



RFI Summary March 2011

Section 1 – General Rules and Eligibility Requirements

Section 1.2 – Registered Participants

RFI 32: I was wondering if there was any rules or regulations for use of alternates in the canoe team.

Response: *Section 1.2 REGISTERED PARTICIPANTS, states that “Substitutions of registered participants will be allowed up to the time of on-site registration. No substitutions shall be permitted after on-site registration.” The alternates need to meet all of the requirements as outlined in the Rules and Regulations.*

Section 2 – Canoe

Section 2.1 – Standardized Hull Design

RFI 2: Section 2.1 states: "...2.5 inches of stern rocker." In the 2010 rules, that section states 3 inches. Since you stated in your email that the dimensions would be the same as last year's and the 2009 hull dimensions, is this in error or is the 2.5" dimension the correct one to follow?

Response: *The hull design for the 2011 competition is the same design used in the 2009 and 2010 competitions. No changes have been made to either the AutoCAD drawings or the Excel Spreadsheet. Upon review of the coordinates in the stern stem section, the CNCCC felt that the 3.0 inch rocker was more accurate of a description for that given section as compared to the 2.5 inch rocker listed in 2009. (NOTE – RFI 61 corrects an error in this response and supersedes this RFI)*

RFI 24: Can the thickness of our canoe vary throughout the hull? For example, can we have a thickness of 1" for one section and a thickness of 2" for another section?

Response: *There are no restrictions on the overall thickness of the canoe and it can vary over the length of the canoe.*

RFI 25: Page 28 which we used for the requisition of materials for our mold construction has a length listed of 16 ft for the length of the canoe... unfortunately the length of the canoe is 20 ft according to

the AutoCAD drawings and the diagram on page 7. What is going on here? We would like to know if we don't have the materials or if we cut the wrong cross sections...

Response: *Figure 6.1 (page 28 of the Rules and Regulations) is an example of what the design drawing is to look like in terms of the various views, block, and bill of materials. It has been incorporated in various editions of the rules, but the canoe itself is not a representation of actual canoe that is to be constructed. Section 2.1 STANDARDIZED HULL DESIGN, covers the overall dimensions of the canoe and that the specifications and drawings located on the www.concretecanoe.asce.org website. General plan, elevation and cross-section views are shown in Figure 2.1. In addition, this design has been used for the past two years.*

RFI 40: The rules give in Section 2.1.1 Dimensional tolerances for the length, width and rocker of the canoe. Are there dimensional tolerances for the 20 individual cross-sections of the canoe and what would the point deduction be if dimensions were not met? Thank you.

Response: *There are no dimensional tolerances for individual cross-sections. However, Section 9.1.2, Judging Criteria, (Final Product) states that "To assess the team's ability to replicate the hull design provided by the CNCCC, the judges will make appropriate measurements of the canoe's length, width, heights, bow/stern rocker, and cross sectional shape. The cross sectional shape will be gauged using three (3) templates, one from each third of the canoe's overall length, at stations to be determined by the CNCCC prior to the start of the conference competitions. These stations may not be the same used at the National Competition, and the CNCCC reserves the right to increase the number of templates used."*

So the cross-section templates are used by the judges to gauge how close the teams came to replicating the canoe and then the judges use that in evaluating and assigning points to the teams. There are no set deductions for cross sectional compliance, it is based on the judges' opinion and objectivity.

RFI 61: In one of the very first RFIs issued, (RFI No. 2, Hull Dimensions – Stern Rocker, issued on 09.16.10), the question was raised "Section 2.1 states: "...2.5 inches of stern rocker." In the 2010 rules, that section states 3 inches. Since you stated in your email that the dimensions would be the same as last year's and the 2009 hull dimensions, is this in error or is the 2.5" dimension the correct one to follow"

The response in the RFI was that "The hull design for the 2011 competition is the same design used in the 2009 and 2010 competitions. No changes have been made to either the AutoCAD drawings or the Excel Spreadsheet. Upon review of the coordinates in the stern stem section, the CNCCC felt that the 3.0 inch rocker was more accurate of a description for that given section as compared to the 2.5 inch rocker listed in 2009."

Response: *There is a typographical error in Section 2.1 of the Rules and Regulations, as it states that there is 2.5 inches of stern rocker. The correct amount of rocker is indeed 3.0 inches. We apologize for any confusion that this may have caused. If you have 2.5 inches listed in the design report (in case they have been already submitted), you will not be penalized.*

2.6 Seats and Mats

RFI 16: This message requests a clarification regarding Section 2.6 - Seats and Mats. Does the 20" x 20" x 20" box for a seat allow for a combination of materials to be used, as long as they are attached to one another? In other words, would it be permissible to attach a 20" x 20" piece to another piece that is 20" high? The finished product would fit inside the box. We submit this question because in previous years we have used this method to create our paddlers' seats but usually get questioned about it at the conference competition (i.e. this method is viewed as using both a seat and mat, even though they are attached and fit within the dimensions of the box).

Response: *Seats may be formed from the use of different materials and shall fit in a 20" x 20" x 20" box.*

Section 3 – Concrete

Section 3.2 – Materials

3.2.1 – Cementitious Materials

RFI 23: After reviewing the rules we have not found a statement specifying for a specific type of Portland cement. Does this mean that we can use Portland Cement type III?

Response: *Section 3.2.1.1 Hydraulic Cement states that the cement “Shall meet the requirements of ASTM C 150, ASTM C 595 and/or ASTM C 1157, and shall react with water to form a binder.” A type III (high early strength) cement is allowed and would generally fall under ASTM C 150.*

RFI 49: Just for clarification, is ground granulated blast furnace slag considered a recycled material? What about air cool ground granulated blast furnace slag?

Response: *Slag in general is a by-product of iron smelting in a blast furnace. The molten slag is separated from the iron and quenched with water, developing a non-metallic, granular material consisting of silicates and alumino-silicates of calcium and other bases. Being a by-product of an industrial process that would generally enter the waste stream, its use as either a supplemental cementitious material (SCM) or an aggregate, make is a sustainable material*

If ground fine enough, it is GGBFS, which is a cementitious hydraulic slag (also known as slag cement). Therefore it is treated as a cementitious material.

There are larger granular gradations of slag (commonly referred to as bottom slag). In this case, they are an aggregate.

The fact that the material may be air cooled does nothing to do with its use as a sustainable material. The sustainability comes from the fact that the material is not “wasted” and can be beneficially used.

3.2.2 – Aggregate

RFI 5: We have looked at multiple sources and are unclear how to classify cenospheres. Should we consider them to be hollow ceramic spheres or glass beads? Also, since it is made from an ash and is part silica, which will be slightly reactive; could we use this as an aggregate in our mix? Several sources are listed below with descriptions:

- The hollow ceramic glass bubble shape of the microsphere results in a variety of uses other than simply being used as a light weight filler. (www.fillite.com)
- CENOSPHERES: Lightweight, hollow ceramic microspheres, also known as glass bubbles, hollow microspheres, or hollow glass spheres. (www.cenostar.com)
- Cenospheres are hollow ceramic microsphere beads arising as a small proportion of the waste ashes from certain coal-burning power stations. (www.schennor.com)

Response: *Reference is made to Section 3.2.2, Aggregate Blends, of the Rules and Regulations which states, “Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate). Each of the sustainable materials used as an aggregate must constitute at least 25% of the total amount of aggregate (by weight). Multiple sources of glass microsphere are allowed and the total of the sources shall meet the requirement of at least 25%. Individual sources of glass microspheres do not need to meet the 25% requirement unless there is a sole source.”*

Glass by definition is a vitreous solid formed by rapid melt quenching. Ceramic materials include glass ceramics which may have an amorphous or glassy structure and can be formed from a molten mass that solidifies on cooling. Glasses can have silica or be silica- free and can contain phosphates, borates, aluminosilicates, etc.

Therefore, cenospheres are, by definition, a glass microsphere.

Per Section 3.2.2, cenospheres can be one of the sources of glass microspheres to meet the sustainable aggregate requirements. However, it is not to be considered an aggregate that is different than other glass microsphere. Case in point, Poraver Siscospheres® are made from post-consumer glass. If combined with cenospheres (and there are various trade names such as Endospheres, Eccospheres, etc), they are considered to both fall under the category of “glass microspheres.”

Therefore, if a team intends to use two or more types of glass microspheres, they are still required to have at least one more different type of sustainable aggregate which does not fall into the category of glass microspheres (e.g., aggregates called microballons, hollow glass spheres, glass bubbles, hollow ceramic spheres, etc.)

