The purpose of this document is to provide the NRC staff with information about a new approach to reducing the quantity of fibers that bypass the ECCS/CSS strainers. The approach is to design and install a debris trap upstream of the existing ECCS/CSS strainers to scrub a significant quantity of fine fibers from the water column.

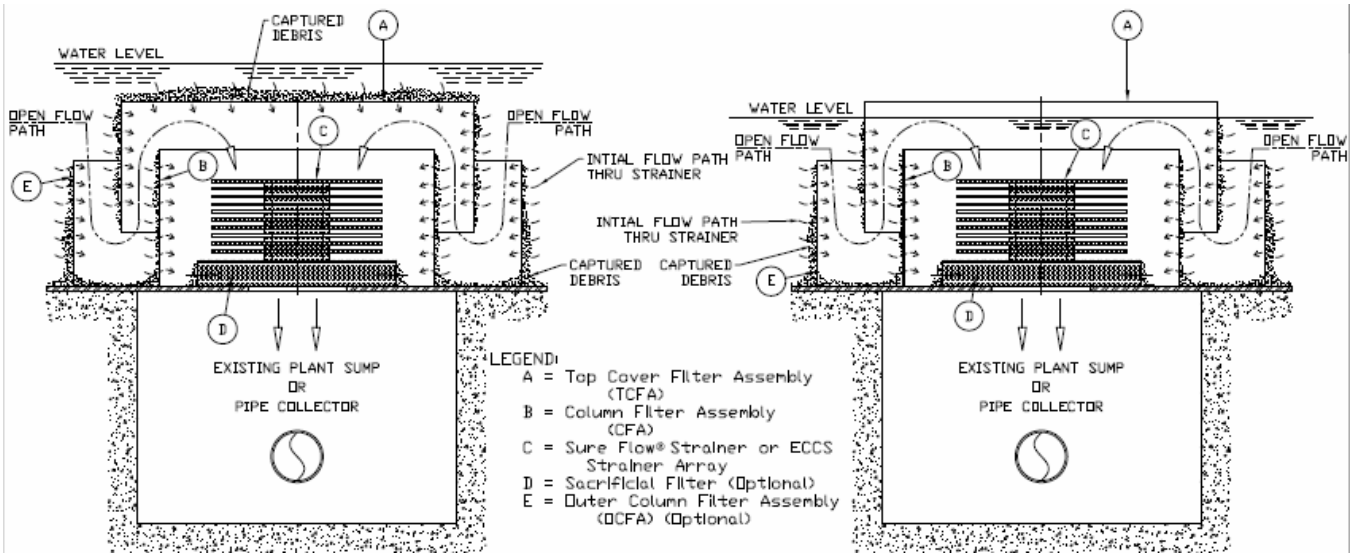
*PCI developed this new hardware and we have filed a provisional patent application with the U.S. Patent office to protect our invention from duplication by others*. PCI refers to this new invention as the **Sure-Trap™**; consistent with our **Sure-Flow® Strainer**.

So, what is a **Sure-Trap™**?

A **Sure-Trap™** is a series of filter panels positioned around an individual strainer or an array of strainers that will trap fibrous debris, specifically fine fibrous debris suspended in the water column and flowing to the strainers. The **Sure-Trap™** will work with most ECCS/CSS strainers, not just the PCI **Sure-Flow® Strainers.**

The **Sure-Trap™** is intentionally designed with an open flow path that enables flow to continue to the ECCS/CSS strainer(s) as the filter panels become clogged with debris. More importantly, this is achieved without a significant increase in the ECCS/CSS head loss.

See one of several concepts below depicting a submerged trap; and, an un-submerged trap.




Upon recirculation start up; and for some period of time, most of the fluid flow is through the filter panels to the strainer(s). As the filter panels trap debris, the volume of flow through the open flow path will increase. As long as the fluid flow continues through the filter panels at some level, the panels will continue to remove and trap fibrous debris including fines suspended in the water column.

Trials thus far are limited; but, are also very encouraging. In one large scale test implemented for a single SFS module using the Tank Test Protocol incorporating artificial mixing energy (which assures that all debris reaches the strainer) the **Sure-Trap™** reduced the quantity of fibers bypassing the SFS module by **54.5** % compared to the SFS module tested without the **Sure-Trap™**. This equates to a bypass fraction for a SFS module with a **Sure-Trap™** of 9.8% versus 21.5% without the **Sure-**

**Trap™.** These fiber only bypass tests introduced a thin bed of fibers; the equivalent of a 0.08" thick bed of fine fibrous debris on the SFS test module. Although tests using the refined LTFP have not yet been tried, better results are logically expected since settling of debris is allowed.

In a mixing tank test introducing the equivalent of a ½" thick bed of fiber fines on the test strainer, the SFS module with a **Sure-Trap™** captured 34.436 lbs of 36.2 lbs introduced (95.13% captured), or, a strainer bypass fraction of only 4.87%. More trials are being considered; and, the results are expected to vary based on the test protocol implemented; and the plant's specific design basis. Regardless, the early results are very encouraging.

**What are the potential obstacles for NRC acceptance?** PCI anticipates the following issues exist; and will require a satisfactory response.

1. Can the **Sure-Trap™** also function as a debris interceptor?

2. Will the **Sure-Trap™** "open flow path" block?

3. How does the **Sure-Trap™** affect the head loss across the ECCS/CSS system? Can it be measured?

Here's what we can say at this time.

