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From: Bill Kennedy [mailto:billkennedy@kennedymetal.com]
Sent: Monday, August 18, 2008 8:31 PM
To: zzMSHA-Standards - Comments to Fed Reg Group
Subject: FW: RIN 1219-AB58

To: zzMSHA-comments@dol.gov and MSHA, Arlington via UPS Next Day Air Letter

From: Bill Kennedy, President, CEO

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Please be advised we have the following ADDITIONAL comments regarding the Proposed Rule relative to Refuge Alternatives for Underground Coal Mines.

The state of West Virginia requested that I look at comments by others regarding heat dissipation from chambers as we have done extensive refuge chamber heat transfer study, and chamber testing in our underground test facility. You have received some very erroneous information regarding chamber heat transfer and consequential chamber interior temperatures. Please find my comments below regarding this subject. These additional comments are supplemental to my earlier comments. The comments below do not replace my earlier statements, but are intended to compliment them.

In our previous comments I stated clearly that 1) the ISO 7243 standard "Hot environments - Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature)" was the standard that should be used for refuge chamber analysis, and that 2), the design or approval of any chamber must include reference to the rock temperature characteristics of the mine in which the chamber is to be used. This remains unchanged

1. There are references to temperature data from the initial NIOSH study of chambers at their Lake Lynn facility. The study referenced was very early in NIOSH's testing and testing procedures were not perfected. The temperature data gathered during that test was from a single probe very near a light bulb used for heat input to the chamber. The recorded temperature did not accurately reflect the temperature in the chamber, but rather that near the light bulb. Attached is a picture I took of the relationship of

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the thermocouple probe and the light bulb. The slender metallic object just to the left of the left most light bulb in the picture is their temperature probe.

Note particularly that any temperature data or conclusions therefrom with respect to this test are erroneous. Temperature values are greatly overstated. NIOSH recognized this and did additional testing with more accurate results. MSHA has comments from others that suggest that temperature information from the first NIOSH tests is valid and can be used to conclude temperatures in chambers. This is grossly incorrect.

2. The same commenter stated that metabolic heat input to the chambers being tested is underestimated by 20 to 30%. The value we use in calculations and testing and the value I believe NIOSH used was 117 watts. This number is found in a number of credible references, and is considered on the high end of the range. . . ASHRAE lists one 'met', or the metabolic heat from one resting man as 100 watts, for instance. The commenter states values as high as 853 BTUs per hour per man. These numbers are wholly unreasonable.*

Our research, that done by NIOSH, and that done by the West Virginia Taskforce are all consistent in a heat rate from the metabolism of chamber occupants of within a percent or two of 117 BTUs per hour.

3. The same commenter references a test of a chamber IN A WAREHOUSE. Chambers are cooled mostly by radiation, which means that the temperature, heat capacity, and emissivity of the things the chamber can 'see', or radiate toward, are what determines most of the cooling capability of a chamber. Tests done where the surrounding conditions are not known, and further, are not mine like rock conditions, are meaningless. The test referenced that was done in a warehouse is of no value whatsoever. The numbers and information gained are meaningless. This is a completely invalid and misleading test. It should be wholly discounted.

4. The same commenter used test results from what appeared to be a partial use of the ISO WBGT standard. While this is the standard and test method that should be used for chambers, it must be used in its entirety, not with some of the specifications omitted. In this case the commenter stated that they did not use the globe portion because they assumed no radiant load. The globe must be used in any case as it radiates heat as well as absorbs it. If one omits the globe portion the results will necessarily be overstated if there is little radiation load. ISO 7243 must be used exactly as prescribed in the standard. No portions may be omitted at the whim of the tester. The numbers and information gained from the reported test are meaningless. This is a completely invalid and misleading report. It should be wholly discounted.

5. The commenter uses a formula for Apparent Temperature (Heat Index) that appears to be Steadman's formula. Note that the Steadman chart reports normal hot summertime conditions in the Midwestern United States as over 150 degrees F. This calculation has no useful purpose in chamber design or analysis. The numbers are 'sensational', and best used by TV weathermen. Only the ISO 7243 WBGT standard should be used for heat and humidity effects on human beings. It has sound scientific basis and has been widely accepted as the international standard for heat stress on people.

6. The commenter states ". . . air cooling systems should be required in refuge chambers intended for more than a few hours occupancy", presumably from the erroneous information referenced above. We know for a fact that there are numerous mine conditions in the United States where an un-air-conditioned chamber can perform its function with internal temperatures within the ISO 7243 standard. Air cooling is not required in all cases and to require it in the rules would place a significant and unnecessary burden on the industry.

Further to my comments above, please be advised that we have completed various full scale tests of refuge chambers in our test chamber. . . a proper underground environment where the rock temperature can be adjusted for varying mine conditions. If MSHA would like to see with their own eyes a chamber under long term temperature study, we would be please to make accommodation to do so.

* To put this to a quick test of reason, please note the following simple thermodynamic example: It is hard to beat the thermodynamic conversion heat output of the combustion of methane under stokiometric conditions. If .5 lpm of oxygen was used to combust a cleanly burning fuel like methane, a stokiometric mixture would yield only 529 btus per hour, or 155 watts. The combustion is $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$. . . or .25 lpm fuel = .25 x .035316 CFM, or .008829 CFM. .008829 x 1000 btus / cubic foot = 8.829 btus / minute = 529 btus / hour. Note that this number is the highest heat theoretically possible with good utilization of the oxygen AND that in the metabolic process in animals a large amount of the heat is used to evaporate water vapor in the lungs. Hence an overall efficiency of $400 / 529 = 75\%$ is not unreasonable or unexpected. The 117 watts, or 400 BTUs per hour is not either unreasonable or understated.

End Comments of 8-18-08 from Bill Kennedy, President, CEO, Jack Kennedy Metal Products and Buildings, Inc., Taylorville, Illinois