George H. Gellrich
Vice President

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CENG SM
a joint venture of
Constellation Energy · EDF

CALVERT CLIFFS
NUCLEAR POWER PLANT

March 9, 2011

U. S. Nuclear Regulatory Commission
Washington, DC 20555

**ATTENTION:** Document Control Desk

**SUBJECT:** Calvert Cliffs Nuclear Power Plant
Independent Spent Fuel Storage Installation
Material License No. SNM-2505, Docket No. 72-8
Response to Request for Supplemental Information, Re: Calvert Cliffs Independent Spent Fuel Storage Installation License Renewal Application (TAC No. L24475)

**REFERENCES:**
(a) Letter from Mr. G. H. Gellrich (CCNPP) to Document Control Desk (NRC), dated September 17, 2010, Site-Specific Independent Spent Fuel Storage Installation (ISFSI) License Renewal Application
(b) Letter from Mr. J. Goshen (NRC) to Mr. G. H. Gellrich (CCNPP), dated January 31, 2011, Acceptance Review of Renewal Application to Materials License SNM-2505 for the Calvert Cliffs Site Specific Independent Spent Fuel Storage Installation (TAC No. L24475)

In Reference (a), Calvert Cliffs Nuclear Power Plant, LLC (Calvert Cliffs) submitted an application for renewal of the Calvert Cliffs Nuclear Power Plant site-specific Independent Spent Fuel Storage Installation license. In Reference (b), the Nuclear Regulatory Commission requested Calvert Cliffs provide copies of calculations that were referenced within Reference (a).

Attachments (1) thru (6) contain the documents requested in Reference (b). Attachments (1) thru (5) contain proprietary information. Non-proprietary versions of these documents are contained in Attachments (7) thru (11). The applicable affidavits for the information that is considered proprietary by Transnuclear, Inc. and Pacific Nuclear Fuel Service, Inc., are contained in Attachment (12). The respective affidavits are signed by Transnuclear, Inc. and Pacific Nuclear Fuel Service, Inc., and set forth, with specificity, the considerations listed in 10 CFR 2.390(b)(4). Accordingly it is requested that the

NMSS01

information that is proprietary to Transnuclear, Inc. and Pacific Nuclear Fuel Service, Inc., be withheld from public discourse.

Should you have questions regarding this matter, please contact Mr. Douglas E. Lauver at (410) 495-5219.

Very truly yours,

**STATE OF MARYLAND** :
: **TO WIT:**
**COUNTY OF CALVERT** :

I, George H. Gellrich, being duly sworn, state that I am Vice President - Calvert Cliffs Nuclear Power Plant, LLC (CCNPP), and that I am duly authorized to execute and file this response on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 9 day of March, 2011.

**WITNESS** my Hand and Notarial Seal:

Notary Public

My Commission Expires: 7/8/14

3-9-11
Date

GHG/KLG/bjd

Attachments:
(1) Transnuclear Calculation No. 1095-6 - Proprietary Version
(2) Transnuclear Calculation No. 1095-16 - Proprietary Version
(3) Transnuclear Calculation No. 1095-35 - Proprietary Version
(4) Transnuclear Calculation No. 1095-49 - Proprietary Version
(5) Pacific Nuclear Document NUH-002 – Proprietary Version
(6) Bisco Products, Inc., NS-3 Specification Sheet
(7) Transnuclear Calculation No. 1095-6 – Non-Proprietary Version
(8) Transnuclear Calculation No. 1095-16 – Non-Proprietary Version
(9) Transnuclear Calculation No. 1095-35 – Non-Proprietary Version
(10) Transnuclear Calculation No. 1095-49 – Non-Proprietary Version
(11) Pacific Nuclear Document NUH-002 – Non-Proprietary Version
(12) Transnuclear and Pacific Nuclear Proprietary Affidavits

cc: J. Goshen, NMSS

**(Without Attachments 1-5)**
D. V. Pickett, NRC
W. M. Dean, NRC
Resident Inspector, NRC
S. Gray, DNR
E. Ghigiarelli, MDE
V. Ordaz, NMSS

