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January 3, 1996

Mr. Carl H. Berlinger, Branch Chief  
Nuclear Reactor Regulation  
US Nuclear Regulatory Commission  
One White Flint North  
Rockville, MD 20852-2738

Subject: **Is post-LOCA ECCS strainer blockage an insulation problem or is it a strainer problem?**

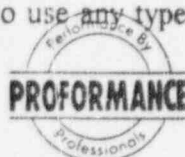
Dear Mr. Berlinger:

I am writing to request an answer to a question PCI has regarding the nuclear safety issue of post-LOCA strainer blockage. We are confused about the root cause of the post-LOCA ECCS strainer blockage problem. Let me explain the source of our confusion.

A large number of the US BWRs have 100%, or close to 100%, reflective metallic insulation (RMI) on their drywell piping and equipment. PCI's contacts within the industry have revealed that the staffs of as many as 15 BWR units are planning to respond to the soon to be released Regulatory Guide 1.82, Rev. 2 and the accompanying Bulletin, as follows: since their piping and equipment are 100% insulated with RMI they should not be required to make mechanical backfits or modifications to their ECCS. This raises the question, **Is post-LOCA ECCS strainer blockage an insulation problem or is it a strainer problem?**

As examples, one BWR utility, with two units, replaced their fiberglass blanket insulation with RMI cassettes to address this pending revised Regulatory Guide. Through our contacts, we have learned that this utility has spent well over \$1,000,000 per unit for this insulation conversion (materials, labor, engineering, dose, and rad waste). There is another utility, with one BWR, which has recently done the same thing, spending close to \$1,000,000 on this drywell insulation conversion. Both utilities are doing this in the interests of nuclear safety and to satisfy the USNRC. The quantities of money would be irrelevant were they not so large, larger, ironically, than a ECCS strainer enlargement project would probably cost.

PCI has seen nothing in writing, nor have we heard anything from the NRC that would encourage the BWR utilities to replace insulation to address this safety issue. Likewise, however, we have seen nothing from the NRC to discourage this sort of utility action. Certainly, each BWR utility is free to use any type of insulation it so chooses, when and



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where it chooses. Nevertheless, over 40% of the US BWRs are preparing to respond to the NRC that with 100% reflective metallic thermal insulation in the drywell, they will not have to do anything more than maintain 100% reflective metallic thermal. The same question, then, keeps coming back: **Is post-LOCA strainer blockage an insulation problem or is it a strainer problem?** Given these realities explained above, PCI continues to be confused about the root cause of this nuclear safety problem.

Mr. Sandervag, of SKI, at the October 25 Water Reactor Safety Meeting in Bethesda, observed that in SKI's opinion, **this is a strainer problem, not an insulation problem.** And that, as we all know, is how it was handled in Sweden, at the five BWRs affected by the Barseback Incident and required to make backfits with new strainers.

Some recent information does seem to suggest that this may be a strainer problem. With the September strainer blockage incident at the Limerick 1 Plant, which followed a similar type of incident at the Perry Plant in 1993, several conclusions could clearly be made. One is that thermal insulation debris is not the only type of material which can filter corrosion product particulate and lead to a high head loss across a suction strainer; there are many others, not previously considered, which can cause strainer blockage and which exist in drywells. A second conclusion is that **if** only small quantities of fibrous material, such as a HVAC air filter media or some polypropylene fibers, can lead to strainer blockage, **then** there are probably many others which, in an actual pipe break LOCA, could similarly be transported from the drywell to suppression pool and cause ECCS strainer blockage. A third conclusion is that existing BWR suction strainers may simply be mechanically inadequate to guarantee post-LOCA ECCS operability, given that they can be blocked so easily, with a very small quantity of fibrous material combined with corrosion product.

