API RP19B Section 1
Data: Food for Thought

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IPS 14-15
API RP19B Section 1 Data

- Overview of Section 1
- Concrete: Sand
- Registered Section 1 Data
- Discussion
API RP19B: Recommended Practices for Evaluation of Well Perforators
API RP 19B Timeline

API RP 43

API RP 19B
1st Edition November 2000
2nd Edition September 2006

API RP 19R
Witness Program May 2003
The ONLY test of a complete gun system: shot density and phasing

5000 psi Concrete Target
  - Briquette strength ≠ Target strength
  - Briquette strength much higher
  - Used only as a go-no go test

Minimum run 1000 charges

Aged 28 days
  - Target and charges

System test minimum 12 shots
2nd Edition—Section 1

Test Site

Gun positioned in target

Casing

Shot gun
Target Ready for API Witness

Target split open

Witness monitors and records data
## Typical API Data Sheet

**System Description**

**Shaped Charge Details**

**Target Details**

**Averages**
2nd Edition—Section 1

- Gun System test into a concrete target (16/30 frac sand, 1.2 to 0.6 mm) SPE 39457 (Brooks et al)

- Gun position important

- SPF & Phasing important

- Penetration & EH

![Penetration in Quartz Sand Target](image)
Concrete: Sand Effect
Sand Size Effect – 2 different gun systems
SPE 39457 (1998)

Penetration in Quartz Sand Target

- **RP19B Sand Range**
  - Penetration range tighter but could still be affected by sand

- **RP43 Sand Range**
  - Penetration could double by using fine sand which also has a higher UCS

Should be 99% Quartz
Registered Section 1 in Numbers

- 25 Registered Manufacturers
- 9 Chinese, 7 Russian, 6 North American, 1 German, Argentinian, Indonesian and Mexican
- 637 Registered Systems
- 462 Deep Penetrating, 142 Big Hole, 17 Good Hole, 6 Reactive shaped charges
- 589 Expendable Hollow Carrier, 55 Strip, 2 Pivot, 1 Port Plug guns
- 23 gun sizes
Registered Data

Registered Systems by Year

![Bar chart showing the number of registered systems by year from 2001 to 2013. The number of systems increases significantly in 2011 and 2012.](chart.png)
Gun Systems by Charge Type

- BH
- DP
Guns Systems by Explosive Type

![Graph showing the distribution of guns by explosive type. The x-axis represents various sizes in inches, ranging from "1.56" to "7". The y-axis indicates the number of systems. The graph uses different colors to represent HNS, HMX, and RDX explosives.](Image)
Discussion Points
What Counts?

- There should be a minimum of 12 shots: two sheets show average of 10 shots
- All data should be included expect for shots out of target: 11 sheets deliberately excluded low shots in the average
- Some shots are reported lost or missing: 171 sheets report lost shots; 130 of these from only 5
Gun Position: Centralization?

- Guns should be positioned as they are run in a real well: 64 sheets report guns perfectly centralized.
- Water can have a big impact on both penetration and casing entrance hole diameter.
- Big Hole charges for gravel pack are very sensitive to stand-off.
Witness Program

- Witnessing is an important part of the process: several Russian companies report self assessed. One company used 3 American witnesses.
  - There are at least 10 reported North American witnesses that seem to witness tests for several companies.
  - There are witnesses outside of North America
Should Tests Be Repeated?

This is data from tests we did on 3rd party supplier

12 May 2014, 21

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Good for Sales?

- Many tenders call for API section 1 test data
- One company shot data in one year only. Next year the company was sold. They have not shot data since
Normalization, 19B, 43, QC?

- 19B briquette is go/no-go test
- 43 is not equal to 19B and expired in 1998
- QC data is not equal to 19B

- What about Rock Performance?
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Questions