API RP67 Oilfield Explosive Safety _ Proposed Changes for the 4th Edition

SLAP-16-02
AGENDA/INTRODUCTION

Outline

- Genesis of the Project
- Steering Committee Make Up
- Overview of 11 Task Groups & How they Morphed
- Individual Task Groups Membership and Major Changes to the Document
- Industry Incident Database
- Questions and Answers
API RP 67 Review & Revision

Process / Organization

Steering Committee
(23 members)

10 Task Groups formed to address specialized subject matter

Task Group 11 formed later for Personnel Training and API Compliance Auditing

Subsequent team formed to create Incident Reporting Database
RP 67 Steering Committee Members

- David Ayre, Co-chair, BP
- James Barker, Co-chair, Halliburton/JRC
- Kerry Daly, Expro Group
- Steve DeLozier, Casedhole Solutions
- Jim Ellis, Ecosse
- Al Salsman / Oliver Han / Alfredo Fayard, Schlumberger
- Parul Kapur / Andrea Boock, Shell
- Jim Gilliat, Baker Hughes
- Hanaey Ibrahim, PDO
- Andy Pettitt, SPEX
- Dan Pratt, Owen Oil Tools
- Frank Preiss, DYNAenergetics
- John Segura, Weatherford
- Alphie Wright, Hunting-Titan
- Larry Albert, Allied-Horizontal Wireline Services
- Phil Crabtree, Chevron
- Tony Ryan, ConocoPhillips
- Bob Ference, Consultant
- Alex Linville, Pacific Scientific
- Caitlin Bowers, Continental Alloys
- Iain Maxted, Guardian Global
API RP 67 Task Groups

1. Detonators, Delays, Surface Firing Panels, WL Interrupts
2. Interrupts – now tasked with Time Delays
3. Downhole Tractors
4. Temperature Management
5. Firing Heads on Bottom of Guns, Slickline Firing Heads
6. Coil Tubing Conveyance
7. Security / Regulatory
8. Pipe Recovery
9. Surface Pressure Control Equipment
10. Special Categories of Explosive Devices
Most recent activity

- Update to the AESC, and API 19B SC in Oct 2015. Industry comments received from the AESC audience.

- Multiple SC Meetings, the Draft RP67 document now created incorporates proposed changes from all 11 Task Groups that have submitted material.

- Draft RP67 document submitted to API, April 2016
Task Group 1

Detonators & Delays, Firing Panels, WL Interrupts

- Group Members:
  - John Brzuzy – BHI
  - Jim Brooks – PRJ Consulting
  - Matthew Clay – Owen
  - Steve DeLozier – CasedHole Solutions
  - Bob Ference – Consultant
  - John Jordan – HuntingTitan
  - Philip Kneisl – Petro-Explo
  - Jim Hill – HAL/JRC
  - John Mason – BP
  - Andy Pettitt – SPEX
  - Ben Potter – Owen
  - Frank Preiss – DYNAenergetics
Task Group 1: New/updated Content

Detonators & Delays, Firing Panels, WL Interrupts

- Detonator classifications
  - Group 1
    - Primary explosives allowed
    - 50 ohm
    - No fire 200 mA
    - RF: follow IME SLP-20
  - Group 2
    - Primary explosives allowed
    - No fire 25 volts
    - RF: manufacturer-defined per IME SLP-20 tables with calculated example(s)
    - FMEA by ITPO
Task Group 1: New/updated Content

Detonators & Delays, Firing Panels, WL Interrupts

- Detonator classifications cont.
  - Group 3
    - No primary explosives allowed
    - No fire 120 volts
    - RF safe
    - FMEA by ITPO

- Selective Gun Systems
- Gun Loading Shop Requirements
- Independent Third Party Organization (ITPO)
- Lightning update for section 8 – Electric Line Conveyed Operations
Task Group 2 New/updated Content

Time Delays (Pyrotechnic and Electronic)

- **Group members**
  - Frank Preiss: DynaEnergetics, to commission team
  - Gary Sutherland: DynaEnergetics
  - Bob Ference: Schlumberger
  - James Barker: Halliburton/JRC
  - Kerry Daly: Expro
  - Manufacturers x 4: Fike/PacSci/Nammo
  - Buck / ATK

- **Subject matter includes:**
  - Time Delay Description
  - Design Features and Characteristics (pyrotechnic and electronic)
  - Assembly Installation
  - Gun Shop Preparation and Installation/Arming Procedure (if applicable)
  - Wellsite Operational Concerns and Preparation and Installation/Arming Procedure
Task Group 3

Tractors

- Group members:
  - Brian Schwanitz - Welltec (chair)
  - Andrew Massie – BP
  - John McGrath - Guardian
  - Homero Castillo - Baker Hughes
  - Thilo Scharf - DynaEnergetics
  - Gerald McInally – Aker
  - Guy Mason - GE
Task Group 3

Tractors

- Key Items
  - Two safety barriers required between the tractor electrical circuitry and the explosive components
  - Multipoint failure analysis on tractor system and two barriers to be conducted by an Independent third party organization (ITPO)
  - No single-point failure will cause or permit voltage to be applied to explosives
Task Group 4

