API Oilfield Safety & Security Forum

Presented by;

Duane Fairhurst - Expro Group Canada Inc.

Lorne Hyvonen - Precision Drilling Technology Services Group
Objective

- As a result of a query received from the Alberta provincial authorities re: the transport hazard classification of Jet Perforating Guns, ERD of the Canadian Federal government reviewed the requirements for storage and transport of Oilwell explosives under the current Explosives Act and Regulations, in particular, product approvals and licensing issues needed updating to assure the continued safety of industry workers and the general public.

- It was determined that the preparation and use of perforating explosives required a Factory License.
Objective

- Perforating guns and assembly operations did not comply with the Explosive Act and Regulations; the path towards compliance began September 25, 2003 with a seminar to explain why Factory licenses and Product Authorizations were now required

- Existing regulations were grandfathered until January 1, 2006
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Result

An Oil Well Blasters sub committee was formed to

- Research and test carriers for transportation
- Research and test blast walls for shrapnel containment
- Research and test Blast Over Pressure (BOP) for Q/D requirements
- Assist in the development and application of a small quantity-distance table with mitigation of debris and shrapnel
Transportation of Gun Systems

- On October 16, 2003 a Hazard Classification Testing Proposal for “JET PERFORATING GUNS, CHARGED, oil well, without detonator” was presented.

- Following acceptance of this Proposal, Gun Systems were tested:
  - Vibration tests were completed in February 2004
  - 12 m Drop tests were completed in June 2004

- Product authorization for Perforating Guns will be complete by the end of February 2005
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Blast Wall Testing

- PSAC Barrier test were conducted in July 2004 to confirm that practical cost effective mitigation measures exist, e.g., Waste concrete blocks
- Results were sent to PSAC and NRCan
- CERLab of NRCan conducted additional tests on unmitigated shape charge effects in open air and developed a test methodology for barrier testing; this report was issued Jan’05
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Blast Wall Testing

- The jet charge and shrapnel did not penetrate the ½” steel at 48” stand-off and dimpled the rear of the plate at 36” stand-off without damaging the plywood.
- ERD approval: Wall designs will be approved as part of the license application approval process following review of barrier wall test data as well as the proposed shop layout details.
Blast Over Pressure (BOP)

- Existing quantity-distance tables are typically based on incidents and use formulas that provide for BOP's between 0.7-0.9 psi for inhabited buildings
- Provided shrapnel and debris from a blast can be contained with a wall or by other means, debris throw is no longer an issue and BOP is the limiting factor for separation distances
- ABS Consulting, Inc. from San Antonio were contracted by ERD to:
  - Model BOP effects from a 5 kg blast within a typical loading bay and perforating shop
  - Provide mitigation strategies and ball-park refit estimates within a typical loading bay and perforating shop
Small Quantity–Distance Table:

- It was determined during the modeling work that the current Q-D formulas based on BOP did not work well for small quantities.
- Modeling using a 5 Kg explosive load within a load bay showed higher than predicted BOP’s due to the reflective pressures from the floor and walls.
Small Quantity–Distance Table:

- As BOP did not look promising for small quantities, it was decided to look at an impulse approach using window breakage and glass throw criteria for separation distances versus BOP; glass being the most vulnerable building material.
- This approach considers both the initial BOP and its duration, i.e., pressure breaks glass and impulse throws it.
- Analysis from events such as the Oklahoma bombing provides data to support this approach.
- This method is still being considered and **IS NOT YET** approved for Q/D.
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Conclusions

- CERLab has developed a methodology to evaluate barrier walls to support use in license applications; several walls and configurations have proven successful.
- Discussions continue on the use of impulse and BOP in Q-D tables in the 0 to 4500 kg range; with emphasis on small explosive quantities from 0 to 50 kg.
- UN Series 6 b) tests support reduced Q-D requirements for storage of perforating charges by themselves as packaged for transport, i.e., NEEQ factor of 25% NEQ.
- Four types of gun systems have been approved for assembly, transportation and storage based on the PSAC code of practice as well as the vibration and drop test results.
- CERLab, ERD and the PSAC sub-committee continues to work towards revision of the COP and resolution of L & C issues by 2006.