# ATTACHMENT (6)

## BISCO PRODUCTS, INC., NS-3 SPECIFICATION SHEET

bisco

NS-3

## CASTABLE NEUTRON AND/OR GAMMA SHIELDING MATERIAL

**bisco products, inc.**
*1420 renaissance drive*
*park ridge, illinois 60068*
*(312) 298-1200*
*telex 282482 brand prid*

BISCO NS-3 Shielding Material is a high hydrogen, medium temperature, attenuation product. It is designed for use in radioactive shipping and disposal casks, shielding doors, and other applications where installation outside of the BISCO factory environment is necessary. NS-3 is provided as a two component, powder and liquid system to form a pumpable thixotropic mixture. Lead and Boron fillers may be blended into NS-3 to enhance gamma and thermal neutron attenuation. The initial set to a rough non-flexible solid occurs within 24 hours and total cure in 28 days.

### NS-3 PROPERTIES

| | |
|---|---|
| COLOR | Off White |
| SPECIFIC GRAVITY | 1.76 |
| HYDROGEN | 5.14E + 22 atom/cc |
| THERMAL AGING: | |
| 100 hrs. @ 150°F | Wt. loss = 2.15%, Hydrogen loss=4.68% |
| 100 hrs. @ 200°F | Wt. loss = 2.90%, Hydrogen loss=6.33% |
| 2 hrs. @ 340°F | Wt. loss = 4.16%, Hydrogen loss=8.90% |
| RADIATION EXPOSURE: | |
| Gamma | 1.5E + Rads Gamma |
| Thermal Neutron (<.55 EV) | 1.5E + 19 $n/cm^2$ |
| Epithermal Neutron (.55 eV-1KeV) | 9.3E + 16 $n/cm^2$ |
| Fast Neutron (>1MeV) | 1.6E + 17 $n/cm^2$ |
| Wt. loss | 7.17% |
| Hydrogen loss | 13.4% |
| THERMAL CONDUCTIVITY: | |
| Pure NS-3 | 5.86 $\frac{BTU\text{-}in}{hr.\text{-}ft.^2\text{-}^oF}$ |
| Lead Filled NS-3 | 9.36 $\frac{BTU\text{-}in.}{hr.\text{-}ft.^2\text{-}^oF}$ |
| COEFFICIENT OF THERMAL EXPANSION | 7.81-06 in/in/°F |
| COMPRESSIVE STRENGTH | 4500 psi |
| SPECIFIC HEAT (Lead Filled NS-3) | 0.145 $\frac{BTU}{lb\text{-}^oF}$ |
| RECOMMENDED SHELF LIFE | |
| Dry Side (moisture sealed) | 1 year |
| Wet Side (35°F - 110°F) | 1 year |

### THEORETICAL ELEMENTAL COMPOSITION

| | | | | | |
|---|---|---|---|---|---|
| Hydrogen | 4.85 wt. % | Oxygen | 57.05 wt. % | Iron | 0.56 wt.% |
| Carbon | 9.35 wt. % | Silicon | 3.36 wt. % | Trace | 1.33 wt.% |
| Calcium | 5.61 wt. % | Aluminum | 17.89 wt. % | | |

### MAXIMUM B4C AND LEAD LOADINGS

$B_4C$: 11.25 wt. %  Lead: 82 wt. %

### APPLICATIONS

Doors, Panels, Glove Box Shields, Vaults (fire resistant criticality control), Structural Shielding Members, Pre-Cast Special Sections, Field-Cast Pieces.