Thermal Management

- David Ayre, BP
- Bob Ference, Consultant
- Andy Pettitt, SPEX
- Justin Mason, JRC/HAL
- Shaun Geerts, Owen Oil Tools
- Chris Sokolove, Hunting Titan
- John Hardesty, GEODynamics
- David Huber / WB Harvey, Baker Hughes
- Ed Cannon / D. Betancourt, Baker Hughes
- Hanaey Ibrahim, PDO/Shell
- Achim Pabst / Roland Peters, DYNAenergetics
- Ed LeBlanc, Cased Hole Well Services
- Andrea Boock, Shell
- Steve Henderson Schlumberger
Task Group 4

Thermal Management

- 2 Major Changes
  A) Description / Suggested Actions in a Thermal Runaway event
    - Partial low order detonation, exponential increase in internal temperature & pressure
    - Typically shallow well environments ~ 30mins from TD to guns at surface
    - Following Actual / Known events
    - Standard “wait times” – Safety Mtg / MoC,
    - 30mins to “200ft” level
    - Flow Chart
    - Above 212F quarantine guns for 2 hrs
    - IR Thermometer Temp1 time1 vs Temp2 time2
Task Group 4

Thermal Management

- B) HMX Testing
  - HMX subjected to temperatures above 300-330F undergoes a phase change from the beta to delta crystalline structure, which is a more shock sensitive structure.
  - Phase change is irreversible.
  - 2005 PSF More testing is needed
  - 2012 N. Sea issue. Is HMX that has transitioned still legal to be transported per UN / DOT?

- The Plan
  - UN Test Series 4b(ii) 12 m drop test. Go-NoGo test for approval to transport packaged items. Charges in boxes
  - Prior Work: Canadian Industry drop tested mostly RDX guns, some HMX. No heat sensitized explosives
Do we have a problem? How serious is the problem?

- Two Part Solution: 1) Box tests first followed by 2) some form of loaded gun drop tests or analog tests.
- Got quotes for testing from UN / DOT approved test site, and solicit funding from API, ~$112k approved. Safety Consulting Engineering (SCE) selected Contract from API issued and accepted.
- Industry agrees to participate. 5 Manufacturers tested 10 products

- Test
  - Drop 3 boxes per product, total of 30 drops.
  - Heat soaked charges at 330F (165C) for 4 hours, then forced cooled to ambient.
- Results: All boxes passed
Task Group 4

Thermal Management - cont

- Intermediate Steps
  - Reversibility / Irreversibility Tests on oilfield HMX powders
  - Conducted at UTEC Corp. Riverton, Kansas
  - Validated prior DYNAenergetics work. – IREVERSIBLE

- Prepared summary for inclusion in API RP 67
- Data we have may be sufficient to approach DOT for an industry wide exemption without the need for gun drop tests. Proposed to approach DOT via the IME.
Task Group 5

Firing Heads on the Bottom of Guns / Slickline Firing Heads

Group members – TCP Heads
Joe Henke – Hunting Titan
Justin Mason – HAL
Parry Hillis – Baker Hughes
Mohammed Medhi – SLB
Kent Folse – Shell
Doyle Dean - BP

• Complete. No changes from 2nd edition.
• Key points from existing document are:
  • Demonstrated safe design
  • Prior review and agreement by service company and operator

Group members – Slickline Firing Heads
– Kerry Daly – Expro
– Kevin Anderson- MicroSmart
– John Creighton- Paradigm Geokey
– Paul Church- Probe
– Scott Griswold- Schlumberger
– Jaime Miller- Spartek
– Malcolm Thom- Spartek

• Added Slickline Firing Heads
  1. Mechanical/pressure type
  2. Battery operated memory systems
  3. Surface-controlled type (digital/acoustic)
• 30-ft drop test requirement
• For mechanical/pressure heads: Two independent safety features to prevent inadvertent functioning
Task Group 5
Slickline Firing Heads

- For memory-type or surface-controlled
- Firing windows defined
- Two independent safety features to prevent inadvertent functioning
- FMEA by ITPO
- Retrieval considerations for disarming
Task Group 6
Coil Tubing Jobs

- Group members
  - Mark Brinsden - Shell
  - Roger Frost – BP
  - Kerry Daly – Expro, Chair
  - Parry Hillis – Baker Hughes
  - Justin Mason – HAL
  - Kevin George – Geodynamics
  - Bryan Chubala – Brico Oil Tools
  - Mohammed Medhi – SLB
  - Kent Folse – Shell

- Risks of multiple services recognized: Pumping, CT, Perforating
- Job agreement between service company and operator, CWOP and/or SIT
- Trip/pop-off valves: Set in accordance to equipment ratings and job parameters
- For absolute and differential pressure firing heads: Communication ports and weep holes are to be used to prevent firing due to trapped pressure
- No pressure testing of pressure-activated firing heads with loaded guns attached
- During deployment: Monitor pressure on CT and wellhead to ensure equalization occurring and no excessive pressures are applied to the firing head system
- Descent rate agreed between service company and operator
- For differential firing heads: Best practice to never drop a second ball, but provision included to allow if no other alternatives are available and agreement between service company and operator
- For misfire recovery operations, best practice considerations are given
  - Trip/Pop-off valve
  - Leaving guns in hole
  - Pressure bleed down between lubricator and CT
Task Group 7