1. Based on prior LTFP testing, we know fibrous debris smalls do not readily transport at the licensees prototypical fluid flow velocities. If some of the smalls do reach the strainer, it is expected to be by tumbling and sliding along the containment floor. For this type of debris, the upstream filter of the **Sure-Trap™** will act like a debris interceptor. Floating debris, which may or may not be pulled down to the strainer, will also be drawn to the vicinity of the strainer. By situating the upstream filter low and the downstream filter high, the **Sure-Trap™** locates filter panels at the 'dirtiest' sections of the water column; meaning high and low. The **Sure-Trap™** is designed so that the 'cleanest' section of the water column (the center) is where water enters the open flow path. Based on observations of past LTFP testing, we do not expect large or small fibrous debris will enter the open flow path, even for high fiber plants.

2. The open flow path is being evaluated at a 4" gap distance based on velocity, head loss and open flow objectives, although other gap distances may also prove to be acceptable. When the outer and top cover filters start to clog, the gaps are designed to have velocities that will pull debris through the gaps. Testing to date has also shown that the fines suspended in the water column are too small to "clog" the open flow path. Therefore, we are confident the open flow path will not / can not be blocked which would adversely affect flow to the strainer(s), or strainer array. Testing in the large test flume facility will confirm this logic as well.

3. A **Sure-Trap™** is expected to induce a very small head loss to the ECCS system; however, the net affect is expected to be less head loss overall. The **Sure-Trap™** is expected to reduce the overall ECCS/CSS system head loss by decreasing the debris head loss across the strainer(s). The worst case head loss caused by the **Sure-Trap™** can be defined by testing and / or by a CFD which assumes 100% blockage of the filter panels. The head loss induced by the **Sure-Trap™** when the filters have clogged is in fact very low and can be designed to be less than 1 inch. Testing is expected to confirm reducing the fibrous debris load on the strainer will reduce the system head loss more than the head loss induced by a **Sure-Trap™** with its filter panels clogged.

Although we do anticipate the NRC will have these concerns; and, probably some concerns not yet identified, the benefits to licensees by removing fine fibrous debris from the flow stream and thereby reducing fiber bypass is expected to pay big dividends to both low fiber and high fiber plants.

For low fiber plants; a plant expecting a 50% bypass fraction from a default value of 30 lbs of latent fibers may not meet long term cooling requirements based on some of the early PWROG in-vessel tests (i.e., core inlet blockage tests). In those tests, even this small quantity of fiber bypass was large enough to raise concerns about blockage in the fuel assembly cooling paths. This condition is expected to improve with more research; however, it is alarming that the quantity required to block could be small.

For this design condition the **Sure-Trap™** is expected to show that the quantity of fibers reaching and bypassing the ECCS/CSS strainer(s) will meet the limit for grams of fibers per fuel assembly to be defined later by the PWROG research.

For high fiber plants, the **Sure-Trap™** in conjunction with the LTFP may reduce the need to replace fibrous insulation with RMI. This reversal of costs for insulation replacement and its associated worker radiation dose is expected to offset the cost for testing and installing the **Sure-Trap™** for some licensees. The plant specific conditions will control these economics.

> Note: A key to this approach is to consider the **Sure-Trap™** with the refined LTFP testing. When a **Sure-Trap™** is tested in a representative flow stream, the quantity of fibers actually reaching the ECCS/CSS strainer(s) is appropriately reduced. If it were true that a large quantity of fibers will suspend in the water column and reach the **Sure-Trap™** than the effectiveness of the **Sure-Trap™** could be diminished. Prior licensee LTFP testing doesn't support the theory that large quantity of fibers will suspend in the water column and reach the **Sure-Trap™** or that it will happen in the plant.

For plants with little head loss margin in their ECCS/CSS system, the **Sure-Trap™** may provide added margin to address the unexpected discovery of more fibrous debris sources during plant operations.

**What's next?**

As stated before, PCI is planning to implement more **Sure-Trap™** trials; but, our resources are limited to do much more until there is interest and support from licensees; and an understanding of the NRC staff's concerns with this new approach. The test protocol for measuring fiber bypass needs to be discussed with the NRC staff to see if any special accommodations are needed for the fiber bypass protocol. At this time, our starting point for fiber bypass testing protocol is as follows.

1. Use the refined LTFP to define the test flume and debris introduction points.

2. Use the refined LTFP methodology to introduce fiber fines; then smalls, into the test flow stream. No particulates will be introduced.

3. Collect in filter bags downstream of the test strainer and before the pump all the fiber that bypasses the **Sure-Trap™** (if applicable) and the SFS test module.

4. After all fibers have been introduced, wait 15 flume turnovers and terminate the test.

5. Dry the bags and contents until they do not change in weight anymore and calculate the net quantity of fibers collected in each bag, add up all bags net weight to determine the total fiber bypass for this design basis.

We are sharing this information regarding the **Sure-Trap™** with the NRC and other stake holders now to allow time for all of us to consider this approach before the industry defines the true limitations for grams of fibers per fuel assembly and possibly a new or different ZOI for fibrous insulation debris generation.

PCI believes it would be prudent for licensees to implement bypass trials of different postulated fibrous quantities without or with a conceptual **Sure-Trap™** design to understand how the final limit to fibers in the fuel assemblies will affect plant modifications and qualification of the plant configuration. Trials can be implemented in a flow stream at one of several Alden Research Laboratory test flumes using plant specific design basis as input.

The data from these bypass trials would also help to understand if a **Sure-Trap™** is a cost effective approach for a given plant.

Thank you for any consideration you give to this approach.

Best regards,

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