71-9284

CBC Columbiana Boiler Company

Containers & Cylinders for Chemicals & Gases
UF_6 & UO_2 Packaging · Galvanizing & Tinning Kettles

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March 22, 2000

Mr. David H. Tiktinsky, Project Manager
Licensing Section, Spent Fuel Project Office
Office of Nulcear Material Safety and Safeguards
United States Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852

Re: Response to February 11, 2000 RAI on the Model No. ESP-30X Package

Dear Mr. Tiktinsky,

The attached responses are in reference to your request for additional information of February 11, 2000 on Columbiana Boiler Company's application (Docket No. 71-9284, dated June 19, 1998 and supplemented on August 27, 1999) for a Certificate of Compliance for the ESP-30X Protective Shipping Package for 30-inch UF_6 Cylinders.

If further information is required, please do not hesitate to call.

Sincerely,

Trevor M. Rummel

Trevor M. Rummel
Vice President

Attachment 1: Response to February 11, 2000 RAI on the Model No. ESP-30X Package.
Attachment 2: Letter from John Mumaw, Owens Corning to Columbiana Boiler Company, dated March 2, 2000.
Attachment 3: Letter from John Mumaw, Owens Corning to Columbiana Boiler Company, dated March 11, 2000.
Attachment 4: VEECO MS-40 Portable Automatic Leak Detector Operations and Maintenance Manual.
Attachment 5: Change pages for Revision 2 of the SAR for the Model ESP-30X Protective Shipping Package for 30-inch Cylinders.

ATTACHMENT 1

Response to February 11, 2000 RAI on the Model No. ESP-30X Package

Chapter 1 General Description

1-1 Revise the specific tolerances on the drawings or the general tolerance level on the drawings 30X SAR to reflect appropriate dimensions.

Response: Drawing 30X SAR has been modified to include a general tolerance table to reflect appropriate dimensions. Additionally, the drawings have been revised and enlarged for easier reading. The notes have been revised extensively, and a single dimension on Sheet 3 was corrected from 6 1/32" to 6". Tamperproof seals were added to the exterior of the 30X overpack.

1-2 Clarify which paint coating (red oxide or epoxy primer) will be used on the carbon steel surfaces in contact with the foam and provide a specification for the coating.

Response: The paint coating to be used on the carbon steel surfaces in contact with the foam is a red oxide epoxy primer. The specification for the primer has been added to Appendix 2.10.2. This red oxide epoxy primer is the same coating used in the performance of the accelerated corrosion testing reported in Appendix 2.10.3. The specification for the test coating has been added to Appendix 2.10.3.

1-3-1 Re-evaluate and correct the quantities of isotopes listed in the contents section of the application (Section 1.2.3). Confirm that the containment analyses were not performed using the concentrations shown in Section 1.2.3.

Response: The contents section of the application (Section 1.2.3) has been modified to correct the isotopic concentrations consistent with those listed and used in the containment analysis (Section 4.0). The application remains inconsistent with ASTM C996 or ASTM C787, since these standards individually do not represent the highest isotopic concentration that may be shipped in the ESP-30X. The contents submitted for approval represent the maximum expected isotopic concentrations for the material to be shipped (encompassing both ASTM C996 and C787), and therefore represent a conservative basis for analysis.

1-3-2 The discussion of the total quantity of contaminants present in the package (i.e., <1150 A_2 value), which was deleted from the earlier revision of the application, should be reinserted.

Response: The discussion has been restored to Section 1.2.3 and Section 4. The maximum total activity present in the package is 24.5980 Ci / 0.0257 Ci per mixture A_2 = 957 mixture A_2 value.

Chapter 2 Structural

2-1 Revise the application to include an appropriate specification for testing water absorption of the foam.

Response: The current specification in Appendix 2.10.2 provides the appropriate testing specification for the ESP-PF-1 foam. The attached memos from Owens Corning provides justification for the use of ASTM C-209.

Chapter 4 Containment

4-1 Clarify and justify the background helium leakage rate shown in the application.