Security / Regulatory / Transportation

- Group members
  - Richard Arsenault, Casedhole Solutions
  - James Barker, JRC
  - Rick Borgus, Wildcat Wireline
  - Shelley Espinoza, Hunting Titan
  - David Huber, Baker Hughes
  - Kenny Jordan, AESC
  - Ed LeBlanc, Cased Hole Well Services
  - Randy Nance, Armag Corp.
  - Andy Pettitt, SPEX
  - Dan Pratt, Owen Oil Tools
  - Bob Ptak, Express Energy Services
  - Eric Rosemann, Gray Wireline
  - Thilo Scharf, DYNAmetering
  - Troy Walker, Walker Technologies

- Security language strengthened
- Expanded language for international requirements
- Role of Responsible Party
- Storage
  - Packaged Explosives Storage
  - Loaded Perforating Gun Storage
  - Key Control / Recordkeeping
- Transportation
  - Transportation Controls / HAZMAT Employees
  - Route planning
  - Communication
  - Breakdowns and Incidents
  - Safety Permits - Government
  - Common Carrier Evaluation
  - Return of Excess Explosive Material
- Disposal / Recycling of Spent Perforating Guns
Task Group 8

Pipe Recovery

- Group members
  - JW Segura – WFT
  - Barry Chapman – SPEX
  - Kevin Morton – JRC
  - George Brunner – Baker
  - Tony Grattan – MCR

- No changes
Task Group 9

Surface Pressure Control Equipment

- Group members
  - **Keith Henderson** – *Hunting Titan* (Co Chairman)
  - **Jim Aubrey** – *Hunting PCE* (Co Chairman)
  - **Richard Housden** – *Halliburton*
  - **Mark Robson** – *Oil States Energy Services*
  - **Kevin Airth** – *NOV Elmar*
  - **Kenneth Filipchuk** - *Weatherford*
  - **Bob Ference** – *Schlumberger* (consultant)
  - **Andrew Massie** - *BP UK*
  - **Steve Delozier** – *Cased Hole Solutions*
  - **Oliver Han** – *Schlumberger* (Replaced Bob Ference)

- Wellsite pressure testing of surface pressure control equipment should be completed prior to inserting any explosive device into the surface pressure control equipment string
- Lubricator string not to be tested above its max working pressure
- Recommend use of Quick Test Safety Sub or Wireline Safety Valve
- If the surface pressure control equipment must be tested with an explosive device inside, special precautions shall be taken.
- Non-volatile liquid, typically a 50 / 50 mix of glycol and water
- Low volume / high pressure pump equipped with over-pressure protection
- Test pressure shall not exceed 80% of the pressure rating of the explosive device
- Exception does not apply to exposed charge guns or cutters. These devices shall never be exposed to a pressure test.
- Warning about adiabatic heating with high volume, high pressure pumps.
- Vent sub use is encouraged
- Well pressure equalization steps are given
- 75-ft safety zone recommended if wellsite allows
Task Group 10

Special Categories of Explosive Devices (propellants, setting tools, core guns)

- Group members
  - Kerry Daly – Expro
  - Dan Pratt – Owen Oil Tool
  - Jim Gilliat – BHI
  - David Cuthill – Geodynamics
  - Tony Grattan - MCR Oil Tools
  - Joe Haney - StimGun
  - Dr. Richard - Schmidt- GasGun

- Key additions:
  - Section for propellant stimulation tools
  - Added Field Safety Considerations
Task Group 11

Personnel Training, Critical Safety Equipment and RP67 Compliance Audits

- Group members
  - Craig Beveridge - Owen Oil Tools
  - Rory DeHart, JRC
  - Kenny Jordan, AESC;
  - Bart Pena
  - Ravi Raura, Allied Horizontal;
  - James Cole, Khaled Gasmi, BHI;
  - Leonard Reed

- Expanded list of definitions and acronyms
- Personnel Training
  - Rationalized EUIC requirements / HAZMAT Employee
- Added Critical Safety Equipment
- Added subsection for “Recommended Equipment”
- RP67 Compliance Audits
  - Existing company processes referenced
  - Defined verbiage - Service companies self-audit and provide documentation as requested to Operators on compliance
- Addendums
  - Stray voltage worksheet created
  - Explosive Arming and Disarming Safety Critical Fundamentals
  - Explosive User in Charge well site checklists
Incident Database Group

Incident Database

• Group members
  • Frank Preiss – DYNAmetergetics
  • JW Segura – Weatherford
  • John McGrath – Guardian
  • Parul Kapur – Shell
  • Kenny Jordan – AESC
  • Jim Gilliat – BHI
  • John Davidson – Chevron
  • Matt Bell – GEODynamics
  • Chip Levine – Hunting -Titan

• Implementing a database to track industry incidents (similar to SAFEX reports)
• Located on Perforators.org website
• Active for 1 year now
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