SMALL QUANTITIES FOR RESEARCH AND LABORATORIES (SQRL) TEST PROGRAM

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INTRODUCTION

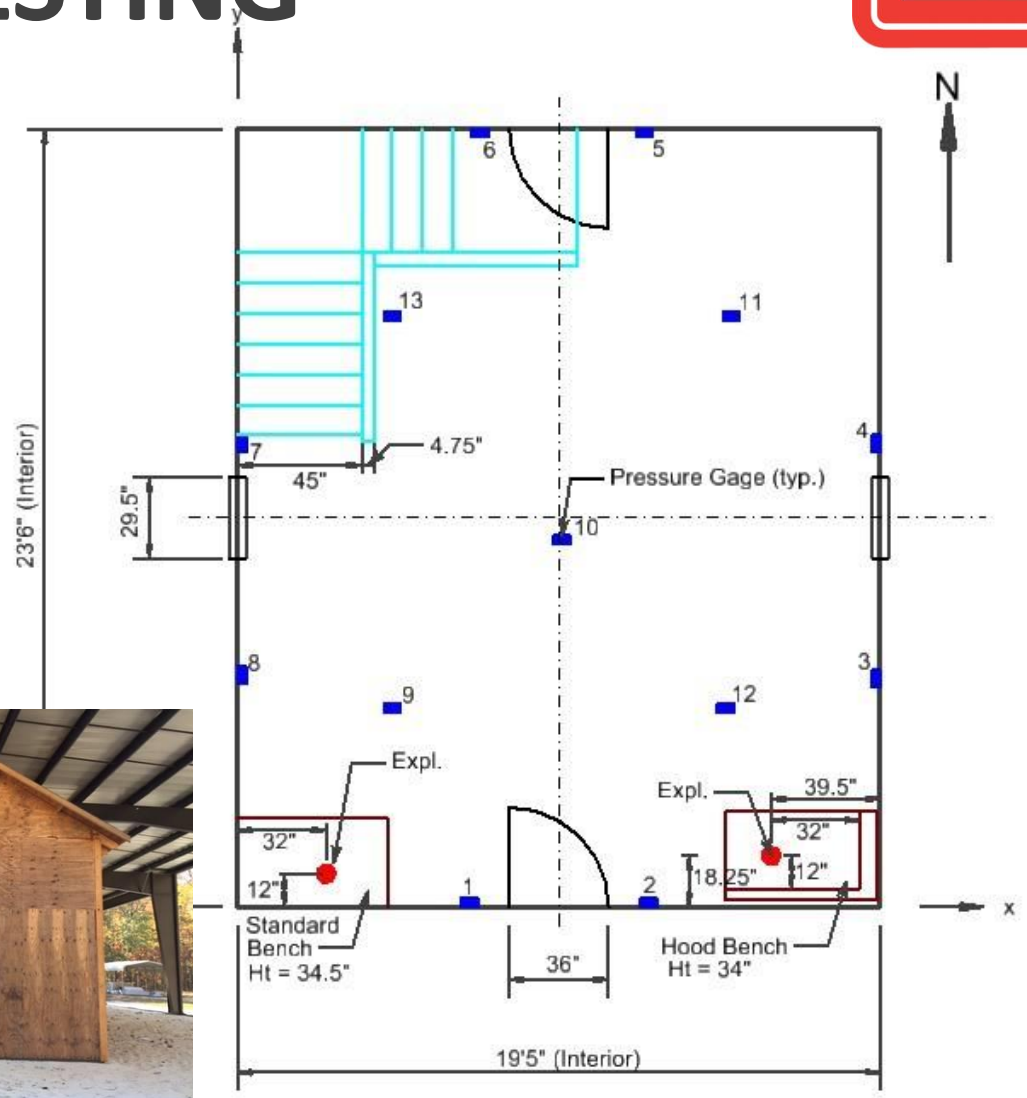
- SQRL test program began to address a specific explosives siting issue:
  - Minimum IBD for NEW $\leq$ 31 lbs is 200 ft in accordance with DoD 6055.09-M.
  - Customer's main building contains labs, classrooms and offices.
  - Labs required NEW $\leq$ 50 g.
  - Use of standard analytical methods resulted in unreasonably high pressures because the low weight to volume ratio was outside the bounds of the methods.
- SQRL Phase I (SQRL I) was designed based on the construction of the customer's labs to determine if 50 g would cause a breach or failure of the wall.
- Small lab quantities has been an ongoing issue for all of the Services and development of criteria to address these small quantities is a priority for the Services.
- DDESB sent surveys to the Services to determine typical quantities and room sizes for their labs.
- SQRL Phase II (SQRL II) was designed to begin developing criteria for small lab quantities.

