<td>OSAC Incorporated/PJavora@osacinc.com</td>
</tr>
<tr>
<td>m Joel Carpenter</td>
<td>Albemarle/joel.carpenter@albemarle.com</td>
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TOTAL API CORPORATE MEMBERS PRESENT:
API MEMBERS MEETING MAN DAYS:
## RECORD OF MEETING ATTENDANCE

**GROUP**: API 13D Revision SC 13 T67  
**CHAIRMAN**: KEITH MURTON  
**MEETING**: API 13D Revision  
**TIME**: 3:06  
**DATE**: 6/25/00

---

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<tbody>
<tr>
<td>TIM WILKIN</td>
<td>M-I L.L.C <a href="mailto:twelkin@null.com">twelkin@null.com</a></td>
</tr>
<tr>
<td>Tom Shumate (Terry Hemphill)</td>
<td>Baroid <a href="mailto:tom.shumate@bellinter.com">tom.shumate@bellinter.com</a></td>
</tr>
<tr>
<td>Harry Dearing</td>
<td>OSS Laboratory <a href="mailto:hperry@ogs106.com">hperry@ogs106.com</a></td>
</tr>
<tr>
<td>Paul Javorka</td>
<td>OSCA Box P <a href="mailto:Javorka@OSCA.com">Javorka@OSCA.com</a></td>
</tr>
<tr>
<td>Larry Mitchell</td>
<td>CFT Testing Group <a href="mailto:lmitchell@cft.com">lmitchell@cft.com</a></td>
</tr>
<tr>
<td>Marty Smith</td>
<td>ExxonMobil <a href="mailto:marty.v.smith@exxonmobil.com">marty.v.smith@exxonmobil.com</a></td>
</tr>
<tr>
<td>Ron Bland</td>
<td>Baker Hughes T&amp;TED Drilling Fluids <a href="mailto:rnb@bakerhughes.com">rnb@bakerhughes.com</a></td>
</tr>
<tr>
<td>David Dinn</td>
<td>ELEMENTO <a href="mailto:david.dinn@elemento.com">david.dinn@elemento.com</a></td>
</tr>
<tr>
<td>Jim Berger</td>
<td>FANN <a href="mailto:Jberger@FANN.com">Jberger@FANN.com</a></td>
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<tr>
<td>Jerry Reiner</td>
<td>FANN Instrument G <a href="mailto:JReiner@FANN.com">JReiner@FANN.com</a></td>
</tr>
<tr>
<td>Stephen Polnaszek</td>
<td>TEXACO <a href="mailto:polnaszek@TEXACO.com">polnaszek@TEXACO.com</a></td>
</tr>
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