One might be inclined to conclude that the Perry and Limerick incidents were simply rare events that only signify a need for greater suppression pool cleanliness. PCI is aware that plant cleanliness was addressed in the recent Bulletin 95-02, and is a necessary step in the right direction. 95-02 was necessary to assure normal plant operability. However, when one asks the question as to whether achievable plant cleanliness will guarantee post-LOCA ECCS operability, we can use one of the two relatively new head loss equations developed by the Science and Engineering Associates (SEA) for the NRC and by Continuum Dynamics, Inc. (CDI), for the BWROG. Use of either a small quantity predicts that with only a few hundred pounds of suppression pool "sludge" and a small quantity (less than 10 ft<sup>3</sup>) of fibrous material reaching the suppression pool, every BWR unit in this country would lose ECCS operability with a pipe break LOCA. Without other safety systems, core damage could even result.

The enclosed Figures A and B show graphically the results of using SEA's equation from NUREG/CR-6224, Equ. B-32b, and of using the BWROG's Equation 1 from their *Interim Report of the Boiling Water Reactor Owners' Group ECCS Suction Strainer Committee, December, 1994*. One thing is clear using either equation: only a small quantity of miscellaneous fibrous material, combined with some corrosion product, would

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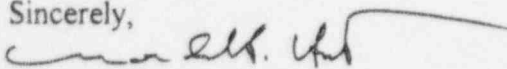
be necessary to lead to ECCS pump cavitation using strainers with a total surface area as currently installed on USBWRs. While the fibrous material tested, by the NRC and BWROG, was shredded NUKON® Insulation Base Wool, many other fibrous materials could also lead to similar behavior, such as HVAC filter media and polypropylene fibers. Other sources of drywell loose fibers are welding cloth, protective clothing, rope, fire endurance materials, and even human hair, and then there are non-porous materials such as pressure sensitive tape, tags, paper, metal foil and sheet plastic. BWR drywells are not fiber free, even with 100% RMI pipe and equipment insulation. They are clean; they are just not fiber free.

The source of the confusion for PCI and for many BWR plants, we believe, is that fibrous thermal insulation is simply the only fibrous material that has been tested. Therefore, many BWR plant personnel have concluded that **by removing that material which is tested**, they can solve the entire problem of post-LOCA strainer blockage. There are numerous sources of fibers in even a clean BWR plant, and even with a relatively clean pool, such as Perry had, strainer blockage will occur given the small, passive strainers currently in place. The BWROG and NCREG/CR-6224 equations both demonstrate clearly that all US BWRs may have this problem at this time, regardless of the type of pipe and equipment insulation.

PCI admits to having business interests in how this issue of post-LOCA strainer blockage is eventually resolved by the USNRC. We are the manufacturer and supplier of both the NUKON® Insulation System and of the Sure-Flow™ Suction Strainer. We are also the insulation labor contractor at several BWR plants. At one of those mentioned above, we recently performed the labor to replace the fiberglass blanket insulation with RMI cassettes. At another BWR site, where we perform insulation labor, we not only handle RMI routinely but we also fabricate it when the manufacturer cannot meet the delivery schedule. Our business interests, therefore, cover a range of products and services with regards to post-LOCA strainer blockage. Our most important interest, however, with regards to these plants, is to promote the safe, clean, reliable, and economical production of electricity from nuclear power. PCI will make every effort to assure that the US nuclear plants are operating 10 years from now, 20 years from now, and longer.

In closing, we respectfully request the NRC to end our confusion by answering this question: **Is post-LOCA ECCS strainer blockage an insulation problem or is it a strainer problem?** We look forward to your reply.

Sincerely,



Gordon H. Hart, P.E.

Technical Services Manager

Attachments Figures A & B

CC: Rob Elliott - USNRC NRR

Mike Marshall - USNRC Research

FIGURE A

USNRC NUREG/CR-6224 EQUATIONS:  
PREDICTED STRAINER HEAD LOSS VS. QUANTITY OF FIBROUS DEBRIS, FOR 7,500 GPM  
THROUGH EACH OF FIVE EXISTING 25 SQ FT SURFACE AREA SUCTION STRAINERS AND  
120 DEGREE WATER