SQRL I - GOALS

- The National Center for Explosives Training and Research (NCETR) main facility contains labs, classrooms and offices. The current 200 ft minimum IBD would cause several rooms to be rendered unusable.
- Interior lab walls are 5/8” sheetrock on each face supported on 6” metal studs at 16” on center with batt insulation between the sheetrock faces.
- The smallest lab has a room volume of 31,800 ft^3. (Weight to volume ratio = 3.47×10^{-6} lb/ft^3)
- **Goal 1** – Determine the maximum NEW which will not cause breaching at 12” standoff.
- **Goal 2** – Determine effects of glass container on lab hood walls.

SQRL I - TESTING

- 10 tests performed in blast house
  - 8 tests with bare charge (NEW = 7.68 g, 15.4 g, 23.1 g, 30.8 g, 38.5 g, & 50 g).
  - 2 tests with bare charge in 250 ml glass beaker with hood walls (NEW = 10 g & 50 g).
  - Charges in corner with 12” standoff from one wall and 32” standoff from other wall.
  - Damage visually assessed after each test.
  - Interior pressure measured at 13 locations for each test.
  - Glass debris from beakers collected.



SQRL I - TESTING

Typical damage from
50 g bare charge

Largest piece of glass
from 10 g in beaker

SQRL I - RESULTS

- Walls of 5/8” sheetrock on each face supported on 6” metal studs at 16” on center with batt insulation between the sheetrock faces with a room volume of at least 3600 ft^3 are sufficient to prevent any debris hazard outside the room from:
  - 50 g NEW bare charge at a minimum 12” standoff from room or hood walls.
  - 50 g NEW bare charge in a standard glass beaker at a minimum 12” standoff from hood walls.
- Recommend zero (0) QD outside a room with this wall construction and a minimum volume of at least 3600 ft^3 for up to 40 g (50/1.25).

SQRL II - GOALS

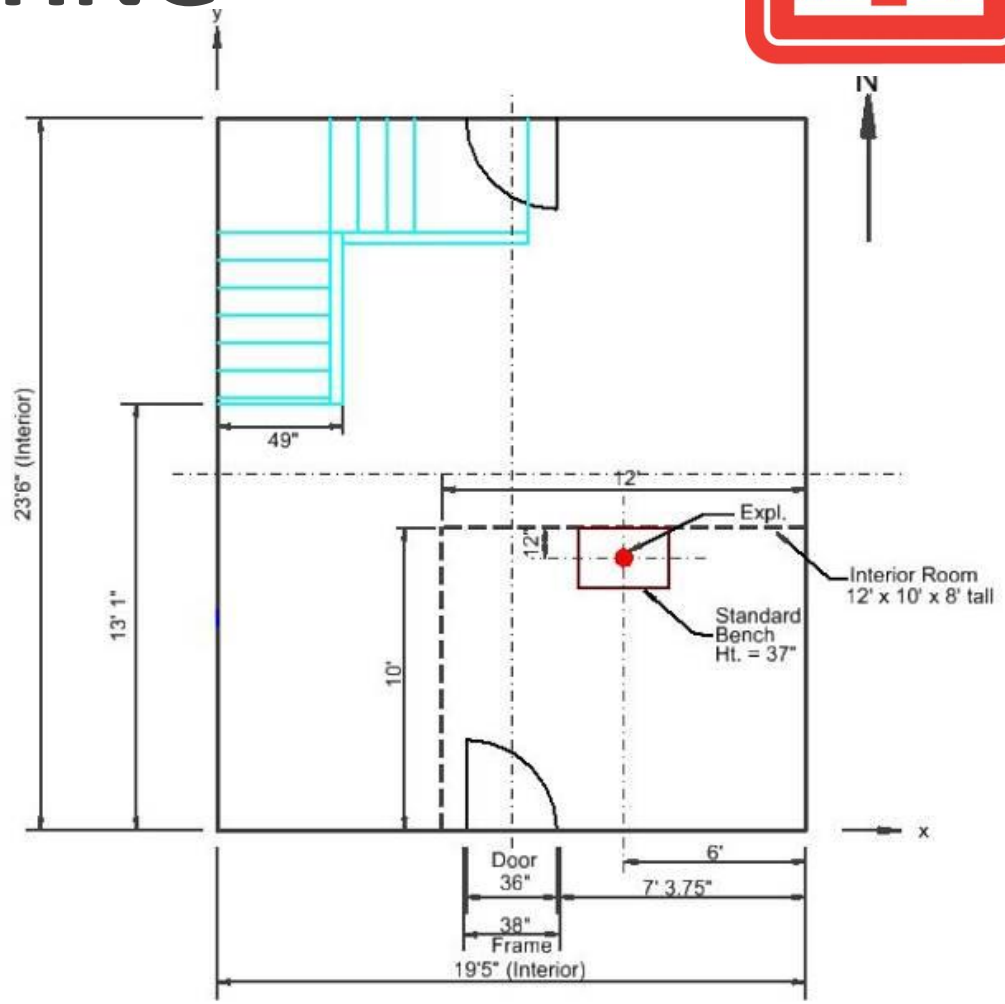
- Survey of Service lab sizes and quantities and existing Service small quantities criteria used to develop SQRL II goals.
  - Smallest lab from survey – 720 ft^3, Weakest wall – sheetrock.
  - Navy has reduced criteria for quantities $\leq$ 0.5 lb. Basis of this criteria could not be found.
  - Air Force has criteria allowing limited use of up to 200 g without approved site plan.
- **Goal 1** – Determine the maximum NEW which does not result in breaching a sheetrock wall at a 12” standoff.
- **Goal 2** – Determine the debris and overpressure hazards from a sheetrock wall due to an explosion of 250 g at a 12” (or 48”) standoff for a room of at least 1000 ft^3.
- **Goal 3** – Determine the hazardous debris distance from an unreinforced CMU wall due to an explosion of 250 g at a 12” standoff.

