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Reduction of Allowed Inventory When Chemicals are Located in Close Proximity with Explosives

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Objective

- To determine the allowed inventory of *chemicals* stored in the <u>same</u> bay, building or magazine, i.e., in close proximity, with *high explosives (HE)* that would, in the event of an accident. result in acceptable risks to colocated workers and the public.

First Moderate Hazard Nonnuclear Facility SBD

- This work was performed to support the development of the Safety Basis Document (SBD) for the Chemistry & Materials Science (CMS) Site 300 Facility.

- This is the first Moderate Hazard SBD prepared according to the *ES&H Manual*, Document 3.1, *Nonnuclear Safety Basis Program* and submitted to DOE for approval.

Background Information

- CMS Site 300 Facility consists of >50 buildings and service magazines scattered throughout S300.
- The Facility is divided into three groups: Process Area, Chemistry Area and the Explosives Waste Treatment Facility (EWTF).
- Their safety bases are the
  - Bases for Interim Operation (BIOS) May 2000 - Process and Chemistry Areas
  - Safety Analysis Report (SAR) 2003 - EWTF.
- This SBD replaces the two BIOS and the EWTF SAR.

Chronology

- CMS initiates effort to replace the two BIOS in 2002. Walt Wajda started the project but a budgetary problem postponed it until May 2004.

- The next completion date was May 2005 (before the BIOs expired).

- The submitted SBD is under review by DOE.

Site Issues

- Determine the effects of the airborne releases to the S300 colocated worker at 100 m distance, and to the offsite public.

- Some CMS buildings are located only a few hundred meters from the S300 offsite boundary.

Technical Issues

- Chemicals are used or stored in the same bay, same cell with high explosives (HE).

- In the past, explosives hazards are analyzed separately from chemical hazards in accident scenarios. Now, the scenarios must include explosions that may disperse the chemicals.

- No available data exists on the airborne release fractions for most chemicals of interest.

Safety Basis Evaluation

- *ES&H Manual* Document 3.1, *Nonnuclear Safety Basis Program*, LLNL

- Chemicals - Temporary Emergency Exposure Limit (TEEL) values & Q values for the colocated worker at 100 m and the public at nearest offsite boundary to facility

- Explosives – Quantity-Distance calculations

Chemical Samples & Explosives Range

- Sample chemicals presented here out of a large number studied
  - Uranium (U), Beryllium (Be)

- HE mass range studied for operational flexibility
  - 5,10, 25, 50, 100 kg

Chemical Inventories Allowed at 100 m for 5 kg HE

- Evaluated independently (LSI Q value)
    - U   2300   kg
    - Be   380   kg

- Evaluated in close proximity (code)
    - U   170   kg   (Q/13.5)
    - Be   16   kg   (Q/24)

Sample Results for Uranium in Close Proximity with 5 kg HE

- For colocated worker at 100 m, the allowed inventory is <u>reduced</u> by a factor of 13.5.

- For offsite public at 400 m, the reduction is a factor of 5.5x <u>lower</u> than the Q value.

- For offsite public at 900 m, the reduction factor is 11x <u>lower</u> than the Q value.

Sample Results for Uranium in Close Proximity with 100 kg HE

- At 100 m (colocated worker), the allowed inventory is <u>higher</u> by 6.5x.

- At 400 m (offsite public), the allowed inventory is 1.4x <u>higher</u> than the relevant Q value.

- At 900 m (offsite public), the reduction is 1.7x <u>*lower*</u> than the relevant Q value.

Sample Results for Beryllium in Close Proximity with 5 kg HE

- At 100 m (colocated worker), the allowed inventory is <u>reduced</u> by 20x.

- For offsite public at 400 m, the reduction is 180x <u>lower</u> than the Q value.

- For offsite public at 900 m, the reduction is 400x <u>lower</u> than the Q value.

Summary

- The allowed inventories of chemicals that are placed in close proximity with high explosives can be <u>much lower</u> than their Q values provided in the *ES&H Manual*, Document 3.1.

- Studying a range of HE masses permits operational flexibility in the chemical and explosives inventories allowed in a bay or cell.

Conclusion

- In order to properly protect the colocated worker and the offsite public, the allowed inventories of chemicals located in the same bay, cell, or magazine with high explosives have to be evaluated carefully. In an accident event, their exposure to the chemicals will then be limited to the approved safe level.

- These studies provide an excellent tool for facility management to determine accurately the allowed inventories that would not pose unacceptable risks to colocated worker and the offsite public.