

The Applied Radiant Energy Corporation

PDR

Manufacturers of **Gammapar** Acrylic/Wood Flooring

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January 17, 1996

Mr. Charles Hosey
Chief, Materials Licensing/Inspection Branch 1
Nuclear Regulatory Commission
Region II
101 Marietta St., N.W.
Atlanta, GA 30323

Dear Mr. Hosey:

SUBJECT: Report on Faulty Source Drive Mechanism and Its Repair

The following is an account of observations and actions taken during January 10 to January 13, 1996, by Applied Radiant Energy Corp (ARECO) personnel to diagnose and repair the drive mechanism for the Cesium-137 WESP capsule holder (plaque).

Summary: During the afternoon of Wednesday, January 10, 1996, it was discovered that the Cesium-137 plaque could not be moved horizontally to positions necessary for the irradiation of target material. After an investigative period it was decided to down load the Cesium capsules and remove the holder from the pool to effect repairs. On January 11, 1996, the incident was reported by phone to NRC operations Office and on the morning of January 11, 1996, to NRC Region II Office.

Repairs were accomplished and the irradiator was restored to its proper operating mode by 2045 hours on Saturday, January 13, 1996. Smears, Geiger Counter readings, and observations of direct reading dosimeters showed no indications of any radioactive contamination, worker radiation exposure or other than normal (background) radiation levels in the area of the pool during and after the procedures that were followed.

Introduction: ARECO is licensed by the NRC to operate an underwater (ANSI Category III) irradiator at 2432 Lakeside Dr., Lynchburg, Virginia. This license (# 45-11496-01) permits ARECO to possess and use both Cobalt-60 and Cesium-137 as irradiator source material. These two isotopes are positioned in two separate Aluminum holders (plaques) that remain near the bottom of a 22 foot deep water pool.

The plaques are rectangular affairs that are about 10' tall by 2' wide. Both hang at a fixed distance, from and near the bottom of the pool, from a stationary horizontal metal beam that spans the diameter of the pool. This beam is located about 10-12 feet below the normal surface of the pool water. The plaques are attached to this beam by means of rectangular plates that ride in a track located

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in the under part of the beam. Movement of the plaque-trolley arrangements is governed by stainless steel cables. Support is provided by series of roller bearings located in the track. Both cables go through metal pulleys situated at either end of the horizontal beam. These cables rise up one side of the pool wall to a chain drive and motor that are located on a metal vertical beam at the side of the pool. The control boxes for the movement of the two plaques are also positioned on this vertical beam.

Discovery of Malfunction: On the afternoon of Wednesday, January 10, 1996, at about 1445 a technician reported to the C&I Production Manager, G.J. Middaugh, and the Conversion Specialist, R.W. Bell, that the Cesium-137 plaque could not be moved horizontally in the irradiator pool by means of the control panel. R.W. Bell is a Radiation Protection Officer.

Attempted Remediation: R.W. Bell and G.J. Middaugh went to the irradiator room to verify the problem. They found that the Cesium-137 source would not move in either the "East" or "West" (forward or reverse) directions (except for a few short jerky movements) when the drive controls were activated. They tried to move it manually by pulling on the stainless steel cable governing this plaque movement but were unable to do so.

R.W. Bell and G.J. Middaugh then examined both ends of the beam as best as they could to see if the cable was caught on either of the pulleys. This did not appear to be the case and the pulleys checked out OK.

Next, they tried to contact A.W. Hartberger, Vice President of New Equipment and Facilities, as he was the chief designer of the plaques as well as their support and drive mechanisms. He was reached by phone at approximately 2000 and was appraised of the situation. A.W. Hartberger could not make suggestions for immediate further diagnosis of the problem, but suggested a meeting the next morning at the irradiator to consider the next step to be taken.

At about 2015, the pool room was locked, the intruder alarm was set and the rest of the building was secured until the morning of January 11.

At 0800 on Thursday, January 11, 1996, A.W. Hartberger, R.W. Bell, G.J. Middaugh, and J.J. Myron, Vice President of Safety and Regulatory Affairs, and a Radiation Protection Officer, met in the pool room. It was suggested that debris of unknown origin could be lodged in the track causing the hinderance of motion. A device was rigged to allow pressurized water to be blown into the track in an attempt to dislodge any obstruction. The device was employed three times with no noticeable results.

