2017 International Perforating Safety Forum

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API RP67 Oilfield Explosive Safety: Development of Changes to the 4th Edition

IPSF 17-06

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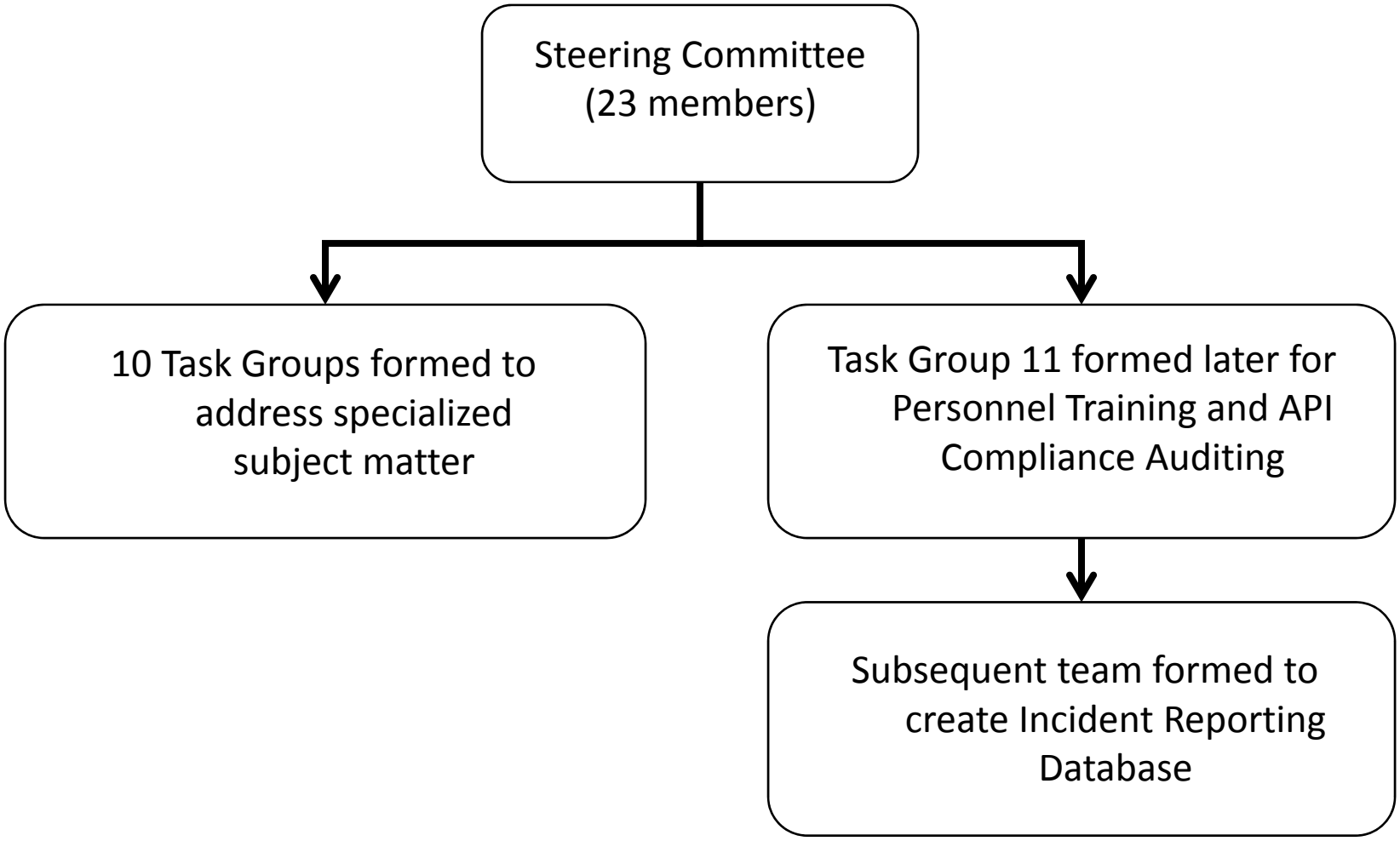
AGENDA/INTRODUCTION