6-23-86

# MATERIAL SAFETY DATA SHEET

## I. Identification

| | |
|---|---|
| Manufactured By: | BISCO PRODUCTS, INC.<br>1125 Howard St.<br>Elk Grove, IL 60007 |
| Emergency Telephone No.: | 312/298-1200 |
| DOT Hazard Class: | non-regulated |
| Trade Name: | NS-3 Neutron Absorbing Material |
| Chemical Family: | Cementatious |
| Formula: | 2 component mixture |
| Date Issued: | 4/24/85 |

## II. Compositional Information

| | Ingredient | Approx. Wt. % | TWA/TLV |
|---|---|---|---|
| Comp. B: | Organic Polymer | 14.5% | |
| | Water | 16.5% | |
| | Ammonia | .06 max | 25 ppm ACGIH |
| Comp. A: | Inorganic minerals | bal | |

## III. Physical Data

Boiling Point ($^{o}F$) - Comp. B=212, Comp. A-NA
Vapor Pressure (68 $^{o}F$,mm Hg) - Comp. B=17, Comp. A-NA
Vapor Density (Air=1) - Comp. B=<1 water, Comp. A-NA
Freezing Point ($^{o}F$) - Comp. B=32, Comp. A= NA
Specific Gravity (g/cc) - for mixture, 1.70 - 1.77
Solubility in water - Comp. B=dilutable, Comp. A=slightly Color - for mixture, greenish cast
Odor - for mixture, slight ammonical odor
Percent volatiles - Comp. B=53, Comp. A=NA
Physical State - Comp. B=liquid, Comp. A=powder (solid)

## IV. Fire And Explosion Hazard Information

Flash Point - Non-combustible
Explosion Limits Lower - NA Upper - NA
Special Fire Fighting Procedures - None
Unusual Fire and Explosion Hazards - Comp. B can splatter above 212 $^{o}F$
Flame Spread of Cured Material : 5 (ASTM E-84-81A)

## V. Health Hazards

Recommended Work Place Exposure Limit - Ammonia: 25 ppm

Effects of overexposure and treatment
Inhalation: Comp. B Vapor or mist can cause headache, nausea, and irritation of the nose, throat and lungs. Move

subject to fresh air.

Skin contact: Irritation to skin upon repeated or prolonged contact. Wash affected skin areas with soap and water.

Eye contact: Slightly irritating to eyes. Flush eyes with water for at least 15 minutes. See a physician if irritation persists.

## VI. Reactivity Information

Stable as packaged.
Hazardous polymerization will not occur.
Conditions to avoid - temperatures over 350 °F.
Hazardous decomposition products - CO, $CO_2$.

## VII. Spill or Leak Procedure

Clean-up: Dike and contain spill with inert material (e.g., sand, earth). Transfer liquid to containers for recovery or disposal and solid diking material to separate containers for disposal. Keep spills and cleaning runoffs out of municipal sewers and open bodies of water.

Disposal: Coagulate the liquid by the stepwise addition of ferric chloride and lime. Remove clear supernatant liquid and flush to a chemical sewer. Landfill or incinerate the solids and the diking materials according to local, state, and federal regulations.

## VIII. Special Protection Information

Respiratory Protection: None required if good ventilation is maintained. Wear respirator (MSHA/NIOSH approved or equivalent) suitable for concentrations and types of air contaminants encountered.
Protective Gloves: Impervious
Eye Protection: Chemical splash goggles (ANSI Z-87.1 or approved equivalent).

## IX. Storage and Handling

Storage: Comp. B minimum temperature of 34 °F, maximum of 140 °F. Keep Comp. B from freezing - material may coagulate. Keep Comp. A in a dry enviornment.

## X. Miscellaneous Information

NOTE: Monomer vapors can be generated when product is heated during processing operations. Maintain adequate ventilation where product is heated or cured.

SECTION 2 - Unsealed Sample Hydrogen Analysis

A. Initial Hydrogen Content of NS-3:

The advertised initial as-cast hydrogen content of NS-3 is 4.85 wt. % at a specific gravity of 1.77 g/cc. This value is a predictable tested value bond upon a sealed sample of NS-3 after a 28-day cure time. The theoretical hydrogen content of NS-3 as-cast, fully sealed with no initial water loss is 5.10 wt. %.

