



State of West Virginia
Joe Manchin III, Governor

WV Office of Miners' Health, Safety & Training
Ronald L. Wooten, Director
1615 Washington Street East • Charleston, West Virginia • 25311-2126
Telephone 304-558-1425 • Fax 304-558-1282
www.wvminesafety.org

August 18, 2008

H. Jack Henry
Chief Executive Officer

and

Gary Midkiff
Chief Operations Officer
Carbonoks, LLC
314 Virginia Avenue
St. Albans, WV 25177

After the evaluation of the documentation submitted and with the recommendation of our technical reviewers the Office of Miner's Health Safety and Training approves Carbonoks, LLC Safe Haven™ for use in meeting the Emergency Shelters/Chambers requirements outlined in the West Virginia Emergency Rule Governing Protective Clothing and Equipment, §56-4-8 with the conditions noted.

The Safe Haven™ is approved for 16 miners for application in underground mines for use when built and provisioned as designed, including the use of desiccant, and providing a minimum of 96 hours life support.

No claims for performance regarding performance of this product under conditions of ongoing fire or pressures above 15 psi are validated by this approval.

Prior to delivery to any West Virginia mine documentation of MSHA approval for all electrical items used in conjunction with the Safe Haven™ warranting they are either intrinsic safety or explosion proof must be submitted to this office. In addition, prior to delivery of any of the optional cooling systems noted in the application submittal of documentation stating the Professional Engineer has evaluated them and he/she warrants their performance as stated in the application must be provided to this office.

Mine Safehouse, LLC shall, upon request, provide this office with verification of valid orders, delivery dates, and status of delivery as required for this office to enforce §56-4-8.

Any changes required or enhancements to the approved design affecting the ability to meet any provision of §56-4-8 shall require approval of this Office prior to any affected Mine Safehouse™ being placed into operation.

Sincerely,

A handwritten signature in black ink, appearing to read "Ronald Wooten".

Ronald Wooten, Director
Office of Miners' Health and Safety

**Review of the Safe Haven™ Manufactured by Carbonoks, LLC for Adherence to
WV Legislative Rule Title 56, Series 4 Emergency Rules Governing
Protective Clothing and Equipment**

August 18, 2008

WV Requirement

	Consensus	Justification
<p>§8.4.1. Provide a minimum of 48 hours life support (air, water, emergency medical supplies, and food) for the maximum number of miners reasonably expected on the working section;</p> <p>-----</p> <p>In addition shelters were reviewed against the recent MSHA PIB 07-03 that makes a federal standard for refuge chambers that has different assumptions than used for the WV standard. The major items are --</p> <ul style="list-style-type: none"> • 96 hours breathable air • 25 ppm instead of 50 ppm on the maximum CO; • 4 gasses to be detected in the chamber (O₂, CO₂, CO, and CH₄); • 0.62297 LPM oxygen per man, not 0.5; • 0.5097 LPM CO₂ scrubbing capability, not 0.4; • 3 fold chamber volume purge air requirement. <p>http://www.msha.gov/reg/complian/PIB/2007/pib07-03.aspSome.</p>	<p>Meets Requirement</p>	<p>The independent professional engineer, Hota GangaRao, PhD, PE (6069WV), and the manufacturer presented reviewers with documentation and addressed inquiries such as to demonstrate that the Safe Haven™ meets individual elements contained in §8.4.2 through §8.4.15. Meeting these requirements satisfies §8.4.1.</p>
<p>§8.4.2. Be capable of surviving an initial event with a peak overpressure of 15 psi for 3 seconds and a flash fire as defined by National Fire Protection</p>	<p>Meets Requirement</p>	<p>The Safe Haven™ design reviewed was for a 16 person unit with life support for at least 96 hours. The independent professional engineer and manufacturer presented detailed computational analysis and evidence from testing supporting their claims that the Safe Haven™ meets or exceeds all applicable Title 56, Series 4 requirements and those applicable from MSHA PIB 07-03.</p> <p>It is the consensus judgment of the reviewers that the Safe Haven™ meets applicable requirements in Title 56, Series 4, §8.4.1 through §8.4.15 and that no claims for performance regarding performance of this product under conditions of ongoing fire or pressures above 15 psi are validated by this recommendations.</p> <p>Further, it is recommended that prior to delivery to any West Virginia mine, documentation of MSHA approval for all electrical items used in conjunction with the Safe Haven™ warranting they are either intrinsic safety or explosion proof be submitted to this Director. In addition, prior to delivery of any of the optional cooling systems noted in the application submittal of documentation stating the Professional Engineer has evaluated them and he/she warrants their performance as stated must be provided to the Director.</p> <p>The independent professional engineer and the manufacturer presented reviewers documentation and addressed inquiries regarding the results of detailed computational modeling of the Safe Haven™ that demonstrated</p>

