1. EXECUTIVE SUMMARY: ALL TEST RESULTS

A. Radiological Protection Capabilities Test Results

Radiological testing was performed on October 9, 2009 per Section 6.8.1 of the Testing Plan. The complete interior of a test Shelter-in-Place (SIP) was protected with RBC Shield® Tiles. The SIP was exposed to a radioactive source consisting of 50.0 milli-Curies of Technetium-99 (140 keV). All four sides and the top were individually exposed at a standard distance (48" for walls, 40" for ceiling) and the radiation outside and inside the SIP was measured.

The exterior surfaces of the walls were exposed at a radiation rate of 4.5 milli-Roentgens per hour (mR/Hr). The roof was exposed at a radiation rate of 6 mR/Hr

The radiation readings measured by a Geiger counter on the inside walls of the shielded SIP ranged from .01 mR/Hr to .03 mR/Hr. Readings were taken at 23 locations. The average radiation rate measured .011 mR/Hr.

The radiation readings on the inside ceiling ranged from .01 to .015 mR/Hr.

The radiation rate inside the exposed shelter was compared the normal background radiation and was determined to be less. Put another way, a person inside the RBC Shield® protected SIP that was being exposed to the radiation source, would receive less radiation then if exposed to normal sunlight and normal soil. The full test report can be viewed at Appendix One, Attachment 11.

Three quotes from the complete test report are noteworthy:

> *"The entire system could withstand much higher levels of insult without the occupants being overexposed."*
>
> *"Even the highest levels of presumed exposure can be survived."*
>
> *"The amount of dose reduction in ambient levels of radiation after a radioactive release can keep occupants safe for a prolonged period of time."*

B. Chemical & Biological Protection Capabilities Test Results

On October 8, 2009, an assessment was made of the chemical and biological protective capabilities of the RBC Shield® Tile protected test SIP per Section 6.8.2 of the Testing Plan. The SIP was subjected to both positive and negative overpressure testing as well as testing of the filtration and air flow volume of the air supply unit. The unit tested was the ASR-100-AV-NBC manufactured by American Safe Room. The ASR-100-AV-NBC unit meets the critical requirements of the US Army Corps of Engineers Technical Letter ETL 1110-3-498, "Design of collective protection shelters to resist chemical, biological, and radiological (CBR) agents."

HEPA Air Filter: The HEPA air filtration system blocked 100% of the particles greater than 3 microns.

Airflow Volume: The airflow volume was 86 cfm[3] which exceeded the manufacturer's specifications of 63 cfm[3]. This volume of airflow (63 cfm[3)] in a protected space/room with a maximum volume of 3,500 cubic feet (99 cubic meters) is capable of giving adequate supply of filtered air for up to 12 occupants. (Larger units are available for up to 120 occupants).

Overpressure: Initially, the SIP had some leaks that prevented the overpressure from registering higher than .1 inches of water column. However, even at that level it was 5 times higher than what the US Army Corps of Engineers requires for Class 2 Collective Protection System.[1]

Through further caulking of air leaks discovered by using negative pressure testing and a smoke agent, the room was sealed to allow an overpressure of .315 inches of water column (.315 iwg). At that level of over-pressurization, the test shelter exceeds the Corps of Engineer standards for a Class 1 Collective Protection Shelter intended for long-term use.[2]

C. Adhesive Peel Testing (Impact of Environmental) Results

The impact of environmental conditions on the adhesives used to affix the RBC Shield® Tiles to the substrate was conducted per Section 2 of the Testing Plan on October 21, 2009 at Environ Laboratories in Minneapolis, MN. The two types of adhesives tested were "hook & loop" fasteners and industrial mastic "peel & stick" tape. The test samples were cured for 24 hours in a controlled, ambient environment. The samples were then tested to measure the impact of heat, cold & humidity on the adhesives. The test results showed that impact was minimal on both adhesive methods for all tested conditions. The two adhesives retained from 89%-100% of their original adhesive strength when subjected to the various environmental conditions.

In two combinations, the adhesives actually increased their holding power when subjected to all environmental conditions (*see test results on the following page*).