Ten samples of NS-3 were submitted for hydrogen analysis immediately after being cast. The hydrogen results obtained are as follows:

| Sample | | Hydrogen % |
|---|---|---|
| 1 | | 5.13 |
| 1A | | 5.30 |
| 2 | | 5.16 |
| 2A | | 5.27 |
| 3 | | 6.21 |
| 3A | | 6.04 |
| 4 | | 5.24 |
| 4A | | 5.22 |
| 5 | | 4.77 |
| 5A | | 4.98 |
| | Average | 5.33 wt. % |
| | Minimum | 4.77 wt. % |

Based upon the above test results, the advertised value of 4.85 wt. % is deemed to be acceptable for a sealed sample of NS-3.

B. Moderate Temperature (250°F) Weight Loss of NS-3:

The attached Technical Report No. NS-3-029 describes a 250°F heat aging of NS-3 over a period of 59 days to a point where the material stabilized. The overall hydrogen loss was .473 wt. % of the total sample which represents a total percent hydrogen loss of 9.3%. At a period of 59 days exposure to 250°F, there was no appreciable continued weight loss, and it was determined that the sample had stabilized.

BISCO PRODUCTS, INC.
NS-3 SHIELDING MATERIAL
FOR NUTECH

NOVEMBER 28, 1988

Additional weight loss tests of NS-3 at approximately 250°F have been conducted at the request of NUTECH and are outlined below:

Test Slab 3" x 12" x 12"

Initial hydrogen content = 4.85 (theoretical)
Final hydrogen content = 4.37 wt. %
Total weight loss = 15.0 wt. %

Remarks: Sample stabilized at 15.0 wt. % loss after 8 days. Sample was not fully cured upon beginning of test. (Sample was cured for only 14 days)

Test Slab 1" x 12" x 12"

Initial hydrogen content = 3.99 wt. %
Final hydrogen content = Not as yet measured.

Remarks: Sample was urethane coated NS-3; sample cast approximately one year ago. It is not possible to determine what percent of the weight loss is attributable to the polyurethane coating.

Since the sample surface is somewhat porous, it is inaccurate to assume that the sample was sealed prior to obtaining the initial hydrogen content due to the fact that the sample was exposed to room temperature for one year.

SECTION 3 - Testing of Sealed Sample of NS-3

Data:
- Sample cast is 6" x 6" x 6"
- Minimum cure time is 28 days (as of December 2, 1988)
- Test to begin on December 5, 1988
- Pressure vessel made of 1/4" steel plate, tested to 80 psig.
- Initial as-cast hydrogen content = 5.11 wt. %

Proposed Test Procedure (Preliminary):

1. Place sample in oven at room temperature.

2. Attach pressure and temperature monitoring devices.

3. Heat oven to 256°F in 60°F increments over a period of 3 hours. Monitor pressure inside the test chamber. If at any time the pressure exceeds 50 psig, discontinue the test. (Pressure relief valve set at 50 psig.)

4. Maintain the 256°F temperature for a period of 48 hours. Record pressure at approximately 12 hour intervals.

5. After 48 hours, turn oven off and allow sample to cool to room temperature. Record pressure at room temperature.

6. After 48 hours, re-heat the sample to 256°F as described in Step 3.

7. Repeat the above cycling 5 times, each time recording the pressures and temperatures.

8. Upon completing the final cycle and cool-down, submit 6 samples of the NS-3 for hydrogen analysis.

9. Prepare a full technical report for submittal to NUTECH upon completion of the above testing.

SECTION 4 - QA/QC Procedures and Placement of NS-3 Procedures

The attached procedures shall be provided to the vendor for in-process QA/QC and successful placing of the NS-3 in the cask.