In regards to their reactivity, cenospheres are typically considered to be inert. However, they are produced from coal-burning and would have properties similar to fly ash which is pozzolanic. It is possible that the cenospheres may be slightly reactive. The CNCCC considers them inert and they are allowed to be used in the competition. If there is information quantifying them as a reactive material, the CNCCC would still deem them acceptable for use.

RFI 7: Regarding the recent clarification (RFI 5) to section 3.2.2 of the rules where it was determined that multiple sources of glass microspheres are considered to be the same. Would regular crushed glass fall into this category as well?

Response: *Microspheres (microballoons, hollow spheres, etc.) are very lightweight particles with bulk specific gravities that are typically less than 1 (on the order of 0.30 to 0.90 depending on particle size and composition). Crushed glass results in a material that is usually coarser than the microspheres and the specific gravity is considerably higher (on the order of about 2.4 to 2.5, again depending on the mineral composition of the glass).*

Crushed glass does not fall into the category of glass microspheres.

RFI 8: "Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate)." If our team chooses to use recycled crushed glass as one of our sustainable materials, would we be able to use any of the following materials as our second sustainable material:

Glass Microspheres such as Eccospheres or Poraver

Ceramic Spheres such as Cenospheres or Extendspheres

Response: *RFI 7 states that crushed glass does not fall into the category of glass microspheres. Crushed glass is a sustainable aggregate. Therefore, crushed glass can be used in conjunction with the various materials that are considered to be glass microspheres (RFI 5) to meet the requirements of two (2) sustainable aggregates.*

RFI 9: Would a slag based aggregate (i.e. pelletized or expanded slag) be acceptable in the concrete mix? Furthermore, would you consider this type of aggregate to be a glass microsphere? This question is asked because this aggregate has a specific gravity less than that of water, but it is not a vitreous solid formed by quenching. Based on that definition provided by RFI 5 and the technical data of the slag aggregate, it would appear that it is not a glass microsphere but we would like a confirmation. Also, since the aggregate is slag-based, there might be a small degree of pozzolanic and/or hydraulic properties and we want to ensure that this aggregate is compliant.

Response: *Pelletized or expanded slag is considered to be a sustainable aggregate and is acceptable for use in the concrete mixtures. It is not a glass microsphere. Slag aggregate is typically considered to be inert, but it is understood that due to its composition, it may be slightly reactive. Please note that there is a difference between pelletized slag (aggregate) and ground granulated blast furnace slag (typically added to cement as a pozzolan). While coming from the same processes, GGBFS is not an aggregate.*

RFI 10: Would the CNCCC accept the use of a recycled expanded polystyrene aggregate as a sustainable aggregate in the concrete mix? We are aware that this aggregate is extremely lightweight and we would need to meet the 25% by weight requirement as well as the new overall concrete density requirements. We just want to see if it would be compliant or not before we invest major resources into testing the material.

Response: Section 3.2.2., Aggregate Blends, states, that “To qualify for use as a sustainable aggregate the material shall be obtained through the process that either reduces the waste of potentially useful materials, reduces the consumption of fresh raw materials, reduces the energy usage, reduces air and water pollution by reducing the need for “conventional” waste disposal or lowers greenhouse gas emissions as compared to virgin production.”

The use of EPS (or other “non-natural”) aggregate sources in concrete reduced the consumption of fresh raw material, and you reduce the need for conventional waste disposal. Therefore it is a sustainable aggregate.

RFI 12: Do the aggregates have to comply with the gradation requirements for ASTM C-33 Fine Aggregates?

Response: *There are no gradation requirements for the aggregate for the 2011 competition. The requirements for meeting ASTM C 33 Fine Aggregates were removed from the rules and regulations several years ago.*

RFI 15: With the change in the two types of recycled aggregate only one of which can be recycled glass, I wanted to ensure that Extendspheres™ were still able to be used. Extendspheres are a coal fired fly ash bi-product and classified as hollow ceramic spheres.

Response: *Reference is made to RFI No 5. – Glass Microspheres, issued 09.24.10. The first sentence of your inquiry is incorrect. One of the aggregates can be glass microspheres (and that covers the family of materials that are considered to be glass bubbles, microballons, hollow glass spheres, hollow ceramic spheres, etc.). As RFI No. 5 stated, cenospheres are, by definition, a glass microsphere. There is a typographical error in RFI No.5 as “Endospheres” should have been Extendspheres. Regardless, the Extendspheres are a brand name for cenospheres (a “coal fired fly ash by-product), hence a glass microsphere. They can be used in conjunction with other glass microspheres as defined above (remember that regardless of composition, source, gradation, specific gravity, brand, etc. the microspheres are considered ONE AGGREGATE TYPE) and with one or more additional sustainable aggregates (i.e., something other than a glass microsphere).*

RFI 19: Regarding aggregate classification - the rules (Section 3.2.2) state only one glass microsphere may be used as a sustainable aggregate: What exactly is considered a glass microsphere? Are Poraver and EconoStar Cenospheres (see attached data sheets) both considered glass microspheres?

Response: *Please make reference to RFI No. 5, Glass Microspheres, issued 09.24.10 and RFI No. 15, Extendspheres, issued 10.19.10. RFI No. 5 covers this topic in detail.*

RFI 20: In the search for suitable sustainable aggregates we have come across a large number of recycled materials that are being used by local industries in the manufacture of “alternative” concretes. These concretes are being used primarily as building materials or flowable fill. Some of the recycled materials that we have looked at include: newspaper, polystyrene (already approved in RFI #10), various plastics, printer toner, gypsum board (sheetrock) and rubber (from ground-up

tires). After having researched ASTM standards 33, 40, 142, 294, 331 and 332, as well as the 2011 NCCC Rules (especially 3.2.2), we have come up with a general criteria for deciding whether a non-traditional aggregate might be acceptable. Specifically, if a material is non-reactive and insoluble (and can be verified as such by the MTDS) and adheres to the guidelines in section 3.2.2 of the 2011 NCCC rules, can we assume it to be acceptable to the CNCCC as a sustainable aggregate? Or should a separate RFI for each material considered be submitted?

Response: *Of the various materials listed above, newspaper, polystyrene (EPS), plastics, gypsum board and rubber (such as crumb rubber, tire shreds, etc.) would be considered sustainable aggregates. Since the subject of printer toner is specifically raised, we will address that as well. We have received in the past several requests for the use of printer toner as pigment and aggregate. Our review of the subject tends to indicate that spent toner (which is considered to be ink with dust particles from paper) would be classified as a pigment in concrete. Our search has also indicated that spent toner has been used in HMA resulting in toner-modified bituminous concrete (Texas DOT). Regardless, we have not seen anything in our searches that indicate that toner can be considered an aggregate. Unless information is provided to the contrary (be it published literature, technical expert opinion, etc.) submitted to the committee, we will consider it as pigment (please note that it does not meet ASTM C979).*

RFI 21: Our team is considering using air cooled granulated blast furnace slag in addition to our other aggregates. Would this be considered a sustainable aggregate?

Response: *If you are referring to bottom slag, then it is indeed a sustainable aggregate.*

RFI 22: We are using Poraver glass beads as well as 3M K25 glass bubbles. Do they fall into the same category for the required aggregates?

Response: *This has been covered in RFI No 5. Glass Microspheres (09.24.10), and FRI No. 19, Glass Microspheres (11.03.10). The technical data sheets provided state that the 3M K25 material is a glass microsphere. We have stated at the term "glass microsphere" covers a variety of materials, including those considered to be glass microspheres, ceramic microspheres, glass bubbles, hollow spheres, etc.*

RFI 26: Regarding the following sentence: "Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of the difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate)." Is crushed glass and glass microspheres considered one or two sustainable materials?

Response: *This has been covered in several RFIs, therefore, we direct you to the recently posted RFI Summary (in PDF format). The answer is that these are considered to be two different sustainable materials.*

RFI 27: "The blend of aggregates used to produce the concrete canoe mixture shall contain a minimum of two (2) different sustainable materials..." If we use sustainable fibers, will this count as one of our sustainable materials?

Response: *No. Fibers are not aggregates.*

RFI 30: The purpose of this RFI is to inquire about the use of wood chips/shavings and foam shavings as an aggregate in a mix design for the concrete canoe. Are these materials prohibited? There are no specific rules written against using these materials in the 2010 Rules and Regulations. I also did not find anything specific about them in any of the ASTM Standards for concrete.

Response: *Wood and foam shavings used in concrete is taking these products out of the waste stream, hence, they meet one of the definitions of being a sustainable aggregate. The fact that there is no ASTM standard for it, does not mean that they cannot be used as such.*

RFI 31: What is the proper way for us to confirm that our aggregate of choice is within the specifications for sustainability?