Removal of Equipment from the Pool: At this point it was decided that further diagnosis of the problem would require a close examination of the track, which would have to be withdrawn from the pool. The first step to accomplish this would be the removal of the Cesium WESP capsules from their plaque. Three C&I shift workers were enlisted to aid in this task. J.J. Myron issued direct reading "pencil" dosimeters (Model 862 -200 mr range, purchased from Atomic

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Products Corp.) to each of the five persons who be involved in the upcoming procedures. All "before " dosimeter readings were recorded. An Eberline E-520 Geiger Counter with an HP-270 probe was transferred to the irradiator (pool) room for detection and measurement of possible contamination and elevated radiation levels. An Eberline Smart Alarm with an HP-260 probe was located near the entrance to the room for personal scanning and swab measurement.

A radiation survey using the Geiger Counter was performed before any down-loading procedures were started. All radiation readings were normal i.e., the same as background (approx. 0.02 to 0.04 mr/hr).

The Cesium-137 "storage table" was lowered to the bottom of the pool by means of ropes hooked to its four corners. It has a 5x5 arrangement of tubes into which the 25 WESP capsules can be loaded.

Starting at about 1000, the Cesium-137 plaque was down-loaded to the storage table. This was accomplished by releasing the bin latches and swinging each of the five bins to the open position. A long handled clamping tool was used to grasp the top of each WESP capsule and transfer it to the storage table at the bottom of the pool near the pool wall. When unloading the uppermost bin, care was taken not to raise capsules high enough to elevate radiation levels above the pool. The Geiger Counter probe was dangled a foot above the pool water during the unloading of this bin. No abnormal radiation readings were noted. Down loading was complete by about 1200 (noon).

Next, at approximately 1300 ropes were passed through the empty Cesium-137 plaque. The ropes were then supported by the hook of an electric hoist. A combination of hoist lifting and lateral hoist movement unlocked the plaque from the plate that rides in the track of the horizontal beam. After it was separated from its support system, it was raised from the pool by the hoist. As it emerged from the pool, the plaque's surface was scanned with the HP-272 Geiger - Mueller probe. All readings were normal (background). When the plaque was placed on the floor more extensive G.M. readings were taken. These readings were also background. The Cesium-137 plaque removal was completed at about 1600 hours.

As the plaque was being taken from the pool, it was noted that there were several small loose objects laying on the top of it. These were identified as ball bearings and various broken pieces from one or more bearing units. Broken ball bearing units would account for the lack of movement of the plaque.

A.W. Hartberger ordered a set of replacement bearings.

At about 1620, J.J. Myron made an attempt to report the incident to NRC Region II Office in Atlanta. A recorded message from the switchboard informed him that the Office was closed and that reporting should be done to the NRC Operations Office at NRC headquarters. This Office was phoned and J.J. Myron gave a report of the incident to date to Ms Leigh Trocine. The call was logged at 1635.

Work on dismantling the irradiator equipment then continued.

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At approximately 1700 a metal clamping device was fitted around the top of the Cobalt-60 plaque. Ropes led from the clamp to the top of the pool where they were engaged by two manual hoists, on each side of the plaque above the pool. In an operation, similar to that employed to remove the Cesium-137 plaque, a combination of vertical and lateral force was applied via the hoists to separate the Cobalt-60 plaque from its supporting plate, track and beam. The Cobalt-60 plaque was moved close to the pool wall and leaned against it in a temporary storage mode. It was secured to the guardrails above the pool by means of the ropes on the clamping device.

The cables to both the Cesium-137 and the Cobalt-60 plaques were disconnected from the chain drives above the pool so that they would come along with the beam when it was removed from the pool.

Next, ropes were passed around the horizontal support beam and two hinged hangers at each end of it that secured it to vertical girders at the pool wall were released. Beam, track cables and support plates were removed as a unit from the pool by means of the ropes. During and immediately after removal the structure was scanned by the Geiger Counter. All readings were normal (background). Beam removal was completed at 2030.

The track was examined and it was discovered that four of the sixteen bearings were badly damaged.

The beam containing the track was transferred to ARECO's Maintenance Dept to effect repairs when the replacement roller bearings arrived.