Response: Helium leak testing was performed on the 30B cylinder using the gas-filled envelope method described in ANSI N14.5. The 30B cylinder was evacuated using a ruffing pump to less than 1e-3 atm. Although it is desirable to remove all of the air inside of the cylinder, it is impossible to achieve a total vacuum, and some atmospheric air remained in the cylinder. After the target internal pressure was reached, use of the ruffing pump was discontinued. The VEECO helium detector was connected with the cylinder as shown in Figure A (attached). The VEECO detector is calibrated via an internal calibrated leak, and stabilizes within a period of two minutes or less. The VEECO detector was calibrated prior to the tests on the 30B cylinder and provided real-time helium flow rate data during the tests. Sections 8 and 10 of ASTM E427 provide information on test apparatus and calibration. The pertinent sections of the operating and maintenance manual for the VEECO detector have been attached for your information. The VEECO detector has its own vacuum pump, and it functions by continuously pulling the atmosphere contained in the cylinder through its detector. Prior to introducing helium into the test envelope, the amount of helium present due to the residual air remaining in the cylinder was determined by sampling continuously with the VEECO detector for a period of approximately five minutes. The resulting helium detection rate is known as the "Background Helium Leak Rate." The Background Helium Leak Rate can be estimated based on the internal cylinder pressure, the normal helium content of air, and the flow rate of the detector. Using this methodology, the Background Helium Leak Rate measured during this test (1.4E-08 and 4.0E-09 std-cm^3/sec for pre-test and post-test, respectively) is appropriate for the atmosphere present in the cylinder. Section 7.1 of ASTM

E427 also provides information on atmospheric halogens and background halogen levels. After determining the amount of helium present in the low-pressure atmosphere contained in the cylinder, helium was introduced into the test envelope, and the helium content in the cylinder was measured continuously for 10 to 25 minutes. The continuous helium-content readings taken during the 30X testing did not fluctuate significantly from the Background Helium Leak Rate during the test, therefore, no leaks were found. Past experience with helium leak testing provides evidence that system leaks, even those on the order of 1E-07 std-cm^3/sec, are detected very quickly by the VEECO detector due to the vacuum it pulls. Further guidance on the time required for a reliable leak test can be inferred by ASTM E427's stability of zero requirement (minimum one minute) and the calibration stabilization time of the VEECO detector (maximum two minutes). In the opinion of SWRI, the 30B cylinder containment boundary did not leak.

4-3 Explain the change in pressure during the testing of cylinder S/N001 on page 16 of Appendix 2.10.9 including supporting calculations.

Response: After the cylinder had passed the soap bubble leak test and the helium leak test, the cylinder was subjected to a fluorescent dye test. The cylinder was filled with water containing a fluorescent dye and pressurized to 20 psig using shop air. Following pressurization, the cylinder was allowed to sit for a minimum of 8 hours. The pass/fail criteria set for the test was the absence (pass) or presence (fail) of fluorescent dye traces on the exterior surface of the cylinder and valving. No dye was present on the exterior surface or valving of the cylinder tested; therefore, it was concluded that the cylinder and valving did not leak. However, a drop in pressure during the test occurred during the test period. In the opinion of SWRI, this pressure drop was not an indication of leakage for the following reasons:

1) The soap bubble test subjected the entire containment boundary to 100 psig and no leakage was detected. It would not have been possible to maintain 100 psig had a leak been present in the cylinder containment boundary or valving.
2) The helium leak test subjected the entire containment boundary to an internal pressure of 1.0E-03 atm. The vacuum was stabilized and maintained during the helium test procedure. It would not have been possible to stabilize the vacuum if a leak had been present in the cylinder containment boundary or valving.
3) No fluorescence was detected on any exterior surface of the cylinder or valving.

There are several possible explanations for the pressure drop that was observed during the fluorescent dye test. The most likely are:

1) While internal temperature measurements were not made after the fire test was completed, the content temperature was approximately 20°F higher at the

initial pressure reading (following the fire test and beginning the fluorescent dye test) than the final pressure reading (following the fluorescent dye test).

2) Using the ideal gas law and 20°F differential temperature, the resulting change in pressure would have been 2.5 psig.
3) The initial pressure measurement was made after changing the orientation of the cylinder from vertical to horizontal. The pressure transducer diaphram may have had water against it during the initial measurement, causing an artificially high reading, due to the water and it's temperature. The final measurement was taken many hours later, after the trapped water had an opportunity to drain away and allow the diaphram to return to ambient temperature. Without knowing the exact temperatures involved it is not possible to calculate the pressure drop that would have occurred due to water; however, because the pressure transducer is highly sensitive to temperature fluctuations, the differential pressure could have been as high as 10 psig.
4) Instrumentation drift or failure may have caused an artificially high or low reading. A 1% drift of the transducer's full scale would correspond to 1.5 psig.