Response: *Section 3.2.2, Aggregate Blends, states in part that "To qualify for use as a sustainable aggregate the material shall be obtained through the process that either reduces the waste of potentially useful materials, reduces the consumption of fresh raw materials, reduces the energy usage, reduces air and water pollution by reducing the need for "conventional" waste disposal or lowers greenhouse gas emissions as compared to virgin production." Based on this sentence, there are five (5) criteria that one can compare the sustainable aggregate to virgin aggregate production. In order to qualify as "sustainable," the aggregate source needs to meet at least one (1) of the five (5).
Process that either*

- 1. Reduces the waste of potentially useful materials*
- 2. Reduces the consumption of fresh raw materials*
- 3. Reduces the energy usage*
- 4. Reduces air and water pollution by reducing the need for "conventional" waste disposal*
- 5. Lowers greenhouse gas emissions*

So the steps would be to see if the aggregate source you are selecting meet one of the five criteria above. For example, we all know and love glass/ceramic microspheres/balloons/hollow spheres. Some of these (not all) have come from the recycling of glass (Poraver) as well as combustion (cenospheres). They meet criteria 1, 2, and 4. Not knowing the efficiencies of the plant and production, it is possible that they may meet criteria 3 and 5.

The manufacturers and suppliers of the material most likely have literature promoting the sustainability of their materials (since this has become an ever increasing standard in today's construction industry). However, it is advised that teams understand why it may meet the sustainability requirements. To say, "well the manufacturer said so and it is on their literature" does not really count.

You may also look at the various checklists associated with Leadership in Energy and Environmental Design (LEED) certification to see whether or not the aggregate may fit the sustainability requirements. The most applicable checklist would appear to be the "Material & Resources" under

New Construction. With that being said, teams are advised to use caution and to interpret the checklist and the rules and regulations correctly. For example, the M&R checklist mentions waste diversion, material reuse and recycled content (these have been already discussed as meeting the rules and regulations definition of sustainable aggregate). However, there are also items such as “regional extraction” which refers to transportation distance (less than 500 miles). While a natural aggregate extracted say 30 miles away would be more sustainable than the same aggregate extracted and hauled from 400 miles away (reduced transportation costs is a sustainable practice), it does not meet our definition as a sustainable aggregate. Remember, the rules and regulations are comparing the sustainable aggregate to virgin aggregate production. The aggregate itself is not a sustainable substitute, in this case.

The CNCCC can also review the information and give our guidance and approval on it. Again, teams will need to explain why the material meets the sustainable requirements. We have a few that have been submitted by teams which simply state we want to use this product, can we?

The last item to address are natural aggregate sources and their potential for use as a sustainable material. The technical answer of course is “it depends” and the best way to give some guidance for your consideration are examples.

- Pumice (or other lightweight natural aggregates such as those from volcanic activities) would not meet our rules and regulations as sustainable. These are natural aggregates that are mined (so you are consuming raw materials and doing nothing to them to make them sustainable).*
- Wood is a natural material and by-products such as sawdust (if it is deemed suitable for concrete use) would be sustainable as meets criteria 1 and 2 and possibly 4. Now, the source of the sawdust has to be taken into consideration. For example, if you went to a place that splits wood and they have mounds on site that they need to get rid of (or say a sawmill), then it is sustainable. If you just went out to the woods, fell a tree and decided to make sawdust, then it was not be sustainable.*
- Expanded Shale, Slate, and Clay – the raw material of course is natural. However, the thermal process that bloats the material results in a product that meets criteria 2 (bloating increases the volume, thereby reducing the amount needed to be mined) and 3 (in this case, the shipping of the lighter material can have reduced energy). In this case you are comparing the expanded vs. non-expanded (raw) material.*

RFI 33: "Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of the difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate)." Is crushed glass and glass microspheres considered one or two sustainable materials?

Response: *This has been covered in numerous RFIs. Crushed glass and glass microspheres are considered to be two sustainable materials.*

RFI 42: Regarding the following sentence: "Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of the difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate)."

Is crushed glass and glass microspheres considered one or two sustainable materials?

Response: *Two. Please note that the author of this response is banging his head against the table as this has been covered numerous times.*

RFI 44: Given that RFI 31 issued on 12.15.10 indicated that expanded shales, slates and clays can be considered a sustainable aggregate, are other naturally produced aggregates which are thermally expanded, such as vermiculite and perlite, allowed as well and considered to be sustainable?

Response: *RFI 31 covers Aggregate Sustainability - Section 3.2.2, Aggregate Blends, states in part that "To qualify for use as a sustainable aggregate the material shall be obtained through the process that either reduces the waste of potentially useful materials, reduces the consumption of fresh raw materials, reduces the energy usage, reduces air and water pollution by reducing the need for "conventional" waste disposal or lowers greenhouse gas emissions as compared to virgin production." Based on this sentence, there are five (5) criteria that one can compare the sustainable aggregate to virgin aggregate production. In order to qualify as "sustainable," the aggregate source needs to meet at least one (1) of the five (5).*

Process that either

- 1. Reduces the waste of potentially useful materials*
- 2. Reduces the consumption of fresh raw materials*
- 3. Reduces the energy usage*
- 4. Reduces air and water pollution by reducing the need for "conventional" waste disposal*
- 5. Lowers greenhouse gas emissions*

Expanded Shales, Slates and Clays (brand names such as Solite, Norlite, Stalite, etc) were originally considered because of the waste of the fines (material passing the No. 200 sieve) which manufacturers typically landfill since for their intended purposes fines are not beneficial. These lightweight aggregates are used in concrete (typically fines are not used – obviously the "concretes" made for the canoe competition go against this notion as fines are almost exclusively used) and in geotechnical applications such as lightweight fill where again the fines are not wanted because the migration of fines through the granular media can lead to settlement issues. As a result, the use of the fines meet Criteria 1.

Since the fines of the ESSC was allowed, the committee looks into whether the rest of the gradation meet the requirement and as covered in RFI 31, determined that it would.

This has now led to other questions regarding natural aggregates with similar process, namely vermiculite and perlite.

Vermiculite is a natural mineral (weathering or hydrothermal alteration of biotite or phlogopite) that expands (exfoliates) with the application of heat routinely accomplished in purpose-designed commercial furnaces. Vermiculite is from Latin vermiculare, "to breed worms." Likewise, Perlite is an amorphous volcanic glass that has a relatively high water content, typically formed by the hydration of obsidian. It occurs naturally and has the unusual property of greatly expanding when heated sufficiently. It is an industrial mineral and a commercial product useful for its light weight after processing.

The CNCCC wishes to point out that the intent of the sustainable aggregate requirement was to have students look at materials that could replace the typical aggregates used in concrete. The examples include items like crushed glass, pulverized brick, recycled concrete, bottom ash, bottom slag, even the microspheres, etc. Materials that can be reclaimed and reused rather than being disposed of.

The fact that a material is thermally expanded does not necessarily make it a sustainable product. In the case of ESSC, the thermally expanded product can be compared to the non-expanded product (there is a reduction in consumed volume since the bloating results in increased volume, so you reduce the amount needed to be mined in order to get the same volume). The shale and slate can be used in its non-expanded form. The vermiculite and perlite still need to be processed in order to be used. To meet the criteria as we define it, the vermiculite and perlite must come from a process that

- 1. Reduces the waste of potentially useful materials (neither does)*
- 2. Reduces the consumption of fresh raw materials (neither does)*
- 3. Reduces the energy usage (neither does)*
- 4. Reduces air and water pollution by reducing the need for "conventional" waste disposal (natural materials with no need for waste disposal)*
- 5. Lowers greenhouse gas emissions (neither does).*

The CNCCC does not consider perlite and vermiculite as sustainable aggregates.

In addition, teams are advised to have a thorough understanding of what makes the aggregate they are using to be considered sustainable. To simply state that the manufacturer/supplier or the CNCCC said so, is not enough. Most likely, the CNCCC will re-evaluate its definition of sustainable aggregate for future competitions so that our intent is more clearly defined.

RFI 47: First, regarding the two sustainable aggregates in our concrete mix: We are wondering if Poraver and bionic bubbles are considered "different sustainable materials"? The production process, composition, and sustainability for each of these materials is different; Poraver is recycled glass molded into a sphere shape, whereas bionic bubbles are derived from coal ash, and then cleaned. More information about bionic bubbles can be found at <http://www.sphereservices.com/cms/>. The CEO of Sphere Services, which produces bionic bubbles, said the two aggregates are "absolutely different." However, both aggregates are considered microspheres. What do you think?

