CFC Logistics, Inc.

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From: <GrayStarNJ@aol.com>
To: <asl@nrc.gov>, <sturner@cfclogistics.com>
Date: 6/4/03 12:38PM
Subject: GRAY*STAR GENESIS Bell Air Supply Question

Dear Sattar:

To answer your question:

"What prevents streaming of photons up through the air supply tubes for the bells which might exceed the regulatory exposure limits?"

First, let me describe the air supply tubes:

Air is supplied via the tubes from a compressor located outside of the irradiator's enclosure.

Compressed air is transported from the compressor to a point above the pool near where the hoist assemblies position themselves during irradiation. There are two points, one above each side of the pool where the bells are lowered.

The air is supplied to the hoist mechanism via a pneumatic powered remote connection which is activated when the hoist trolleys are located in the there positions above the pool.

Once engaged, and as the bells are lowered into the pool, air is supplied via the above connection.

The air goes into a flexible hose which is located on a retractable spring driven reel mounted on the hoist assembly.

The hose is 3/8 inch ID and 0.64 inch OD and approximately 35 feet long.

As the bells are lowered, the hose is pulled from the reel and is maintained in a vertical orientation by the spring pressure of the reel mechanism.

The other end of the hose is connected to a stainless steel stand tube. This stand tube has an offset to prevent any streaming of photons directly up the tube.

The other end of the tube is connected to a hole in the top of the bell. The hole in the top of the bell is through 3 inches thick steel plate.

The air travels directly through the hole into the top of the inside of the bell.

Next, let me describe the path of potential photons and how they are obstructed from streaming up the tubes:

At no time is any part of the tube perpendicular to any of the source. In other words, all photons must undergo considerable scatter before they can possible stream up the tube.

Most of the photons will enter the bell. A very small portion these photons will travel in the direction of the "hole" in the top of the bell.

The hole is 3 inches thick (through steel) and is minimal in diameter (approx. 1/2 inch.) Any photons following this path will have already been scattered and the "hole" will collimate the photons directly upward.

Directly above the "hole" is the stainless steel stand tube. This tube has an offset in it so that the collimated photons would either pass through the tube into the water shield and no longer represent a streaming issue, or pass through the offset which would require two more scatter events.

The photons which survive the two more scatter events [At this point, there is a minimum of three scatters and collimation] would continue up the 3/8 inch ID flexible tubing for approximately 14 feet to the surface of the pool (further collimation).

The point of egress of these photons is relatively inaccessible to personnel for two reasons. First, there is no reason for a person to be at this point above the pool when the bells are in the pool. Second, the tube extends another 20 feet (approx.) to the reel mechanism. For potential exposure to occur, a person would have to be directly over the tube which is impossible without moving the tube and thus not being directly over it.

Photons that leave the source and travel in the direction of the surface of the pool and enter the tube are not a potential source of streaming because of their path. Their path would be through several feet of water, or through the thick steel top of the bell and then through the water up to the 3/8 inch ID tubing. They would have to go through a scatter event to be parallel with the tubing and collimated through the tubing to the surface of the pool.

Finally, verification that there is not a flux above regulated exposure limits:

After the initial source is loaded, a survey will be performed that will specifically test for exposure levels at every point above the pool.

During normal operations (or any operation that would have the bell at the bottom of the pool), personnel do not have access to the exit point of the

tubing through the pool water.

Personnel are limited to the outside of the pool rim which is not in direct line of the egress of the tubing. The rim of the pool will also be surveyed for exposure per the regulations.

I will send you pictures and drawings to help illustrate the above.

Thank you for your question,
Russell

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Creation Date: 6/4/03 12:36PM
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