The pressure was not being monitored as a quality test, merely as a guide. The presence or absence of the fluorescent dye provided the pass/fail criteria for the test. In order for the cylinder to leak and not produce an exterior fluorescence from the dye, it would have had to leak at the location of an air bubble (estimated half-liter in volume) trapped in the cylinder during the test. Because of the orientation of the cylinder, the air bubble would not have been located at a weld seam. There was no observed damage on the exterior skin of the cylinder that would have indicated a leak at a location other than a weld or valve. Thus, there was no avenue available for leakage from the air pocket, and no water leakage was detected. Therefore, it is the opinion of SWRI that the cylinder did not leak, and that the observed pressure drop was caused by unknown experimental circumstances.

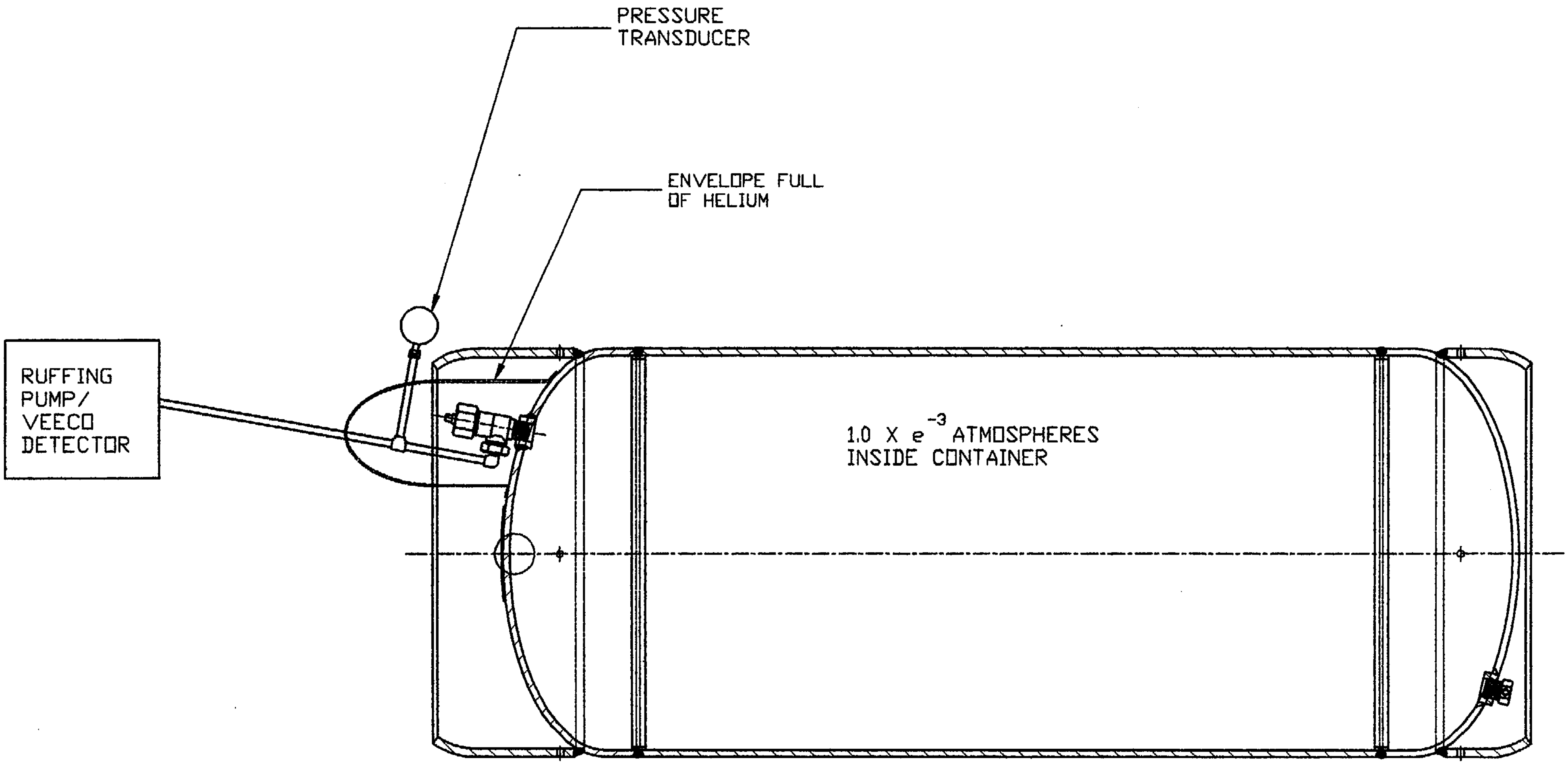
4-4 Correct the design pressure for the UF_6 cylinder.