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<p>Association standard NFPA-2113 of 300 degrees Fahrenheit for 3 seconds;</p>		<p>its ability to sustain a 15 psi overpressure for 3 seconds without failure of structural components or deformation that would affect the operation of the unit. The computational analysis was done by Mr. GangaRao PE (6069WV) of West Virginia University, Morgantown, WV. The WV OMHS&T does not validate any claims that represent performance greater than 15 psi.</p>
		<p>The demonstration of survivability of flash fire requirement was accomplished through review of detailed construction drawings and the material specification of all external components. The reviewers did and the WV OMHS&T should not validate any claims for performance that exceeds the flash fire requirement.</p>
		<p>However, it is noted that no claims for performance regarding performance of this product under conditions of ongoing fire or pressures above 15 psi are validated by this recommendation.</p>
<p>§8.4.3. Be constructed such that it will be protected under normal handling and pre-event mine conditions;</p>	<p>Meets Requirement</p>	<p>The independent professional engineer and the manufacturer presented reviewers documentation and addressed inquiries concerning the detailed construction drawings and material specifications for the Safe Haven™ that demonstrated to the reviewers the ability of the Safe Haven™ to survive normal handling conditions in an underground mine and the ability of the manufacturer to address mine-specific operational capacity.</p>
<p>§8.4.4. Provide for rapidly establishing and maintaining an internal shelter atmosphere of oxygen above 19.5%, carbon dioxide below 0.5%, carbon monoxide below 50 ppm, and an apparent-temperature of 95 degrees Fahrenheit;</p>	<p>Meets Requirement</p>	<p>The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated the ability of the Safe Haven™ to comply with applicable requirements in WV 56-4 and the MSHA PIB 07-03.</p>
<p>----- In addition shelters were reviewed against the recent</p>		<p>The 96 hour supply of oxygen and removal of CO2 were demonstrated both computationally and through experimentation. The maintenance of</p>

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<p>MSHA PIB 07-03 that makes a federal standard for refuge chambers that has different assumptions used for the WV standard. The major items are --</p> <ul style="list-style-type: none"> • 96 hours breathable air • 25 ppm instead of 50 ppm on the maximum CO; • 4 gasses to be detected in the chamber (O2, CO2, CO, and CH4); • 0.62297 LPM oxygen per man, not 0.5; • 0.5097 LPM CO2 scrubbing capability, not 0.4; • 3 fold chamber volume purge air requirement. <p>http://www.msha.gov/regs/complian/PIB/2007/pib07-03.aspSome.</p>		<p>CO was addressed through the design of the airlock which computational data were provided and through the use of purge air for which computational analysis were supplied.</p> <p>The maintenance of an apparent temperature below 95 F was demonstrated through computation and experimentation provided the appropriate quantity of the identified desiccant is provided. The WV OMHS&T does not validate the ability of the Safe Haven™ to maintain an apparent temperature below 95 F if the claim is made regarding an ongoing external fire without the use of a mechanical cooling system which was not included as part of this review.</p> <p>Further it is recommended that prior to delivery to any West Virginia mine documentation of MSHA approval for all electrical items used in conjunction with the Safe Haven™ warranting they are either intrinsic safety or explosion proof must be submitted to the Director. In addition, prior to delivery of any of the optional cooling systems noted in the application submittal documentation stating the Professional Engineer has evaluated them and he/she warrants their performance as stated must be provided to the Director.</p>
<p>§8.4.5. Provide the ability to monitor carbon monoxide and oxygen inside and outside the shelter/chamber;</p> <p>-----</p> <p>In addition shelters were reviewed against the recent MSHA PIB 07-03 that requires monitors for 4 gasses to be detected in the chamber (O2, CO2, CO, and CH4);</p> <p>http://www.msha.gov/regs/complian/PIB/2007/pib07-03.aspSome.</p>	<p>Meets Requirement</p>	<p>The independent professional engineer and the manufacturer presented documentation and addressed inquiries demonstrating the ability of monitoring applicable gases inside and outside the Safe Haven™.</p>

**Review of the Safe Haven™ Manufactured by Carbonoks, LLC for Adherence to
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WV Requirement

	Consensus	Justification
§8.4.6. Provide a means for entry and exit that maintains the integrity of the internal atmosphere;	Meets Requirement	The independent professional engineer and the manufacturer presented documentation and addressed inquiries that demonstrated the ability to enter and exit the Safe Haven™ without violating the integrity of the internal atmosphere through computational and experimental means.
§8.4.7. Provide a means for MSHA certified intrinsically safe power if power required;	Meets Requirement	It is recommended that prior to delivery to any West Virginia mine documentation of MSHA approval for all electrical items used in conjunction with the Safe Haven™ warranting they are either intrinsic safety or explosion proof must be submitted to the director. In addition, it is recommended that prior to delivery of any of the optional cooling systems noted in the application submittal documentation stating the Professional Engineer has evaluated them and he/she warrants their performance as stated must be provided to the Director.
§8.4.8. Provide a minimum eight quarts of water per miner;	Meets Requirement	The independent professional engineer and the manufacturer presented documentation that sufficient water would be provided for 96 hours – 16 quarts per miner.
§8.4.9. Provide a minimum of 4,000 calories of food per miner;	Meets Requirement	The independent professional engineer and the manufacturer presented reviewers with documentation that 96 hours of food would be provided – 8,000 calories per miner.
§8.4.10. Provide a means for disposal of human waste to the outside of the shelter/chamber;	Meets Requirement	The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries demonstrating that a means would be provided to meet this requirement.
§8.4.11. Provide a first aid kit as defined at W. Va.	Meets	The independent professional engineer and the manufacturer presented

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Code Chapter 22A Article 2-59(3)(b) independent of the section first aid kit required by W. Va. Code Chapter 22A Article 2-59(3) and 2-60(f);	Requirement	reviewers with documentation that required first aid materials would be provided.
§8.4.12. Have provisions for inspection of the shelter/chamber and contents;	Meets Requirement	The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated that sufficient provisions had been made for inspecting the Safe Haven™.
§8.4.14. Provide a battery-powered occupant-activated strobe light of a model approved by the Director that is visible from the outside indicating occupancy;	Meets Requirement	The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated that once MSHA approved strobes are available they will be provided for the Safe Haven™.
§8.4.15. Provide provisions for communications to the surface; and	Meets Requirement	The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated the ability to of the Safe Haven™ to support existing and emerging communication options and that each would be equipped to support the mine's communication system.

Reviewers:

Randall Harris, Engineering Advisor to
Director OMHS&T

Keith Heasley, Ph.D., Associate
Professor, Department of Mining
Engineering, West Virginia University