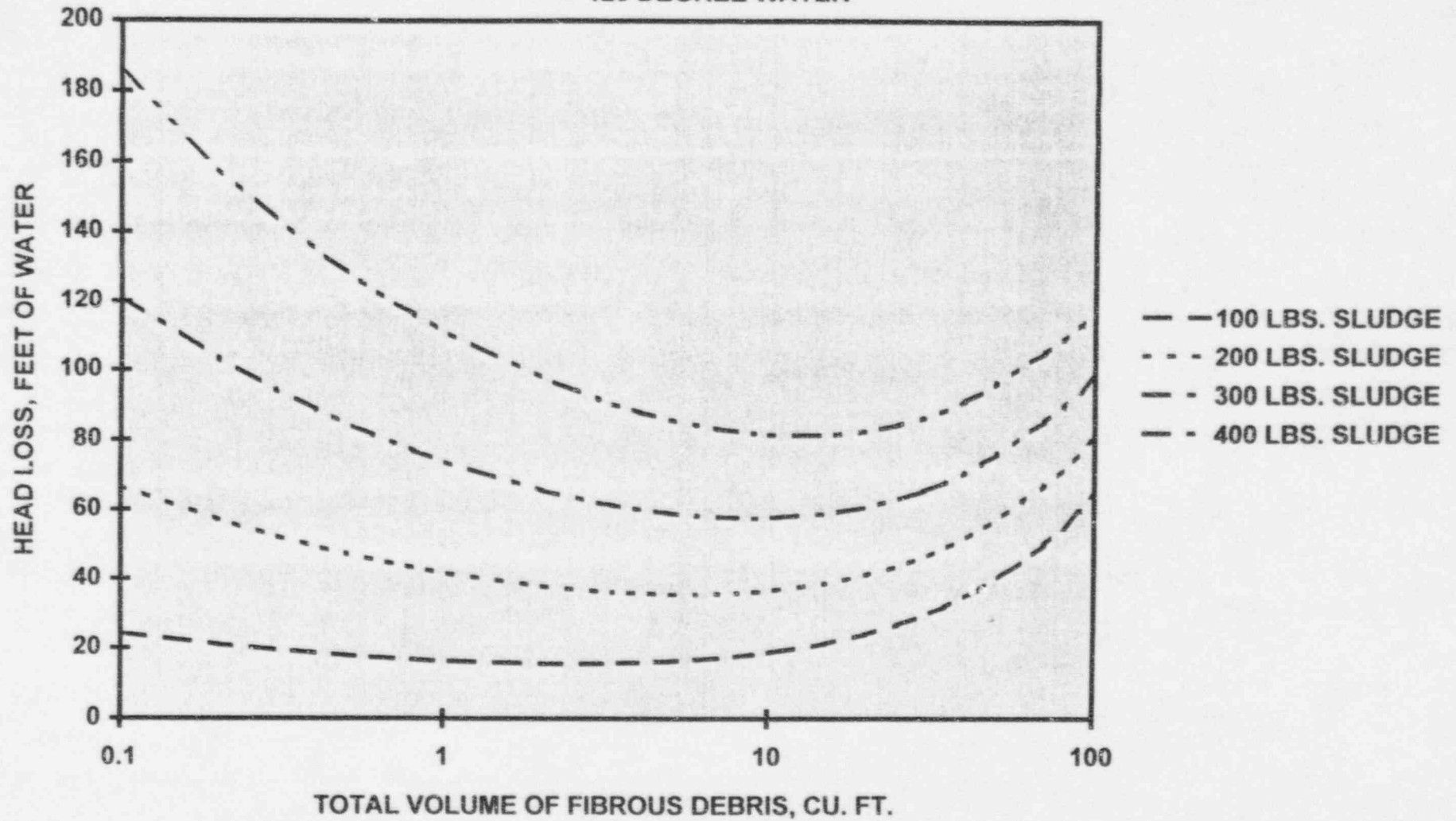




FIGURE B

BWROG HEAD LOSS EQUATION:  
PREDICTED STRAINER HEAD LOSS VS. QUANTITY OF FIBROUS DEBRIS,  
FOR 7,500 GPM THROUGH EACH OF FIVE 25 SQ FT SURFACE AREA STRAINERS