Response: The external design pressure listed in Section 4.1.1 of the application has been corrected to 25 psig.

4-5 Specify the maximum allowable leak rate for the package.

Response: The maximum allowable leak rate for Type B shipments, assuming the maximum radioactive contents and using the 30B cylinder, is 2.2E-06 ref-cm^3/sec and 2.61E-04 ref-cm^3/sec for Normal and Hypothetical Accident Conditions, respectively, per ANSI N14.5-1997. However, because the criticality safety of the package depends upon excluding water, it is necessary to assure that moist air (air containing water) cannot leak into the package. Therefore, the packaging must be leak tight with a maximum leakage rate of less than $1X10^{-7}$ ref-cm^3/sec. Section 4.0 has been revised to reflect this change. In addition, Chapters 7 and 8 have been revised to reflect the new leak test requirements per ANSI N14.5-1997. As a final precaution, tamperproof seals have been added to the ESP-30X overpack, as shown in the revised drawings (Appendix 1.3.1).

FIGURE A


PRESSURE
TRANSDUCER
ENVELOPE FULL
OF HELIUM
RUFFING
PUMP/
VEECO
DETECTOR
1.0 X e^{-3} ATMOSPHERES
INSIDE CONTAINER

ATTACHMENT 2

LETTER FROM JOHN MUMAW, OWENS CORNING TO COLUMBIANA BOILER COMPANY DATED MARCH 2, 2000

INTEGREX TESTING SYSTEMS
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www.integrextesting.com

March 2, 2000

OWENS CORNING INTEGREX™ TESTING SYSTEMS

Eco-Pak Specialty Packaging
107 Meadowview Farms Drive
Jonesborough, Tennessee 37659

Attention: Ms. Jennifer Jones
Mr. Tom Daugherty

Reference: Owens Corning Testing Services Report No. 71547 dated July 20, 1999 entitled "Characterization of Product Performance 9.5 and 10.5 pcf ESP-PF-1 Foam".

Dear Mr. Daugherty

The objective of this letter is to explain the choice of test method for the determination of water absorption for your products tested and reported under Owens Corning Testing Services Test Report No. 71547 entitled "Characterization of Product Performance 9.5 and 10.5 pcf ESP-PF-1 Foam".

The subject work proposal specified testing of the water absorption using ASTM Test Methods C 209, Section 14 as prescribed in ASTM C 1126. This method was chosen for the following reasons.

1. ASTM Standard Specification C 1126 for Faced or Unfaced Rigid Phenolic Thermal Insulation was used as the guide for test methods selection. In Section 13.8 of that specification, it says: "Water Absorption – For the purposes of this specification determine in accordance with Test Methods C 209. Length of test shall be 2 hours. (Facings can affect the determined value.)"

2. ASTM Standard Test Methods C 209 for Cellulosic Fiber Insulating Board contains twelve test methods that are used extensively for not only cellulosic fiber insulation boards but also other board products that fall under the broad definition of insulating boards. Section 1.4 of the Scope of ASTM C 209 states: "Several of the test methods contained in this document are referenced by material specifications other than cellulosic fiber insulating board. These include mineral fiber, perlite, polyisocyanurate, polystyrene, and phenolic materials."

3. A review of thermal insulation product specifications in the ASTM standards shows that most of the available insulation material specifications call for testing of water absorption using the C 209 procedure or a method different only in the length of immersion time or weighing technique. Specifications requiring C 209, Section 14 direct include: (1) C 726 Mineral Fiber Roof Insulation; (2) C 1289 Faced Rigid Cellular Polyisocyanurate Insulation; (3) C 1126 Phenolic Foam Insulation and C 208 Cellulosic Board. Product specifications C578 Rigid Cellular Polystyrene Insulation and C 552 Cellular Glass Insulation and C 591 Unfaced Rigid Cellular Polyisocyanurate Insulation call for a modified version of the C 209 procedure.

4. In Section 14 of C 209, the test method for Water Absorption is presented. In that test method, there is no restriction as to the density or mass of the material to be evaluated by this method.

5. The only mention of density limits in C 209 is in the Section 3.2 definition of cellulosic fiber insulating board as follows: " cellulosic fiber insulating board – a fibrous-felted, homogeneous panel made from ligno-cellulosic fibers (usually wood or cane) and having a density less than 31 lb/ft3 (497 kg/m3) but more than 10 lb/ft3 (160 kg/m3)," This definition has no bearing on the use of the water absorption test method.

6. Both C 1126 and C 209 are the responsibility of ASTM Committee on Thermal Insulation. Therefore, the reference of C 209 Section 14 by Specification C 1126 and other similar specifications has been reviewed and approved by a diverse group of insulation technical experts.