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



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		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 / Steel Alloys & Services
• Iain Maxted		Guardian Global

API RP 67 Task Groups

1. Detonators, Delays, Surface Firing Panels, WL Interrupts — Submitted
2. ~~Interrupts~~ – now tasked with Time Delays — Submitted
3. Downhole Tractors — Submitted
4. Temperature Management — Submitted
5. Firing Heads on Bottom of Guns, Slickline Firing Heads — Submitted
6. Coil Tubing Conveyance — Submitted
7. Security / Regulatory — Submitted
8. Pipe Recovery — Submitted
9. Surface Pressure Control Equipment — Submitted
10. Special Categories of Explosive Devices — Submitted
11. Personnel ,Training , and RP67 Compliance Audits. — Submitted

Most recent activity

- Sent out for ballot 20 Dec 2016
- Responses required by 20 Feb 2017
- Results

	Affirmative	Negative	Abstain	Did Not Vote
Balloting Totals:	12	2	0	4

Total Responses:	14	
Total Ballots:	18	
Response Rate ((Affirmative + Negative + Abstain) / Total Ballots):	78%	Must be > 50%
Approval Rate (Affirmative / [Affirmative + Negative]):	86%	Must be >= 66.66%
Consensus:	YES	

- Document now back under Steering Committee review for disposition and resolution of the ballot comments.

Task Group 1.0
Detonators & Delays, Firing Panels, WL Interrupts

Group Members:

- John Brzuzy – BHI
- Jim Brooks – PRJ Consulting
- Matthew Clay – Owen
- Steve DeLozier – CasedHole Solutions
- Bob Ference – C Consultant
- John Jordan – C HuntingTitan
- Philip Kneisl – Petro-Explo
- Jim Hill – HAL/JRC
- John Mason – BP
- Andy Pettitt – C 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

Time Delay Devices

- Delay devices we have identified are TCP related
- The group members predominantly have Wireline backgrounds
- The general group isn’t an authority on TCP Delay devices
- Moved to newly recommissioned TG 2.0

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 3.0
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 3.0
Tractors

- Status
  - Complete. Submitted material to Steering Committee.

- 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 4.0
Temperature Management

- **Group Members:**
- **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 4.0
Temperature Management cont.

- Status: 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 4.0
Temperature Management cont.

- B) HMX Testing
  - HMX subjected to temperatures above 300-330F under goes 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? More testing needed!

Task Group 4

Thermal Management cont.

- 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 5.0
Firing Heads on Bottom of Guns

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

- 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

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

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 Ops

- 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**, *DYNAenergetics*
  - **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

Task Group 11*

Industry Learnings / Gaseous By Products

- Group members
  - Justin Mason
  - James Barker
  - David Ayre

- Prompted by some recent incidents:-
  - Resurrected 1950's era information on Perforating Gaseous By Products (Fatalities)
  - Carbon Monoxide in confined spaces
  - Mud Shaker rooms on Offshore rigs
  - Wellhead cellars on land rigs

Incident Database Group

Incident Database

- Group members
  - Frank Preiss – DYNAenergetics
  - 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 2 years now

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The Plan Forward

- Approved by API ballot 20 Feb 2017

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Consensus:	YES	

- Committee / Sub-Committee(s) reconvene to decide on disposition of comments / answer comments (304)
- Publish circa Q3 or Q4 2017
- ~ 6 years to update

Future Industry Meetings and Updates for RP67

- International Perforating Safety Forum (PSF) — 4 May 2017
  - Houston TX
- API Subcommittee on Perforating / — 30 Sep 2017
- SPE Paper ATCE Houston
- Institute of Makers of Explosives — ????? 2017
  - Washington DC

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QUESTIONS?
THANK YOU!

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