Response: *The author of this response is being sarcastic, but you really don't want to know what he thinks about this question. Short answers – No, for the competition, Poraver and bionic bubbles (i.e., cenospheres) are not "different sustainable materials" (and, yes, they are both glass microspheres and we have clearly defined them as such in various RFIs).*

However, being the nice guy that he is, he will address it one last final time. Please refer to "Microspheres (Glass vs. Ceramic), Crushed Glass and "Similar" Products" (issued to the listserv on 01.26.11) a portion of which is below:

The CNCCC has received numerous inquiries regarding what is considered a "microsphere," how it differs from crushed glass, and other "similar" products to ensure that they do not meet the definition of a microsphere. The CNCCC has issues various RFIs regarding this; however, we still are getting the same questions. The following should provide clarification. Reference is made to Section 3.2.2,

Aggregate Blends, of the Rules and Regulations which states, "Only one of the sustainable materials used may be glass microspheres (e.g., different grades of a particular product, similar products from different sources, regardless of difference in gradation, specific gravity, particle shape, or composition, will be considered as one type of aggregate). Each of the sustainable materials used as an aggregate must constitute at least 25% of the total amount of aggregate (by weight). Multiple sources of glass microsphere are allowed and the total of the sources shall meet the requirement of at least 25%. Individual sources of glass microspheres do not need to meet the 25% requirement unless there is a sole source."

Microspheres

- *Microsphere – this covers the family of materials also known as glass microsphere, ceramic microsphere, glass/ceramic hollow spheres, glass/ceramic microballons, glass/ceramic hollow microballons, glass bubbles, ceramic bubbles, hollow glass bubbles, hollow ceramic bubbles, etc. These materials have bulk densities typically in the range of 0.3 to 0.9 g/cc.*
- *Glass by definition is a vitreous solid formed by rapid melt quenching. Ceramic materials include glass ceramics which may have an amorphous or glassy structure and can be formed from a molten mass that solidifies on cooling. Glasses can have silica or be silica-free and can contain phosphates, borates, aluminosilicates, etc.*
- *There are various trade names for microsphere/balloons/hollow spheres/etc. including, but not limited to, everyone's favorite Poraver Siscorspheres®, Extendospheres, Endospheres, Enviroospheres, E-spheres, 3-M K1, etc.*
- *Cenospheres are a by-product from energy production (usually related to coal combustion) and are a glass ceramic shell and therefore by definition, a glass microsphere. Extendo and Endospheres are two name brands of cenospheres. BIONIC BUBBLES IS A TRADENAME FOR CENOSPHERES.*
- *For the most part it appears that many microspheres are a sustainable aggregate – Poraver is made from post-consumer glass, cenospheres as well (see above bullet). Teams should check to see if the other spheres that they are considering meet the sustainability requirements.*
- *And to nip this in the bud, there are similar products out there called "Macro (ballons/spheres, etc)" which are simply larger versions of the microspheres. The CNCCC considers them to be equivalent to microballoons, so therefore, you cannot have (for example), Extendo microspheres and Endo Macrospheres and call them two separate sustainable aggregates. They all fall in the same family of aggregates for this competition.*

With this being said, teams are allowed to use different types of microspheres. However, if you use them, you are still required to have at least one non-microsphere sustainable aggregate meeting the requirements set forth in the rules and regulations.

RFI 51: 3.2.2 Aggregate Blends: "Each of the sustainable materials used as an aggregate must constitute at least 25% of the total amount of aggregate (by weight)." 3.3.2 Aggregate Proportioning: "The amount of sustainable aggregates must comprise a minimum of 50% of the total amount of aggregate by weight."

For a mix we have designed, it contains two (2) sustainable aggregates that make up 100% of the aggregates. However, each aggregate does not make up 25%. One aggregate is 85%, and the other is 15%. Since the minimum requirement for sustainable aggregates weight is 50% and we have 100% is it acceptable for each individual aggregate to not make up 25% of the total amount of aggregates?

Response: *Section 3.2.2. is clear that EACH of the sustainable materials used must constitute at least 25% of the total amount of aggregate. The fact that you have 100% sustainable aggregates does not mean you met all of the requirements. There are three requirements based on these sections – 50% of the aggregate used is sustainable; a minimum of two sustainable aggregates (one of which can be microspheres); and each sustainable aggregate selected has minimum of 25% of the total weight of aggregate (you can have “non-sustainable” aggregate as well).*

In the case of two sustainable aggregates that make up 100% of the total aggregate used, the minimum combination is 25% of one and 75% of the other; you cannot go below 25% of either.

As currently designed at 85% and 15%, the mixture is not in compliance with the rules and regulations (think of it this way, if one designed a mixture with 99% and 1%, would it be in compliance?)

RFI 51: Would fly ash also be considered a recycled aggregate?

Response: *No. Fly ash is a pozzolan. The rules clearly indicate that it falls under the cementitious materials category (as a pozzolan it is a SCM). We reference the ASTM for fly ash as well.*

RFI 63: The purpose of my email is to dispute the answer of two of the RFIs, RFI No. 31 and RFI No. 44, both talk about sustainable aggregates which is the most popular topic this year. Now the product I am going to talk about is perlite, which in RFI No. 44 you state that perlite does not fall under any of the 5 sustainable criteria. However, as someone does research under the uses of perlite you find that it does fall under at least one of the criteria.

The criteria are:

- Reduces the waste of potentially useful materials
- Reduces the consumption of fresh raw materials
- Reduces the energy usage
- Reduces air and water pollution by reducing the need for “conventional” waste disposal
- Lowers greenhouses gas emissions

As we all know Perlite is a generic term for naturally occurring siliceous rock, which is can be heated which then expands, which can then produce more of the raw material. Now in RFI No. 31 it says, “Expanded Shale, Slate, and Clay - the raw material of course is natural. However, the thermal process that bloats the material results in a product that meets criteria 2 (bloating increases the volume, thereby reducing the amount needed to be mined) and 3 (in this case, the shipping of the lighter material can have reduced energy). In this case you are comparing the expanded vs. non-expanded (raw) material.”

Now in RFI No. 44 it says, “The fact that a material is thermally expanded does not necessarily make it a sustainable product. In the case of ESSC, the thermally expanded product can be compared to the non-expanded product (there is a reduction in consumed volume since the bloating results in increased volume, so you reduce the amount needed to be mined in order to get the same volume). The shale and slate can be used in its non-expanded form. The vermiculite and perlite still need to be processed in order to be used.”

So which is it? Perlite as you stated thermally expands, which is the only things that the Shale, Slate, and Clay has going for it, is it a sustainable aggregate under the fact that it reduces the consumption of fresh raw material, because perlite unlike clay can expand up to 20 times its size. Now we can get into the dispute that you have stated that if a material falls under the criteria as “Thermal Expansion” it falls under sustainable criteria 2 and possibly 3, it is ok to use it as a sustainable aggregate. Which you then change your mind 2 months later after school have already worked with it in their mix.

However besides the thermal expansion perlite has other properties that allow it to fall under the category as sustainable. First perlite comes from siliceous rock, which comes from diatomite which is formed from dead diatoms (microscopic singlecelled algae). So yes perlite is mined to find this dead algae however, using this dead algae helps reduce the need to use other natural resources like rock or sand. In Addition, algae has the ability to reproduce and grow, which would fall under sustainable criteria 2, again since using this algae helps reduces the consumption of fresh raw material.

Also in case you did not know perlite is used in horticultural applications, which is used “as a component of soilless growing mixes where it provides aeration and optimum moisture retention for superior plant growth.” (www.perlite.net) Also “horticultural perlite [has a] neutral pH and [is] sterile and weed-free.” (www.perlite.net)

Now this means that perlite is used in soil instead of fertilizer which makes it fall under sustainable criteria 5. Since fertilizer comes from cows which as they produce the fertilizer excrete a “fart” which is a big contributor to greenhouse gases. So if you use perlite instead of fertilizer you are lowering the greenhouses in the world.

In addition, as stated perlite is weed-free, which means the use of weed killer is not needed, which again lowers greenhouse gas emissions.

Now a common use of perlite is insulation, which means that if used in a building it would fall under sustainable criteria 3. Using perlite would reduce the energy used to heat and cool a building.

Also unlike the recycled glass spheres that are so popular, perlite does not need to be heated at over 900 degrees Fahrenheit, which using perlite would again reduce the energy usage since it is mined and then you can grind it and use it. You do not need to heat it, you do not need to add anything to it, and the energy it does use is just from the mining equipment. So like I said using perlite instead of recycled glass lowers the energy usage.