At 2050, J.J. Myron carried out a radiation survey of pertinent points in the pool room (demineralizers, filter bed, etc). All readings were normal (background). The five direct reading dosimeters were collected and read. All readings were the same as when the dosimeters were issued ($\pm 1\text{mr}$).

At about 2100, the pool room was locked, the intruder alarm was set, and the rest of the building was secured.

Between 0800 and 0900 on Friday, January 12, 1996, J.J. Myron phoned the NRC Region II Office and reported the incident to Mr. John Pelchat.

Track Repair: Replacement bearings were received on Friday, January 12, 1996. Maintenance replaced all sixteen bearings in the Cesium-137 track late on this day. They also replaced the old Cesium plaque cable. The cable to the Cobalt-60 plaque was not replaced as it received much less use (<10%) compared to that of the Cesium-137 plaque. No work in or around the irradiator pool was done on this date.

Putting Back Equipment in the Pool: At 0830 on Saturday, January 13, 1996, the five direct reading badges were reissued to workers who would be taking part in the replacing of the irradiator components in the pool. Initial readings were recorded.

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At 0900 work began to put the horizontal beam, with its support plate, track, bearings and cables, back in place in the pool. It was lowered down by ropes and swung into position. Hinged hangers on each end of the beam were maneuvered into place to secure the beam to two vertical girders at the pool wall. It was locked in place at 0945.

From 0950 to 1000 the movement of both plaque cables was tested several times by pulling on them manually and noting the movement of the supporting plates as they traversed the pool.

At 1010 Maintenance personnel began to reconnect the two plaque cables to the chain drives on the east girder above the pool. Hook up was complete at 1030.

At 1045 the Cobalt-60 plaque was moved from the pool wall by means of the ropes attached to the metal clamp at its top. These ropes were then looped through the hooks of two manual hoists above the pool. The plaque was maneuvered to the point directly below its supporting plate. Then two hanging hooks in the plaque were locked into two slots in the plate by a combination of vertical and lateral movements using the two hoists. This reattachment of the Cobalt-60 plaque to its supporting plate, and hence the horizontal beam with its track, was completed at 1355.

The metal clamp was disengaged from the top of the Cobalt-60 plaque and removed from the pool via its ropes. It was scanned with the Geiger Counter as it emerged.

The movement of the reattached Cobalt-60 plaque was tested by running it to and fro in the pool by activating its controls located on the east girder. Its performance was as designed.

At 1415 the empty Cesium-137 plaque was lowered into the pool by means of ropes attached to the top corners of its structure. The ropes were then looped through the hooks of two manual hoists above the pool. The plaque was then maneuvered to the point directly below its supporting plate. Then two hanging hooks in the plaque were locked into two slots in the plate by a combination of vertical and lateral movement using the two hoists. The reattachment of the Cesium-137 plaque to its supporting plate, and hence the horizontal beam with its track, was complete at 1445.

Movement of the reattached Cesium-137 plaque was tested by running it to and fro in the pool by activating its controls located on the east girder. Its performance was as designed.

Reloading of the Cesium-137 plaque started at about 1515. The WESP capsules were transferred from the storage table back into the plaque, to the same positions from which they had been unloaded, using the long handled clamping tool. When loading the uppermost bin, care was taken not to raise capsules high enough to elevate radiation levels above the pool. The Geiger Counter probe was dangled

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a foot above the pool water during the loading of this bin. No abnormal radiation readings were noted. Loading was complete by 2015.

Cesium-137 plaque movement was then tested again and its performance was found to be as designed.

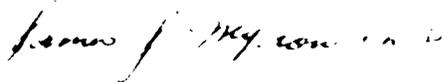
At 2020, all devices and tools that were extraneous to normal irradiation procedures were removed from the pool, with scanning for contamination. No contamination was detected. J.J. Myron carried out a radiation survey of pertinent points in the pool room. All readings were normal (background). The five direct reading dosimeters were collected from the workers and read. All readings were the same as when the dosimeters were issued ($\pm 1\text{mr}$).

The irradiator plaques were declared to be ready for normal operations at 2045.

I trust that the above account of the actions taken fulfill reporting requirements. If you have any questions regarding this report please contact me at 804-385-5300.

Yours truly,

THE APPLIED RADIANT ENERGY CORPORATION



James J. Myron, Ph.D.
Vice President, Safety & Regulatory Affairs

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