This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U.S. Department of Energy.

SAVANNAH RIVER SITE
REMOTELY RECHARGEABLE EPD
WSRC-STI-2007-00655

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Radiation measurements inside the Contact Decon Maintenance Cell (CDMC) in the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS) are required to determine stay times for personnel. A system to remotely recharge the transmitter of an Electronic Personnel Dosimeter (EPD) and bail assembly to transport the EPD within the CDMC was developed by the Savannah River National Laboratory (SRNL) to address this need.

I. INTRODUCTION

Maintenance personnel frequently perform activities within the CDMC at DWPF and information regarding the radiation level in the area is required prior to entry. A remotely rechargeable battery charger to charge the transmitter of the EPD and a bail assembly to transport the EPD within the CDMC was designed and fabricated. The rechargeable EPD is used for remotely monitoring the radiation level within the CDMC. The device is stored in the CDMC on a docking platform. The Remote Rechargeable EPD system permits an in-cell crane to remotely lift the MK-2 EPD for movement and relocation around the contaminated area to survey equipment and work spaces prior to entries by maintenance personnel. Once all the necessary measurements are completed and transmitted to a laptop located in a "clean" area, the device is placed back on the docking platform where alignment pins provide accurate placement of the equipment to allow the recharging unit to be connected with the transmitter. Pins, located on the side of the EPD bail assembly, allow the crane operator to position the EPD for monitoring. The system used prior to development of the rechargeable EPD transmitter required personnel to enter a contaminated area to replace the batteries in the EPD transmitter after approximately 8 hours of operation. The development of the Remote Rechargeable EPD Transmitter provided a solution for increasing the change out of the transmitter battery from 8 hours to a projected one year interval.

II. DESIGN

The Rechargeable EPD has four main components to the design. These components are the EPD assembly, the body, the docking platform, and the recharging unit.

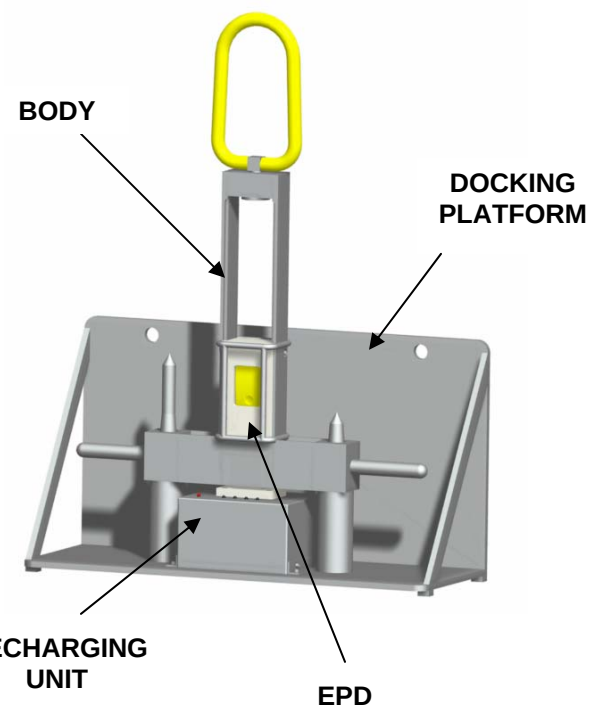

Fig. 1 - Rechargeable EPD Assembly

II.B. Body

The body of the Rechargeable EPD provides many of the necessary features to allow the system to be operated via a

crane. The features of the body are the lifting bail, turning posts, alignment holes, and the cage (Fig. 2).