Now under the 5 criteria that was laid out and explain several times perlite falls under sustainable criteria 2, 3, and 5.

I would appreciate that you would count perlite as a sustainable aggregate. As for the fact that it falls under 3 of the 5 criteria. Now I understand your reasoning to not want perlite count because you want us Future Engineers to think outside of the box and find the new sustainable aggregate which would

better mankind. So maybe next year ,like you stated in a previous RFI, you will need to define what you want a little more. However, under this year's rules and regulations perlite falls under a sustainable aggregate.

Thank you for your time and because it is so close to competition time I would highly appreciate it if you could give me your response as fast as you can.

Response: *While the CNCCC response is going to be that we have decided to allow perlite to be considered a sustainable aggregate, we will address some issues as well.*

Section 3.2.2 Aggregate Blends states that "To qualify for use as a sustainable aggregate the material shall be obtained through the process that either reduces the waste of potentially useful materials, reduces the consumption of fresh raw materials, reduces the energy usage, reduces air and water pollution by reducing the need for "conventional" waste disposal or lowers greenhouse gas emissions as compared to virgin production." While it is true that perlite can be used for filling in CMU for better thermal insulation (it is also used for cryogenic purposes – so Ted Williams head may be preserved using perlite), is weed free in horticultural applications, or can be used as fertilizer in an effort to reduce ozone depletion resulting from the gaseous expulsions of flatulent bovine, those are not processes from which the perlite is obtained (rather they are end uses). However, the bloating of the raw perlite is a process (similar to that for expanding shales, slates and clays) which will make it sustainable.

Perlite Comes from Diatomite

It is stated above that "perlite comes from siliceous rock, which comes from diatomite which is formed from dead diatoms (microscopic singlecelled algae). So yes perlite is mined to find this dead algae however, using this dead algae helps reduce the need to use other natural resources like rock or sand. In Addition, algae has the ability to reproduce and grow, which would fall under sustainable criteria 2, again since using this algae helps reduces the consumption of fresh raw material."

Perlite is siliceous rock and is an amorphous volcanic glass (hence igneous rock) that has a relatively high water content, typically formed by the hydration of obsidian. It occurs naturally and has the unusual property of greatly expanding when heated sufficiently. It is an industrial mineral and a commercial product useful for its light weight after processing. It is not diatomaceous earth (diatomite) which is a naturally occurring, soft, siliceous sedimentary rock that is easily crumbled into a fine powder. Perlite has nothing to do with algae.

Perlite Does Not Need to Be Heated

It is stated above that "Also unlike the recycled glass spheres that are so popular, perlite does not need to be heated at over 900 degrees Fahrenheit, which using perlite would again reduce the energy usage since it is mined and then you can grind it and use it. You do not need to heat it, you do not need to add anything to it, and the energy it does use is just from the mining equipment. So like I said using perlite instead of recycled glass lowers the energy usage."

According to the various references (www.perlite.net, etc.) expanded perlite is obtained by quickly heating the raw perlite material to 1600 degrees Fahrenheit (nearly 900 degrees Celsius). So to have a sustainable material the perlite needs to be expanded.

Is it or is it not a Microsphere?

Perhaps you did not see this one coming. According to various sources, there are various grades of perlite. Raw perlite (in this form, it is not a sustainable aggregate since you are mining natural raw material) which can be crushed, and expanded perlite which can be further broken down into coarse, medium and fine gradations. The fine expanded perlite is even called "Perlite Hollow Microspheres" (http://www.perlite.org/product_guides/29%20Perlite%20Microsphere%20Filler.pdf) and the CNCCC has addressed this issue in the various RFIs. If the fine perlite are microspheres, would the larger expanded perlite be similar as it is still bloated volcanic glass? This would meet the definition as we clearly laid out in the rules and regulations and clarified in the RFIs – a glass (be it volcanic glass) that is processed resulting in a product that is hollow, lightweight and now sustainable (since it is result of the bloating process).

So the question is what should we classify the perlite as – a separate sustainable material, a microsphere, or both (depending on the grade that is used)? We assume that your response would be to classify it as a non-micropshere material and a separate sustainable material. The CNCCC would be very well in its right to classify the perlite as a microsphere. However, at this point in time and in an effort not to complicate issues, the CNCCC will take the position that expanded perlite would fall along the lines of ESSC and not that of a glass microsphere.

3.2.4 – Admixtures

RFI 34: Is the use of whitening admixtures like titanium dioxide permitted by the CNCCC?

Response: *Section 3.2.4.3, Coloring Admixtures/Agents and Concrete Pigments, states that they need to meet the requirements of ASTM C 979. If you have a product that contains titanium dioxide that meets these requirements, it can be used.*

RFI 54: We're compiling our MTDS sheets for the Engineering Notebook. Does Latex have to meet ASTM 1438? We've emailed our contact about it and he's said that it's never tested and we'd be hard pressed to find a latex admixture that shows ASTM 1438 on the MTDS. Last year, our Materials Director had a response from the committee about this that said it didn't need to show on the MTDS. Is this still true?

Response: *According to Standard Specification for Latex-Modified Concrete (LMC) Overlays (ACI 548.4-93) "There is no ASTM standard for these types of latexes at this time. When such a standard becomes available, it shall govern." The ACI document Guide for the Use of Polymers in Concrete (ACI 548-1) provides a table of properties of latexes. ASTM 1438 does not need to be met or indicated on the MTDS. As long as it is a commercially available latex, the CNCCC will accept it. We are also allowing waste paint latex as well.*

Section 3.3 - Requirements

3.3.1 Mass of Cementitious Materials

RFI 38: We are writing this RFI in regards to Section 3.3.1 of the 2011 Rules and Regulations for the Concrete Canoe Competition. Specifically on the definition of Hydraulic cement.

"The minimum amount of hydraulic cement is 30% (by mass) and the maximum amount is 50% (by mass) of the total cementitious materials content in any given concrete mixture (e.g., c/cm ratios shall be in the range of 0.30 to 0.50 for any given concrete mixture."

Our question is in the definition of Hydraulic Cement pertaining to slag cement and whether or not slag cement is hydraulic or not. According to the Slag Cement Association:

"Ground granulated blast-furnace slag(GGBFS): A hydraulic cement formed when granulated blast-furnace slag is ground to a suitable fineness. Commonly referred to as slag cement, or GGBFS."

If this is the case then only a maximum combination of 50% of a portland and slag can be used in the mixture. This would mean that all of the top 5 schools from the 2010 competition were over this amount and thus in violation of Section 3.3.1. Also in several of the RFI responses from the past regarding seem to give contradicting responses concerning the hydraulic nature of slag as a cementitious material. Meaning that in several RFI responses slag cement was considered a pozzolan. We am writing this RFI to get the final ruling of the CNCCC's stance on the hydraulic nature of slag cement, if the slag in question is 100% GGBFS (no other cases, we are aware of the 70-30 slag/portland mixture, but this does not pertain).

Response: *Section 3.3.1, Mass of Cementitious Materials, states (first sentence) that "All concrete mixtures must contain hydraulic cement meeting the requirements of Section 3.2.1.1." Section 3.2.1.1, Hydraulic Cement, states that the cement "Shall meet the requirements of ASTM C 150, ASTM C 595 and/or ASTM C 1157, and shall react with water to form a binder." In addition, Section 3.2.1.4, Slag Cement, states that it "Shall meet the requirements of ASTM C 989, Grade 100 minimum."*

Slag (or slag cement) is typically considered a pozzolan in that it is primarily vitreous siliceous materials which react with calcium hydroxide to form calcium silicate.

The rules basically require that a portland cement be used and supplemented with pozzolans such as fly ash, slag, silica fume, metakaolin, etc.

The top five schools at the 2010 competition were not in violation of the rules (note that the rules have changed as well).

RFI 46: In my understanding Slag can be used as hydraulic cement, since it reacts with water and forms a binder with it. RFI 38 state that Slag Cement is no considered as a hydraulic cement. However, in the "Product Data Sheet" of the material we purchased clearly states that it is considered a hydraulic cement, and I quote :

"PRODUCT DESCRIPTION: Essroc Slag Cement is a hydraulic cement conforming to ASTM C 989. It comes from the production of iron in a blast furnace. The molten slag is separated from the iron and

quenched with water, developing a non-metallic, granular material consisting of silicates and aluminosilicates of calcium and other bases. Essroc Slag Cement is formed when the granules are ground to a suitable fineness, generally more than Type I portland cement."

With regards to the competition's rules my question is the following (since all the mix trials have yield better results when using this material as the main and only hydraulic cement) can it replace Portland Cement in the concrete mixture (use slag cement only; no portland cement)?