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[1] Unified Facility Criteria 4-020-01, "Security Engineering Planning Manual"

Definitions:

Toxic free area (TFA) same as meaning as Protected space or Safe Room.
Chemical, Biological and Radiological (CBR) same meaning as Nuclear, Biological and Chemical (NBC).

D-5. Toxic-Free Area Overpressure *(continued in the footnotes on the following page)*
For existing facilities being modified, or new facilities being designed with a Class 2 CP [Collective Protection] system, the air intakes will be protected with a CBR filtration system. The TFA will be designed for a minimum overpressure goal of 5 Pa (0.**02 inches** wg).

This overpressure corresponds to a wind speed impact pressure normal to a wall of 12 km/hr (7 mph). This wind speed condition is most favorable for directing a plume of agent with minimum dispersion toward an outside air intake.

[2] US Army Corps of Engineer, Unified Facility Criteria 4-020-01, "Security Engineering Planning Manual," Paragraph 3-6.2.3

Test Results:

RESULTS OF CALCULATION, PEEL STRENGTH, LBS. PER INCH, AVERAGE						
Sample	Ambient	95% Relative Humidity	140^0	-30^0	% of Ambient	Pass/Fail
Hook & Loop on Wood	7.02	7.22	8.25	7.16	>100%	Pass
Hook & Loop on Hook & Loop	4.97	4.98	5.51	4.78	96%	Pass
Hook & Loop on ABS Plastic	12.28	11.06	12.79	11.0	90%	Pass
Mastic on Wood	6.19	6.24	5.81	5.57	89%	Pass
Mastic on ABS Plastic	4.94	5.91	5.2	5.92	>100%	Pass

D. Adhesive Shear Testing (Bond Strength) Results

Shear testing was completed per Section 3.2 of the Testing Plan on October 28, 2009 at the Loctite North American Engineering Center in Rocky Hill, Connecticut. The tests measured the bond or shear strength of the following four adhesives used to affix the ABS plastic to the lead:

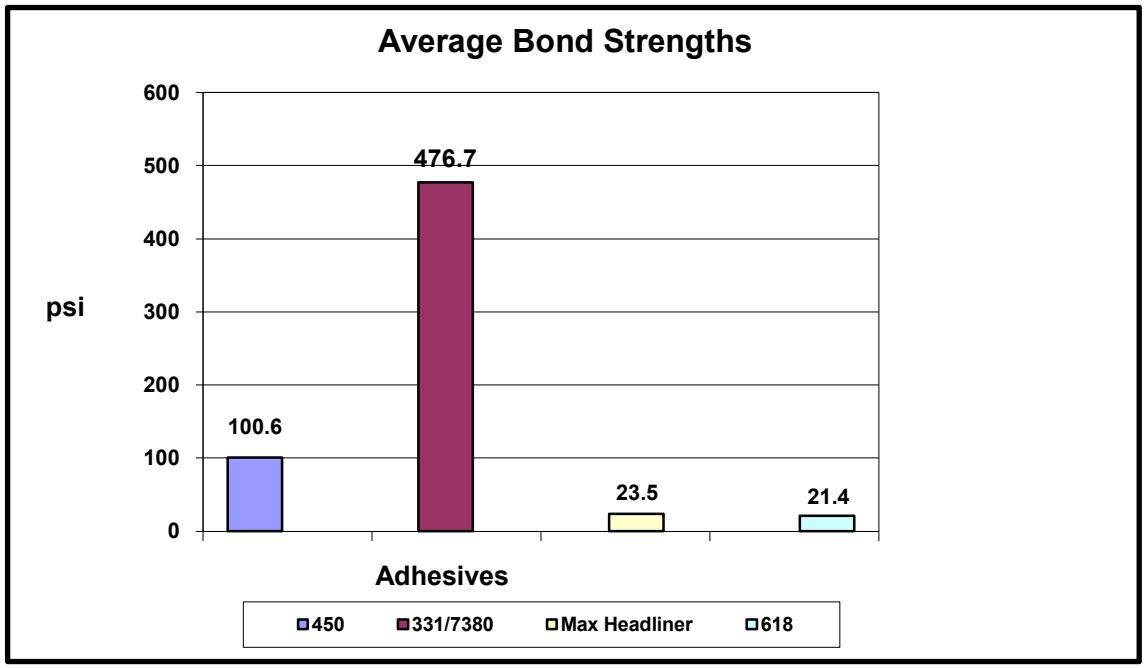
- Loctite® 0450™ SprayPac® Polyshot™ Hysol® Hot Melt Adhesive. This is a 4,500 cP, neutral, EVA-based hot melt adhesive.
- Loctite® 331™ Depend® Adhesive. This is a 25,500 cP, amber, two-part no-mix methacrylate ester acrylic adhesive.