7. I have discussed this issue with Frank Tyler, who is chairman of ASTM Subcommittee C16.32 which is responsible for the C 209 Standards. He indicates that the methods of C 209 are in the process of being rewritten as stand alone methods because they have been successfully used by industry for materials other than cellulosic boards.

In summary, I feel that the selection of the test method for water absorption presented in Section 14 of ASTM Test Methods C 209 was appropriate for the phenolic material in question. First, because it is specified in the applicable material specification. Second, because there is no listed restriction on sample density presented in the method. Third, that the test method in question is frequently referenced in other ASTM material specifications covering materials of similar or lessor densities than those tested in the subject report. And finally, that the procedure of ASTM C 209, Section 14 or some slightly modified version has been successfully used for many thermal insulations as a measure of water absorption for many years.

If you have further questions, I would be happy to discuss the selection of this test method at any time.

John R Mumaw

John R. Mumaw P.E.
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Note: Owens Corning Testing Systems changed its name to INTEGREX Testing Systems effective October 1, 1999.

ATTACHMENT 3

LETTER FROM JOHN MUMAW, OWENS CORNING TO COLUMBIANA BOILER COMPANY, DATED MARCH 10, 2000

INTEGREX™ TESTING SYSTEMS

2790 Columbus Road, Rt. 16
Granville, Ohio 43023-1200

March 10, 2000

Eco-Pak Specialty Packaging
107 Meadowview Farms Drive
Jonesborough, Tennessee 37659

Attention: Ms. Jennifer Jones
Mr. Tom Daugherty

References: Owens Corning Testing Services Report No. 71547 dated July 20, 1999 entitled "Characterization of Product Performance 9.5 and 10.5 pcf ESP-PF-1 Foam".

Letter of March 3, 2000 to Tom Daugherty on Water Absorption Test Method selection.

Dear Mr. Daugherty,

This letter is an addendum to my previous letter in response to questions from Rose Montgomery about an additional test procedure available for cellular plastic water absorption testing.

Ms. Montgomery asked whether the procedure listed in ASTM Test Method D 2842 " Water Absorption of Rigid Cellular Plastics" would provide different results than those of the method in C 209 Section 14, for the material evaluated in the above referenced report.

Test Method D 2842 evaluates a foam material's water absorption in a similar manner to the C 209 test, however there are two main differences that must be noted. First, the weighing of the sample is done by measuring the difference in buoyancy between the start of the test and the end of the test. Secondly, the test specimens are submerged for a period of 96 hours.

The first difference is the weighing procedure. For open cell materials, this could be significant. However, for the tested phenolic material, the closed cell response to both weighing procedures is very close. A slight increase in the water attached to some large surface voids might be included in the buoyancy test method, where the C 209 method permits a 10 minute drain after removal from the water. The anticipated difference in water absorption caused by the difference in test procedures should be less than a few tenths of one percent, by volume, at the levels measured for the product.

The second difference is the time of exposure. C 209 Section 14 specifies a 2 hour soak compared to the D 2842 requirement for a 96 hour soak. Here the difference could be significant depending upon the chemical nature of the material being tested. For hygroscopic materials, those with an affinity to water, the time of exposure would be critical in that the base material would have more time to absorb water into the walls of the cells. For materials that are non-hygroscopic, the time of exposure would be relatively unimportant. The phenolic foam material in question, however, was a closed cell foam. The phenolic plastic substrate material is non-hygroscopic i.e. it doesn't absorb water. Therefore, a great portion of the void volume is not available for liquid water absorption since no mechanism is available to get the water into the closed cells except by vapor diffusion through the cell walls. The vapor diffusion through phenolic plastic cell walls would be a very slow process. On the other hand, the absorption of water into those cells that are open to the surface, as at the cut surfaces, would be very rapid and would be at a greater level than would be seen through a thick sample. The bottom line is that a closed cell phenolic foam should be unaffected by the difference in time of test between the two methods

In summary, substitution of the test procedure presented in ASTM D 2842 for that presented in ASTM C 209 Section 14, would not significantly affect the results for water absorption for the heavy density phenolic foams tested. This conclusion is based upon the facts that the phenolic foam in question is closed cell and non-hygroscopic.

If you have further questions, I would be happy to discuss them at any time.

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ATTACHMENT 4

VEECO MS-40 PORTABLE AUTOMATIC LEAK DETECTOR OPERATIONS AND MAINTENANCE MANUAL