Response: *Reference is made to Section 3.3.1 Mass of Cementitious Materials, which states that "All concrete mixtures must contain hydraulic cement meeting the requirements of Section 3.2.1.1. The minimum amount of hydraulic cement is 30% (by mass) and the maximum amount is 50% (by mass) of the total cementitious materials content in any given concrete mixture (e.g., c/cm ratios shall be in the range of 0.30 to 0.50 for any given concrete mixture). In addition, the total amount of hydraulic cement meeting the requirements of Section 3.2.1.1 shall not exceed 400 lb/yd³ in any concrete mixture."*

Section 3.2.1.1 Hydraulic Cement states that it "Shall meet the requirements of ASTM C 150, ASTM C 595 and/or ASTM C 1157, and shall react with water to form a binder." ASTM C 150 covers portland cement, C 595 covers blended cements and C 1157 covers hydraulic cements. In addition, Section 3.2.1.4 Slag Cement states that it "Shall meet the requirements of ASTM C 989, Grade 100 minimum."

Here is a quick primer on cement (reference The Portland Cement Association, PCA):

Portland cements are hydraulic cements composed primarily of hydraulic calcium silicates. ASTM C150, Standard Specification for Portland Cement, recognizes ten (10) types - Type I and Type IA (General purpose cements); Type II and Type IIA* (for moderate sulfate resistance); Type II(MH) and Type II(MH)A* (moderate heat of hydration characteristic and moderate sulfate resistance) Type III and Type IIIA* (high early strength); Type IV (rate and amount of heat generated from hydration minimized. Develops strength slower than other cement types and Type V (high sulfate resistance). * denotes Air-entraining cements*

Blended hydraulic cements are produced by intimately and uniformly intergrinding or blending two or more types of fine materials. The primary materials are portland cement, slag cements, fly ash, silica fume, calcined clay, other pozzolans, hydrated lime, and pre-blended combinations of these materials. ASTM C595, Specification for Blended Hydraulic Cements, recognizes three (3) classes of blended cement: Type IS (X) - Portland blast furnace slag cement; Type IP (X) -Portland-pozzolan cement and Type IT (AX)(BY) -Ternary blended cement. The letters X and Y stands for the percentage of supplementary cementitious material (SCM) included in the blended cement, and A and B are the Types of SCMs, either S for slag or P for pozzolan. Type IS(X), can include up to 95% slag cement. Type IP(X) can include up to 40% pozzolans. As an example for ternary cements, Type IT (S25)(P15) contains 25% slag and 15% pozzolans.

All portland and blended cements are hydraulic cements. Hydraulic cement is merely a broader term. ASTM C1157, Performance Specification for Hydraulic Cements, is a performance specification that includes portland cement, modified portland cement, and blended cements. ASTM C1157 recognizes six types of hydraulic cements: Type GU-general use; Type HE-high early strength; Type MS-moderate sulfate resistance; Type HS-high sulfate resistance; Type MH-moderate heat of hydration; Type LH-low heat of hydration.

So based on this – slag is a SCM (and it is generally considered to be a type of pozzolan and a cementitious hydraulic slag). ACI document 233R (Slag Cement in Concrete and Mortar) states the following “When slag cement is mixed by itself with water, initial hydration is slower than that of portland cement; therefore, portland cement, alkali salts, or lime are used to increase the reaction rate.”

In other words slag cement (which is just a fancy name given by marketing people to a material that has been traditionally called ground granulated blast furnace slag) typically requires an activator (portland cement is most commonly used for this purpose) to obtain the required strength within the reasonable time period.

In all three ASTM designations, portland cement is a component. The rules require that portland cement be used and that the minimum amount is 30% by mass and the maximum is 50% by mass (c/cm ratios shall be in the range of 0.30 to 0.50 for any given concrete mixture). The slag can make up anywhere from 50 to 70% of the cm.

RFI 46a: *In our RFI 46 (issued 02.01.11), the last paragraph stated that “In all three ASTM designations, portland cement is a component. The rules require that portland cement be used and that the minimum amount is 30% by mass and the maximum is 50% by mass (c/cm ratios shall be in the range of 0.30 to 0.50 for any given concrete mixture). The slag can make up anywhere from 50 to 70% of the cm ”*

The last sentence of this paragraph would only be applicable if only portland cement and slag (i.e “slag cement”) were used. Teams can have more than one supplemental cementitious material (SCM) and therefore it would be the sum of the SCM that can make up anywhere from 50 to 70% of the total cm used. The use of slag is not a requirement and we wanted to ensure teams did not interpret the last sentence as such.

Examples:

50% Type III Cement, 25% Slag and 25% Silica Fume

30% Type I/II Cement, 0% Slag, 60% Fly Ash and 10% Silica Fume

3.3.2 Aggregate Proportioning

RFI 13: *In past years, there has been a requirement that not more than 5% of the total aggregates in a concrete mix may pass through the #100 sieve (or some similar rule). This year, I have been unable to find such a requirement in the text of Section 3.2.2, Aggregate Blends, nor elsewhere in the Rules and Regulations. Is there no such requirement this year? Or is this requirement posted in a section other than Section 3.2.2?*

Response: *There are no gradation requirements for the aggregate for the 2011 competition.*

RFI 14: *A question regarding aggregate blending - is each team allowed to sieve their own aggregates to achieve the desired aggregate size used in a concrete mix? For example, could a team use their own sieve to separate smaller aggregates from larger ones for use in a structural vs. a finishing mix?*

Response: *There are no gradation requirements for the aggregate for the 2011 competition. The method of achieving the desired gradation is left to the teams. The removal of the gradation requirements was made in order to provide teams flexibility with the aggregates as well as the fact that gradations are done by percent passing (weight) and usually the specific gravity of the aggregate is one value (for example, 2.65 for sand) but when dealing with the various lightweight aggregates used in competition the specific gravities vary significantly.*

3.3.3 Allowable Unit Weights

RFI 3: With regards to the unit weight limit, 55 to 70 pcf, it is not clearly stated if there will be any deductions or consequences when the range limit is not met.

Response: *The deduction for not being within the specified limits of the concrete unit weight was inadvertently left off of the deduction score card provided in the Rules and Regulations. The deduction for not being within the 55 to 70 pcf [which is based solely on the yielded mixture proportions which is the same as the measure plastic (wet) unit weight of concrete] is 15 points. This is shown as Infraction I on the attached document. Teams are advised that the attached Final Product Deduction Score Card supersedes the version originally submitted with the Rules and Regulations.*

Section 3.4 – Documentation

3.4.1 – Mixture Proportions Table

RFI 4: My team has a question regarding Appendix C – General Guidelines for Concrete Mixture Data Table 3.1. It is said that the Actual Batch Proportions are “what is batched in the laboratory and includes any deviations from proposed proportions (Non-SSD Proportions) or assumed amounts.” Does “batched in the laboratory” mean the concrete freshly mixed or as placed on the mold?

Response: *Reference is made to ASTM C138. The scope of C 138 states that “this test method covers determination of the density of freshly mixed concrete and gives formulas for calculating the yield, cement content, and air content of the concrete.” Table 3.1 provided in the Rules and Regulations is a worksheet that is used during your research and development (concrete testing) phase when you are determining the concrete(s) that you are going to use for the canoe.*

Batched concrete is the fresh concrete (wet, plastic) that you made based on designed proportions during the R&D phase. From the batch, items such as slump are measured and cylinders/cubes/beams would be cast for testing purposes. With the known volume of the cylinders, etc. and the measured weight of the test specimens, the unit weight, air content (gravimetric) and yield can be determined. The values from the batch are then compared to what the anticipated design was and then adjustment are made so that the yielded proportions are computed.

Once concrete(s) with desired properties are achieved (unit weight, slump, strength, etc.) and selected for the use in the canoe, the R&D phase is completed and Table 3.1 is then completed as well. This/these is/are the concrete(s) that the team is specifying for the canoe. The concrete that is batched during the canoe casting process should be the specified concrete(s). QC cylinders, cubes, etc. should be taken as part of the quality control process to check that unit weight and strength are within specified limits.

The CNCCC understands that the placement methods for the canoe may compact the concrete and therefore the density “as placed” may be different than the density of a cylinder or cube.

RFI 39: I am wondering if there is a requirement as to how aggregates should be reported in the Mixture Proportions Tables for the Design Paper? My team has used various gradations (grades) of two sustainable aggregates for our concrete. Do we need to report gradations for each aggregate type used (for example, Aggregate A 1.0-2.0 mm, Aggregate A 0.5-1.0mm, etc.), or would general categories like "Aggregate A", "Aggregate B", etc, be acceptable? I ask because there is only a limited amount of room to put information in the mix tables.

