

D.5 SUMMARY

In Phase I, hypothetical blast scenarios to initiate structural collapse were identified. In particular, a plausible scenario with the minimum amount of required explosive was identified and carried forward to the Phase II blast analyses. This scenario proposes a linear shape charge blast consisting of 9 lb of RDX, centered on Column 79. The recommended column preparation for use of this shape charge required a minimum of 15 min to make initial cuts to the column with an oxy-propane torch, plus additional time for charge placement.

In Phase II, 2-D SHAMRC blast propagation calculations were performed for the minimum explosive case identified in Phase I. Calculations were also performed for a lesser charge size (2 lb) in the interest of evaluating threshold explosive requirements. There were 4 blast analyses performed in total, consisting of two different charge sizes (2 lb or 9 lb of RDX) and two floor layouts with differing partition densities in the tenant areas (Layouts 2 and 3). The primary conclusion from Phase II analyses was that windows were expected to fail on the north and east faces for even the most conservative blast loading case considered (the densely-partitioned Layout 3 with a 2 lb charge). Other scenario and charge size combinations resulted in greater predicted damage.

In Phase III, an acoustic analysis was performed to assess the distance from the building that the blast would have been audible. Analyses were performed for both layout scenarios, using the pressure history and window failure location predictions generated during Phase II. For all scenarios and charge sizes, significant audible sound was predicted from all building faces. For locations where sound propagation was unobstructed, the sound level from all building perimeter openings at 1 km would have been approximately 130 dB to 140 dB.

D.6 REFERENCES

- Cantor. 1985. Irwin G. Cantor P.C., Structural Engineers, Structural Drawings, 7 World Trade Center.
- Crepeau, J., Needham, C. and Hikida, S., SHAMRC second-order hydrodynamic automatic mesh refinement code. 2001. Methodology, 2001. Applied Research Associates, Albuquerque, NM.
- Crepeau, J., SHAMRC second-order hydrodynamic automatic mesh refinement code. 1998. User's manual, 1998. Applied Research Associates, Inc., Albuquerque, NM.
- Hamby, William, "Ultimate Sound Pressure Level Decibel Table," 2004, [http://www.makeitlouder.com/Decibel 20Level 20Chart.txt](http://www.makeitlouder.com/Decibel%20Level%20Chart.txt), 6 Jun 2008.
- Kinney, Gilbert and Graham, Kenneth, *Explosive Shocks in Air*, 2nd Edition, Springer, 1985.

****Deleted reference January 2009. All pertinent material is contained in Meyers 2002.****

Meyer, S.B., Becvar, K.E., Stevens, D.J. and Marchand, K.A., Shard Fly-Out Model, Final Technical Report prepared by Applied Research Associates, Inc. for the Technical Support Working Group, December 2002.