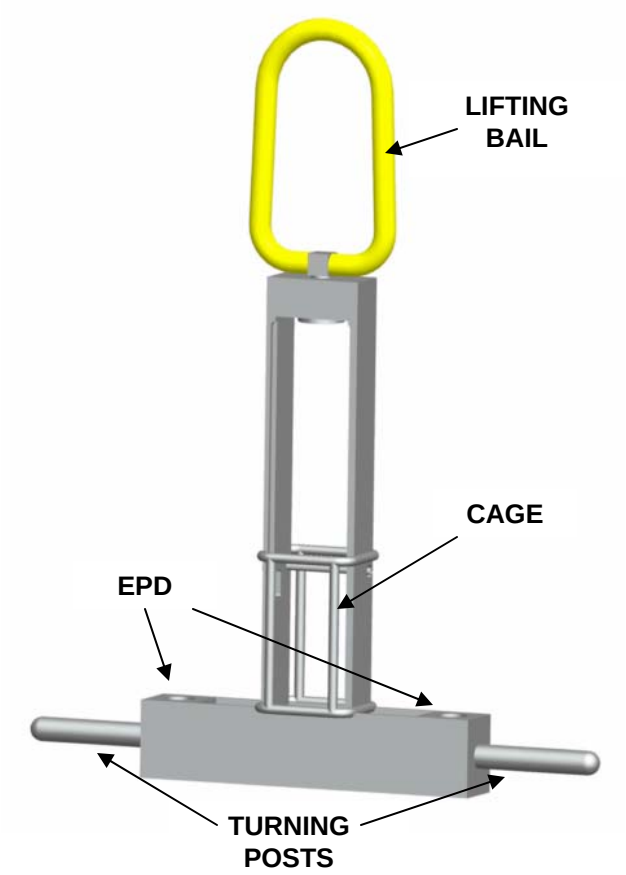

Fig. 2 - Body Weldment

The lifting bail is a standard issue bail used for jumper weldments and was selected to ensure compatibility with the cranes in the CDMC. The bail is welded to a swivel pin and a swivel disk to allow the rest of the body to rotate relative the bail. This is achieved by welding the bail to the pin and then the pin to the bottom side of the disk. The top side of the disk and its mating face were machined to 32 RA to minimize friction (Fig 3).

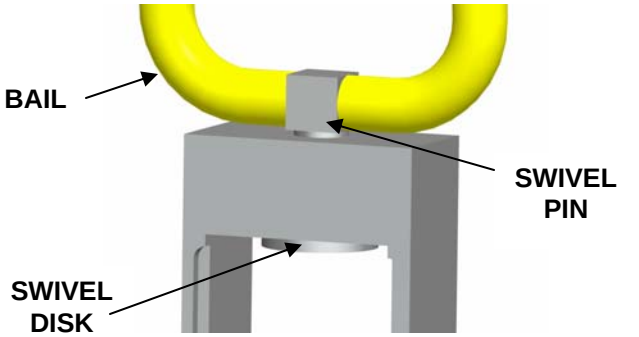

Fig. 3 - Lifting Bail Swivel

When monitoring the radiation level within the cell the direction the EPD is facing is very important. If the EPD is turned away from the source the EPD will be shielded. The gamma radiation will be slightly attenuated but the gamma radiation will be blocked completely by either the steel or the plastic that comprises the EPD housing. The EPD must have a direct line-of-sight between the beta window, the orange dimple on the front of the EPD, and the source. To assist the operators turning posts were placed on the sides of the body that may be used to turn the system by hitting them up against another object in the cell. Since coming into contact with other objects in the cell is expected a cage was developed to protect the EPD from physical damage while not appreciably shielding the EPD. While the system does recharge the batteries for the transmitter, the battery for the EPD itself is of a different type and is not recharged by the recharging unit. The battery for the EPD is estimated to last approximately six months at which time the EPD is recalibrated. A hole in the side of the body allows the battery to be quickly replaced reducing an operator's exposure time. To keep the EPD housing securely in the body and quick-pin used (Fig 4).

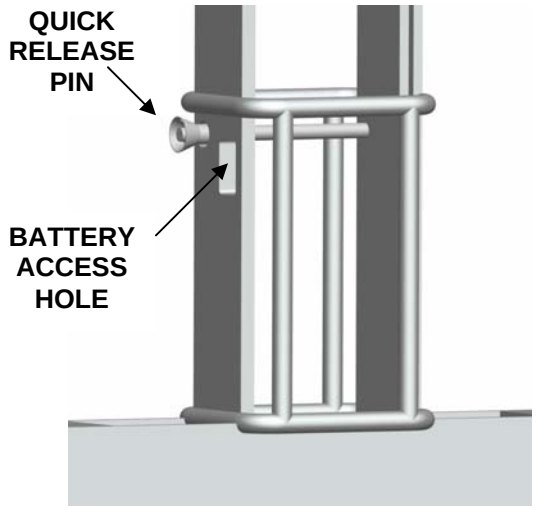

Fig. 4 – Quick Release Pin & Battery Access Hole

II.B. Docking Platform

The docking platform provides a surface for the alignment pins and the recharger to be mounted. It also provided lifting points for the platform to be to be transported within the cell with a crane (Fig. 5).

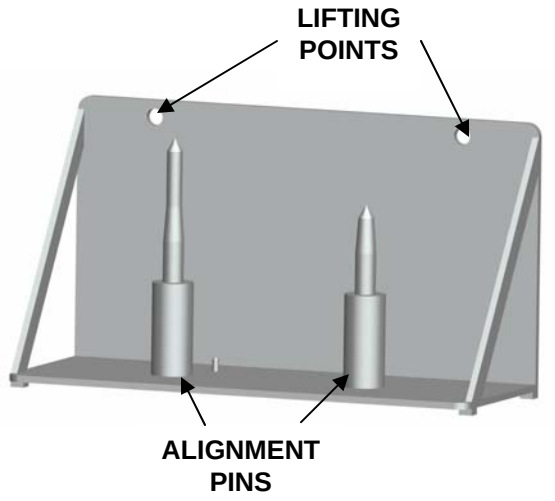

Fig. 5 - Docking Platform Weldment

The alignment pins are different heights to allow a crane operator to focus on getting the alignment hold on one pin at a time rather than both. Once the body is on the first pin it can then be lowered and placed around the second pin. At this point the diameter of the pins is gradually increased to align the pins in the EPD housing to those on the recharging unit.