Another related question is if it would be acceptable to define certain gradations, such as "Coarse" and "Fine", as used by our team this year, and report the weight ratios of further gradations in a separate sentence? If you need further clarification on my question, please let me know.

Note – Aggregates A and B are used in order not to disclose the aggregates the team used.

Response: *The main issue that would need to be addressed is that the various gradations (grades) of certain aggregates have different specific gravities and different absorptions so when the computation is shown in the table it would make sense that it would have to be broken down. If you have an aggregate with a fairly consistent specific gravity and absorption then it appears that you can list it as one aggregate (with no need to separate the grades). One possible option is to have a smaller table discussing the grades, specific gravities and absorption values (along with the Amount and Volume summarized so that calculations can be checked) within the body of the report and then put a reference to it in the Table 3.1. with a more simplistic description. Another option is to have Table 3.1 extend beyond one page and list everything in the Table (while the rules indicate one separate page per table, the intent is to not have more than one table on a given page. Extending the table to more than one page is reasonable).*

The latter would be the preferred option as the judges (at conference) and the CNCCC (at Nationals) will be checking the compliance of the mixtures.

3.4.3 Material Technical Data Sheets

RFI 17: My team has a question regarding section 3.4.3 - Material Technical Data Sheet. It is said that: "Material Technical Data Sheets (MTDS) for each material used in the construction of the canoe shall be presented". We are currently considering the option of crushing an old concrete canoe to make a recycled aggregate. What type of information (other than the mix design of the original canoe, specific gravity and absorption) shall we include in our custom-made MTDS?

We also have a question regarding section 3.2.2 - Aggregate Blend. It is said that "The CNCCC will consider the use of “non-deleteriously reactive aggregates” in concrete canoe mixtures". After how long is a concrete canoe considered as being un-reactive? Would it be legal for us to crush last year's canoe and use it as an aggregate?

Response: *The information that you listed would suffice. Recycled concrete aggregate is considered to be inert. Yes, you may crush your canoe.*

RFI 37: A local pottery studio has agreed to donate its rejected pieces to the team, which we then crush and grind to the desired size. Since this aggregate is diverted from the waste stream, we have assumed that it qualifies as a sustainable aggregate, but we would like confirmation.

Due to its nature, this aggregate does not have a MTDS, and so, according to section 3.4.3 of the rules, "shall be submitted to and approved by the CNCCC as alternatives before their application." Is there a process for this? Also, what should take the place of the MTDS in the Engineer's Notebook?

Response: *This would definitely be considered a sustainable material. It is understood that given the nature of the material, an MTDS would not be generated. As a result, the team is responsible for obtaining the information. Gradation, specific gravity, and absorption will be required at a minimum. A letter from the pottery studio indicating that they are the supplier of the material would be helpful as well.*

RFI 60: We seek clarification regarding the Material Technical Data Sheets needed for the engineer's notebook. For the Engineer's Notebook, the rules clearly state a Material Technical Data Sheet (MTDS) for each type of concrete material present in the mix must be available. We have obtained recycled gypsum from a supplier and they have sent both authorization that it is indeed a sustainable aggregate as well as a Material Safety Data Sheet (MSDS). I understand the MSDS is not acceptable in place of the MTDS, but the company does not have a MTDS for the recycled gypsum, explaining that it is merely crushed drywall. What action should be taken to obtain something equivalent to a MTDS? Is there anyway information in the MSDS would be sufficient?

Response: *In this case, the letter from the supplier and the MSDS should be provided. However, it is assumed that some testing was performed so that you have parameters such as specific gravity and absorption (needed for the concrete mixture table). Test results if performed by the team or outside laboratory should be provided as well.*

3.4.5 Concrete Sample Cylinders

RFI 48: Can you clarify how many cylinders we need to display at our table at competition? We believe it's one per concrete mix used (in our case two, since we used one grey and one white), but we wanted to double check.

Response: *Section 3.4.5, Concrete Sample(s) Cylinders, states that "3 in. x 6 in. or 4 in. x 8 in. samples of each concrete mixture used in the canoe shall be made available for compliance checking as part of the product display (Section 10.1.b). The sample(s) shall be a quality control (QC) test cylinder taken at the time of construction and be representative of the in-place density, color, consistency and make-up of the concrete(s) used in the canoe. The concrete cylinders shall be provided in two halves, preferably sawn in half, or broken by performing a splitting-tensile test in accordance with ASTM C 496."*

Section 4 – Reinforcement

RFI 6: "Bondo, epoxy, or similar materials are not permitted at any time during the casting of the canoe (i.e., placement of concrete, reinforcement and floatation)" Does this statement apply only to the

placement of the reinforcement during the concrete casting process, and not to preparation done to the reinforcement during preparation for casting? This question is in regards to wet casting and using an epoxy to make the reinforcement rigid during the casting process.

Response: *Reference is made to the CNCCC Intent of Section 4, Reinforcement, which states that “In general, teams are permitted to develop a reinforcement scheme that (a) uses materials that contain sufficient open space measured in terms of percent open area (POA), (b) the total thickness of the reinforcing layers is equal to or less than 50% of the total thickness of the reinforced concrete composite, and (c) the reinforcing materials do not have post-manufacturer applied coatings that enhance the properties of the reinforcement.” Adding epoxy to reinforcement would violate item (c). The preparation of reinforcement is still part of the casting process (whether it happened immediately before placement in the canoe or even several months before placing it in the concrete).*

RFI 58: Regarding the following sentence: “a piece of plate glass, 6 mm (~1/4”) or thinner, is to be placed on the reinforcing.” What kind of plate glass do you mean is it the one you usually use on mirrors and big windows (thin sheet of glass that looks like plastic glass)? What is the minimum amount that should we been using (what are the dimensions)? Is it optional?

Response: *The intent is to be able to measure the thickness of the reinforcement (especially when it is a mesh). Any piece of glass will work. The amount you need will depend on the size of the sample you are testing. There is no minimum amount. If you are using items like steel rods or WWM, you can augment the measurements with calipers or a tape measure.*

RFI 59: We have two layers on the conventional fiberglass reinforcement in this year's canoe. We also installed a steel cable near the top of each gunwale so we could later post-tension it. Do the two cables count as primary reinforcing?

If so, what ASTM will the cables have to conform too? No distributor seems to have a MTDS for the standard steel cable that we used. We got the steel cable from Lowes, so the best we can do is print of their spec sheet off their website. Please indicate what we should do.

Response: *The steel cables count as primary reinforcement. There is no ASTM requirement for the steel. The specification sheet will suffice for the MTDS as steel has well known properties.*

Section 5 – Final Product

Section 5.2 – Lettering

RFI 55: My question is in regards to using the canoe name in the center of the canoe as an aesthetic piece. This graphic will be separate from the actual school name (consisting of letters 4 1/2" +/- 1/2" high). I wish to have clarification on whether it is allowed to have both the convention name in the appropriate location and appropriate sizing, as well as, an aesthetic graphic with the canoe name somewhere near the center of the canoe.

Response: *If the graphic you are referring to is made our of integral colored concrete or stained, then it is allowed.*

Section 5.5 – Concrete Stains

RFI 56: I would like to know a specific site where I can order the stains that are required by the Committee since I can't find any. Are powdered stains mixed by the team with the required amount of water (for example, 10% of solid stain and 90% water) allowed?

Response: *The CNCCC does not provide recommendations on the materials that can be used in the competition. However, there are numerous water-based and acid-based stains on the market that meet the specifications outlined in the rules and regulations. You may also use the listserv (canoe@ftl.com) to solicit a response from other schools that may be willing to point you in the right direction.*

As long as the materials being used are in compliance with the regulations, they can be used. There are a variety of stains that require dilution to meet the solids contents (manufacturers typically provide that information). If you have a particular stain in mind, please submit it to the CNCCC as soon as possible for review (since this is a request submitted prior to the question deadline, we will allow the team to submit the product to us).

Section 5.6 – Concrete Sealers

RFI 35: In Section 5 (Finishing) - 5.6 Concrete Sealers: Needs to be meet either of the following: (a) Silane- or siloxane-based penetrating sealer with a minimum solids content of 20 percent and a VOC of less than or equal to 350 g/L. "OR" (b) Liquid membrane-forming compound for curing and sealing that is certified to meet the requirements of ASTM C 1315.

Referring to part (a), the company we are looking into purchasing a sealer is stating that (VOC) is usually expressed as ppm (parts per million). We wanted to clarify this, before purchasing the sealer.