SQRL II – TESTING

Free-standing walls used for Goal 3 and for initial estimation of maximum NEW for Goal 1.

½” sheetrock on 2”x4” studs at 16” on center without insulation.

No breach or spall from 250 g @ 12” standoff from CMU wall.



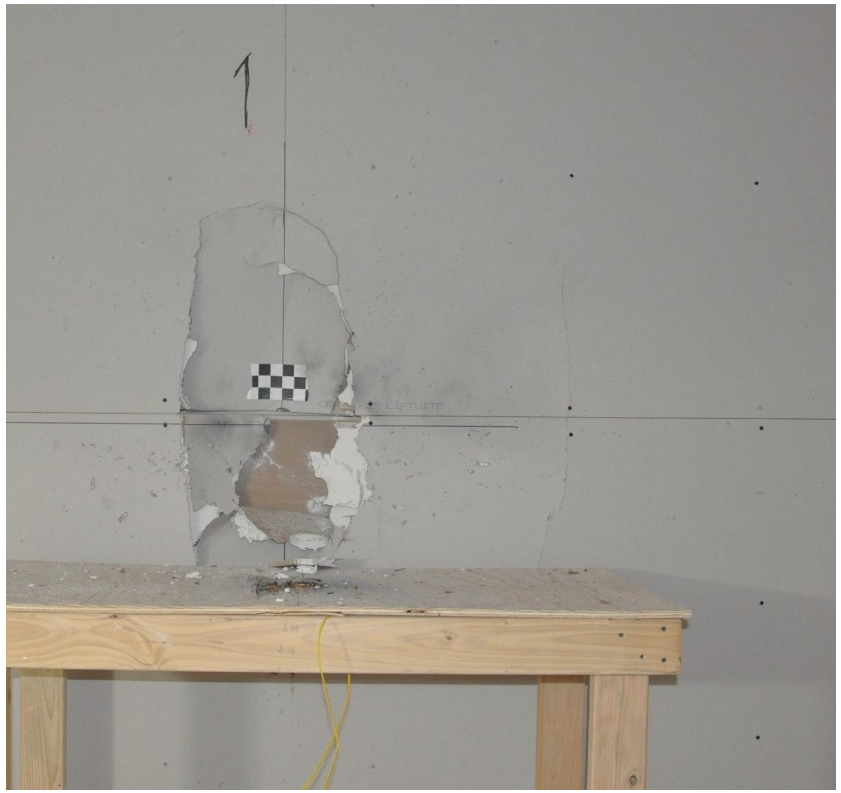
10’x12’x8’ room built in Blast House for Goal 2 and final Goal 1 testing.

SQRL II – GOAL 2

250 g did massive damage to Blast House so only one test performed at this NEW.

SQRL II – GOAL 1 & REVISED GOAL 2B

Goal 1 – Max NEW that did not cause breach @ 12” standoff = 30 g.



At 48” standoff, 40 g NEW did not cause breach.

SQRL II - CONCLUSIONS

- Recommend the following QD criteria be adopted.

Minimum Room Volume (ft^3)	Minimum Standoff Distance (in)	Net Explosive Weight (NEW)	Inhabited Building Distance (ft)	Public Traffic Route Distance (ft)	Intraline Distance (ft)
960	12	$\leq$ 25 g	0	0	0

FUTURE TESTING

- Preliminary SQRL III goals:
  - **Goal 1** – Define an NEW that has a zero (0) QD in a room with a realistic volume and weak/worst case scenario walls (room volume > 3000 ft^3, sheetrock walls from SQRL II).
  - **Goal 2** – Define an NEW that has a zero (0) QD in a room with a realistic volume but has current standard construction or weak walls that have been retrofit (room volume > 3000 ft^3, sheetrock walls from SQRL I or retrofit walls from SQRL II).
  - **Goal 3** – Define a non-zero QD (IBD < 200 ft current default distance) for a larger NEW in a room with a realistic volume and/or the SQRL II room and sheetrock wall structure.

QUESTIONS?

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