II.C. EPD Assembly

An EPD transmitter is procured as standard equipment to be attached to an EPD for remote measurement of an areas radiation level. The transmitter has a 1.5 VDC AAA alkaline battery that will last approximately 8 hours prior to requiring replacement. To provide remote radiation measurements in the CDMC, this would require personnel to "dress out" to replace the battery prior to entry therefore increasing radiation exposure time.

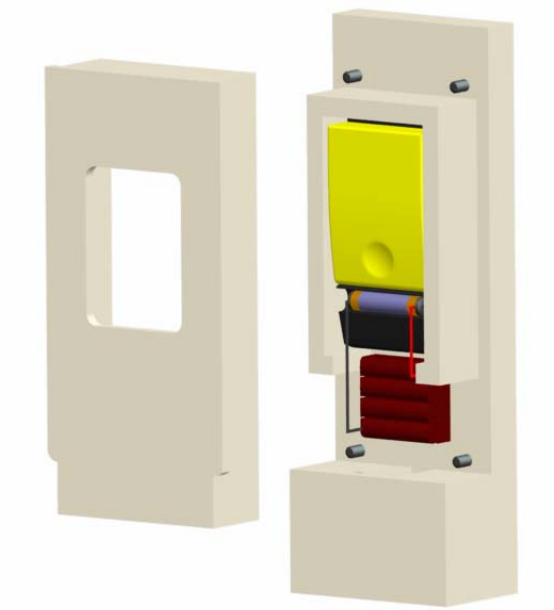

Fig. 6 - EPD Assembly

To reduce personnel exposure due to battery replacement requirements, the EPD transmitter was redesigned with a new enclosure to permit the connection of multiple AA alkaline rechargeable batteries. This permits remote continuous use of the EPD for a period of approximately 100 hours prior to recharging. In addition, the design of the EPD enclosure assembly permits continuous monitoring of the area when the unit is placed on the docking platform while recharging the transmitter batteries, i.e., the batteries are disconnected from the EPD transmitter during a recharge and connected to a 1.5 VDC power source located within the charger assembly.

II.D. EPD Transmitter Charger

The EPD enclosure and the battery charging unit have connectors with alignment pins to ensure good electrical contact when placing the EPD on the docking station for charging. The charging unit is designed to provide a 1.5 VDC charge for the batteries located in the EPD enclosure. A separate 12 VDC power supply within the charger provide control voltages and also a 1.5 VDC source for the EPD transmitter during the charging period, which permits continuous remote monitoring of the radiation level in the surrounding area. In addition, the charger is equipped with circuitry to provide a status of the charge condition of the rechargeable EPD transmitter's alkaline batteries. LED's located on the enclosure and visible via the CDMC crane camera blink green while the batteries are charging. When the batteries

are fully charged, the LED's provide a continuous green display. In addition, if any one of the rechargeable batteries fail or if a bad electrical connection exists, the LED's will display a continuous red color. The estimated life of the rechargeable batteries is approximately 2 years for an estimated 400 – 500 charge cycles.

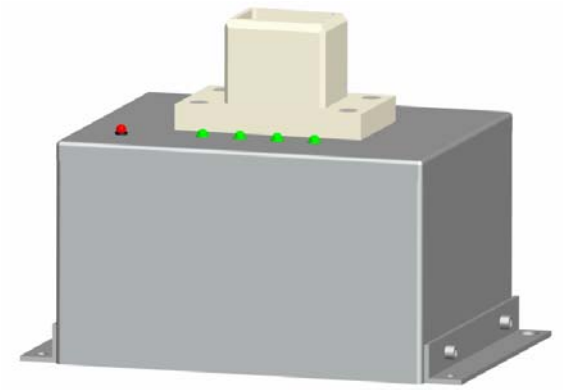

Fig. 7 – EPD Charging Unit

III. RESULTS

The Remote Rechargeable EPD was successfully tested and delivered to DWPF where it is currently in use in the CDMC. The completed system can be seen in Figure 8.

Fig. 8 - Remotely Rechargeable EPD located on the docking station for charging.

ACRONYMS

ALARA – As Low As Reasonably Achievable
CDMC – Contact Decon Maintenance Cell
DWPF – Defense Waste Processing Facility
EPD – Electronic Personal Dosimeter
SRNL – Savannah River National Laboratory
SRS – Savannah River Site

ACKNOWLEDGEMENTS

Don Varble – Engineered Equipment & Systems