Response: *VOC are typically provided in grams per liter (g/L), but can be easily converted to parts per million (ppm). 350 g/L is about 350,000 ppm. 1 liter (of water or a substance with a SG = 1) weights 1000 grams, therefore 350 grams is 35%. 35% of a million is 350,000 ppm.*

Section 6 – Design Paper

Section 6.2.2 - Format

RFI 41: It's stated that the mold will be considered a lump sum cost. If we used recycled wood and fasteners to build a frame around our foam mold, should we consider market value of the wood we used or would the cost be considered \$0.00 for the wood when factoring it into the lump sum cost with foam and other materials? Also, would cost of machining of the mold be considered in the lump sum or would that be considered construction labor (which the rules say not to include)?

Response: *Market value should be provided. You can put a note stating that the material was reclaimed. If the mold was purchased (i.e. done by others, then the cost for the machining would be provided since that is incorporated into the final product). If done by the team, then the cost for construction is not included.*

Section 6.3 - Submissions

RFI 53: Is the host school even allowed to provide electronic submission as an option as long as we send in our five hard copies of the report? Our host school has provided it as an option to submit an electronic copy in .pdf format rather than sending in the hard copies.

Response: *Section 6.3.1 Conference Competition (Submissions) clearly states that “For the Conference Competitions, each school shall provide five (5) bound copies of the Design Paper. Electronic copies of the report are not required at the conference level and shall not be requested by the host school. All copies of the Design Paper must be received by the date specified by the conference host school or be subject to penalties. Please note that the CNCCC.”*

This is not an option. Hard copies only for the conference competitions. Host schools are not to request electronic versions.

Section 7 – Engineer’s Notebook

Section 8 – Oral Presentation

RFI 57: The question we have is in regards to the Oral Presentation Score Card found on page A-2 of the 2011 National Concrete Canoe Competition Rules. Under the deductions section on the bottom portion of the scorecard it lists a 15 point deduction for Sponsorship or Commercialism Violation.

The reason we are curious about this deduction is because in recent years, both at the conference and national level, teams have said company or manufacturer names such as Poraver, Extendospheres, etc either in their presentations or during their responses to the judge’s questions. We have always thought of this as being a commercialism or sponsorship violation but we have noticed teams have not been deducted for this violation. Could you please specify what is included in this deduction and what is acceptable to mention during the presentation or in the question session following the presentation?

Response: *The CNCCC understands that many teams, if not all, end up using products that are donated to them. In the case of the Oral Presentation, as well as the Design Paper, teams are allowed to provide the brand names of the products that they are using. For example, the various microspheres listed above, and items such as Dow Latex, or BASF Glenium HRWR, etc. Actually we (the CNCCC and the judges) would prefer to have that information handy as it helps delineate between various products and allows us to look up information on a product if it is needed.*

An example of a violation would be more along the lines of a slide at the end of the presentation thanking all of the sponsors and listing them.

Section 9 – Final Product (Canoe and Cutaway Section)

9.1 Aesthetics

RFI 50: Concerning Section 9.1.1 General Requirements pertaining to the canoe display stand. No lighting, sound, or canopies shall be permitted at the time of judging. Does this permit the use of move parts using electricity?

Response: *No it does not. The intent is for the judges to focus on the canoe and cross-sections and the CNCCC eliminated items such as lights, sounds, etc. (eliminate the “flashiness” for the lack of a better term). In addition, there are no requirements that electrical outlets would be provided (and to nip it in the bud, you cannot provide generators, solar cells if you wanted to be sustainable, etc. and provide your own).*

Section 10 – Product Display

RFI 28: What attire is required at the product display? We had planned on wearing our team T-shirts which will display our sponsors. The rules say sponsor-related items shall not be part of the display, but does our attire fall under the display?

Response: *There is no attire requirements for the display (they are not considered to be part of the display). The reference to sponsor-related items are for items such as “We like to thank...X, Y, and Z.” or hanging company banners, etc. Now if you have a product, for example, an admixture, there is no issue if you list it as part of the display (for example, Degussa HRWR). We understand that materials are donated (i.e., sponsored), but in this case, it is providing a brand name, not serving as a marketing tool.*

RFI 29: For our product display, is a banner allowed to hang from the edge of the table, or is everything required to sit above the surface of the table?

Response: *A school banner may be used as well as a table skirt. Other than that, it is a table top display.*

RFI 36: In regards to the following passage from this section of the rules:

"Table Top Display – the tabletop display, including overhangs, projections, and braces, shall fall wholly within a 30” (W) x 96” (L) x 48” (H) box. The tabletop display shall be placed on the table and provide enough space to accommodate all information and samples. It will only be viewed from only one side that opens to the front of the table."

Is it permissible to enclose the bottom of the table with plywood that it is offset in from the table edge approximately 1 inch? If this isn't allowed on all sides can it be done on the front only? If the use of plywood is allowed, can the plywood be laminated to create a built up design or painted with a design? All additions will still be offset back from the edge of the table so as to not extend beyond the table edge.

Response: *The focus is on the table top display. The only type of covering that is allowed on the table is a skirt.*

RFI 52: My team has a question regarding Section 10 - Product display. It is said that "the table top display shall fall wholly within a 30" X 96" C 48" box". In the answer to RFI #36, it is said that "The only type of covering that is allowed on the table is a skirt". Is it permissible to use an enclosed box having the dimensions of a standard conference table (30" X 96" X 29") as a way of supporting the table top display? We would only use the box as an esthetical element, we would not use it to display information or samples.

Response: *No. Section 10.0, General Requirements, states that each team shall provide "a. Conference Table – standard table, with maximum dimensions of 30”(W) x 96” (L) x 29” (H). Each team shall provide their own table (may include a table cloth). See example to the right (not shown here)"*

In essence, what you stated is that you are building a table. The CNCCC has specified a folding conference table and a table top display. There is no deviation from this.

Section 11 – Race Rules and Regulations

RFI 62: There has been some confusion in some of our past conference competitions regarding how to address canoes that did not complete races, whether it be due to them swamping in the middle of the race or not being structurally capable of competing after running some events. Our question is what are the criteria for awarding points in races and Final Product points (potential DQ) in cases where the canoe does not finish races?

Response: *The CNCCC has had this issue come up more than once at the conference competitions. The intent is to design and construct a concrete canoe that can withstand the rigors of competition. That includes competing in the events (inclusive of travel to and from the various venues) and requires the teams to compete in all of the races. The issue generally arises with the interpretation of the Infraction on the Final Product Deduction Card - A canoe not built within current academic year, cannot race due to design or safety issues, or cannot complete sprint and endurance events (No Final Product Points)*

The intent of the statement "cannot complete sprint and endurance races" is that the canoe is not structurally capable of competing in the races.

Did Not Finish (DNF) – the most typical case is a canoe getting swamped during the course of the race and the team members not attempting to drag the canoe across the finish line. In this case, as long as the canoe is structurally sound (with or without repairs) and is seaworthy enough to compete in races, then the team gets a DNF for the race (no race points awarded unless it is the finals of a sprint event that included preliminary rounds). There is no effect on the Final Product points unless tape repair is warranted or if the canoe is deemed to be not structurally sound.

Another example could be a collision where the canoe suffers damage during the course of the race and therefore could not / did not finish a race. Depending on the circumstances (and this is a case by

case basis), the team can make repairs with tape (deduction may be waived, again, case by case) or possibly decide not to repair, and could be given the opportunity to re-run the race. In this case the DNF would be replaced with the new time posted by the team.

Did Not Compete – There have been instances where a team has not competed in events. One example was a team that suffered damage in a race but decided not to race the last race to avoid putting tape on the canoe. The thinking was that it rather receive 0 points for a DNF in a race rather than losing 25 points on Final Product. There were many issues that resulted from this as the interpretation of the teams and judges were incorrect. Regardless, Section 9.2.3.b. clearly states that “Failure of the canoe to complete all preliminary sprint and endurance events will result in the canoe receiving zero Final Product points for the competition.” In short, teams must compete in all of the required races with a canoe that are structurally sound to do so. If repairs are warranted to make the canoe seaworthy, those measures need to be taken.

Race Points – Teams are awarded the race points that they accumulate even if the canoe DNF in certain events or receives no FP points at the end (unless the canoe was not built that academic year). For example, if a team completes 3 races (and places), but DNF 2 races for whatever reason or is damaged beyond repair, then that team gets the points for the 3 races and 0 points for the 2 it did not complete/compete. The FP points are based on Section 9.2.3 and the infractions on the Deduction Score Card.