  Loctite® 7380™ Depend® Activator. This is a 43cP, light brown, acrylic amine activator.
- Loctite® Max Strength Headliner ™ Spray Adhesive. This is a foam, clear SIS copolymer adhesive.
- Benders 618 Contact Cement. This is a red, spray, neoprene-base, solution adhesive.

Each type of adhesive was applied to a one-inch square of ¼"- lead which was then applied to the center of a 3-inch square of ABS plastic as prescribed by ASTM Manual D4501. Five test samples were prepared for each type of adhesive.

The test samples were cured for 24 hours and then sheared apart, using the prescribed testing tool.

The chart on the following page shows the results of the testing:



Lessons Learned

(1) While the 331/7380 adhesive has the superior bonding strength, the manufacturer reports that it has the strongest odor. It also has the disadvantage of remaining uncured if an inadequate amount of activator is used.

(2) The manufacturer reported that the 0450 is four times the strength of the two solvent-based adhesives, has low odor, is not flammable, is easily automated, and supports immediate part assembly upon application.

E. Adhesive Odor Testing Results

Odor testing was completed per Section 4.2 of the Testing Plan on December 1, 2009 at Ghesquiere Plastic Testing, Inc. in Harper Woods, Michigan. The reference specimens (section of ABS tiles) were rated as less than the reference samples of ABS plastic alone, as well as less than the reference sample of raisins.

F. Standard Seismic Testing Results

Standard seismic testing was completed per Section 5.2 of the Test Plan on October 2, 2009 at Dayton T. Brown's facility in Bohemia, New York. The standard tests were taken a step further by removing all supporting framework for the tiles and subjecting the test walls to three rapid, consecutive applications of 100% test energy.

In all tests, including the supplemental tests (Sequence 4), the RBC Shield® Tiles remained in place on the testing platforms with no discernable movement.

Sequence	Axis	Condition
1	Vertical	Zone 4 Seismic Vibration
2	Longitudinal	Zone 4 Seismic Vibration
3	Transverse	Zone 4 Seismic Vibration
4	Transverse	Zone 4 Seismic Vibration (with the Wooden Frame of Serial No. DTB#4 removed, per customer's request)
5	Transverse	Zone 4 Seismic Vibration
6	Transverse	Zone 4 Seismic Vibration

See the complete test report at Appendix One, Attachment Eight.

G. Horizontal Displacement Seismic Testing Results

Horizontal displacement testing was conducted on November 5, 2009 at Architectural Testing, Inc. in York, Pennsylvania per Section 5.3 of the Test Plan. The testing was intended to determine whether the tile construction and fastening methods would meet the performance requirements for Seismic Use Group III[3] or Seismic Use Group II[4] in NEHRP *Provisions*[5].

The testing demonstrated that the RBC Shield® tiles remained in place with only minimally discernible movement even at the outer limits of the movement specified under the design criteria. At the completion of three cycles of horizontal displacement, the tiles returned to their original positions. None of the tiles exhibited any separation or loosening from the testing platform.

These results clearly demonstrated that the tile construction and fastening methods meet the performance requirements for both Seismic Use Group III and Seismic Use Group II in NEHRP *Provisions.*

[3] Those structures that are considered essential facilities required for post-earthquake recovery

[4] Those structures having a substantial public hazard due to occupancy or use

[5] NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, Part 1 – Provisions, 2000, BSSC (Building Seismic Safety Council), Washington, D.C., Issued by the Federal Emergency Management Agency.