H. Jack Henry  
Chief Executive Officer  
Trinity Resources LLC  
P.O. Box 800  
737 Eleanor Industrial Park  
Eleanor, WV 25070

Dear Sir:

After the evaluation of the documentation submitted and with the recommendation of our technical reviewer, the WV Office of Miners' Health, Safety and Training approves the Trinity Resources, LLC, 'Guardian Angel™' for use in meeting the Emergency Shelters/Chambers requirements outlined in the WV Legislative Rule Governing Protective Clothing and Equipment, CSR§56-4-8 with the conditions noted.

The Guardian Angel™ is approved for 10 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 other than those required by W. Va. Law or of ongoing fire or pressures above 15 psi are authorized by this approval.

Prior to delivery to any West Virginia mine documentation of MSHA approval for all electrical items used in conjunction with the Guardian Angel™ warranting they are either intrinsic safety or explosion proof must be submitted to this office.

Trinity Resources, 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 CSR§56-4-8.

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

Sincerely,

C. A. Phillips  
Acting Director
May 11, 2011

**WV Requirement** | **Consensus** | **Justification**
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§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; | Meets Requirement | 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 Guardian Angel™ meets individual elements contained in §8.4.2 through §8.4.15. Meeting these requirements satisfies §8.4.1.

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 --

- 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;

§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 | Meets Requirement | The independent professional engineer and the manufacturer presented reviewers documentation and addressed inquiries regarding the results of detailed computational modeling of the Guardian Angel™ that
May 11, 2011

WV Requirement | Consensus | Justification
--- | --- | ---
Association standard NFPA-2113 of 300 degrees Fahrenheit for 3 seconds; | | demonstrated 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 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.

However, it is noted that 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.

§8.4.3. Be constructed such that it will be protected under normal handling and pre-event mine conditions; | Meets Requirement | The independent professional engineer and the manufacturer presented reviewers documentation and addressed inquiries concerning the detailed construction drawings and material specifications for the Guardian Angel™ that demonstrated to the reviewers the ability of the Guardian Angel™ to survive normal handling conditions in an underground mine and the ability of the manufacturer to address mine-specific operational capacity.

§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; | Meets Requirement | The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated the ability of the Guardian Angel™ to comply with applicable requirements in WV 56-4 and the MSHA PIB 07-03.

The 96 hour supply of oxygen and removal of CO2 were demonstrated both computationally and through experimentation. The maintenance of CO was addressed through the design of the airlock which computational
May 11, 2011

WV Requirement | Consensus | Justification
--- | --- | ---
refuge chambers that has different assumptions used for the WV standard. The major items are --
| 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.

data were provided and through the use of purge air for which computational analysis were supplied.
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 OMSH&I T does not validate the ability of the Guardian Angel™ 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.

Further it is recommended that prior to delivery to any West Virginia mine documentation of MSHA approval for any electrical items used in conjunction with the Guardian Angel™ 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 interviews are not covered by this application and will require the submittal of requests for modification along with necessary documentation stating the Professional Engineer has evaluated them and he/she warrants their performance to the Director.

§8.4.5. Provide the ability to monitor carbon monoxide and oxygen inside and outside the shelter/chamber;

Meets Requirement

The independent professional engineer and the manufacturer presented documentation and addressed inquiries demonstrating the ability of monitoring applicable gases inside and outside the Guardian Angel™.
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<td>§8.4.6. Provide a means for entry and exit that maintains the integrity of the internal atmosphere;</td>
<td>Meets Requirement</td>
<td>The independent professional engineer and the manufacturer presented documentation and addressed inquiries that demonstrated the ability to enter and exit the Guardian Angel™ without violating the integrity of the internal atmosphere through computational and experimental means.</td>
</tr>
<tr>
<td>§8.4.7. Provide a means for MSHA certified intrinsically safe power if power required;</td>
<td>Meets Requirement</td>
<td>It is recommended that prior to delivery to any West Virginia mine documentation of MSHA approval for any electrical items used in conjunction with the Guardian Angel™ 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 interviews not be included without appropriate modification application being submitted with documentation stating the Professional Engineer has evaluated them and he/she warrants their performance as stated must be provided to the Director.</td>
</tr>
<tr>
<td>§8.4.8. Provide a minimum eight quarts of water per miner;</td>
<td>Meets Requirement</td>
<td>The independent professional engineer and the manufacturer presented documentation that sufficient water would be provided for 96 hours – 16 quarts per miner.</td>
</tr>
<tr>
<td>§8.4.9. Provide a minimum of 4,000 calories of food per miner;</td>
<td>Meets Requirement</td>
<td>The independent professional engineer and the manufacturer presented reviewers with documentation that 96 hours of food would be provided – 8,000 calories per miner.</td>
</tr>
<tr>
<td>§8.4.10. Provide a means for disposal of human waste to the outside of the shelter/chamber;</td>
<td>Meets Requirement</td>
<td>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.</td>
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<td>§8.4.11. Provide a first aid kit as defined at W. Va. 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);</td>
<td>Meets Requirement</td>
<td>The independent professional engineer and the manufacturer presented reviewers with documentation that required first aid materials would be provided.</td>
</tr>
<tr>
<td>§8.4.12. Have provisions for inspection of the shelter/chamber and contents;</td>
<td>Meets Requirement</td>
<td>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 Guardian Angel™.</td>
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<tr>
<td>§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;</td>
<td>Meets Requirement</td>
<td>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 Guardian Angel™.</td>
</tr>
<tr>
<td>§8.4.15. Provide provisions for communications to the surface; and</td>
<td>Meets Requirement</td>
<td>The independent professional engineer and the manufacturer presented reviewers with documentation and addressed inquiries that demonstrated the ability to of the Guardian Angel™ to support existing and emerging communication options and that each would be equipped to support the mine’s communication system.</td>
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