PRC-SRP-00024
Revision 0

DESIGN REPORT NARRATIVE FOR THE FLOOR SAW, KUR-1782F-RPT-026 R0 (300-296 Soil Remediation Project)

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
Richland, Washington 99352

PRC-SRP-00024
Revision 0
EDC#: ECR-16-001241

DESIGN REPORT NARRATIVE FOR THE FLOOR SAW, KUR-1782F-RPT-026 R0 (300-296 Soil Remediation Project)

Document Type: RPT Program/Project: 300-296 Soil Remediation Project

F. M. Blackburn
CH2M HILL Plateau Remediation Company

Date Published
October 2016

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
Richland, Washington 99352

APPROVED
By Julia Raymer at 3:16 pm, Nov 08, 2016

Release Approval Date

DATE:
Nov 09, 2016
HANFORD RELEASE

Release Stamp

Total pages: 19

KUR-1782F-RPT-026

300-296 Soil Remediation Project

Design Report Narrative for the Floor Saw

Revision: 0

Issue Date: May 26, 2015

Prepared for:

AREVA Federal Services LLC
Richland, Washington 99354

Prepared by:

KURION
Isolating Waste from the Environment

Kurion, Inc.
1355 Columbia Park Trail
Richland, Washington 99352

Approved By:

Earl R. Lloyd
Project Manager/Project Engineer

Approved By:

Ron Mitchell
Design Manager

Report Title: Design Report Narrative for the Floor Saw

Project Title: 300-296 Soil Remediation Project

Status: ☐ In-Process ☒ Final

Contains assumptions and/or inputs which require verification: ☐ Yes ☒ No

Report History

Revision #	Reason for Revision	Approvals/Date		
0	Initial Issue (IFC/IFF)	Originator:	Jon Lahti	5-26-15
		Checker:	Ron Mitchell	5/26/2015
		PM:	Earl Lloyd	5/26/2015
		ESH&Q:	Jan McCallum	5/26/15

Table of Contents

Figures

Acronym List

Acronym	Definition
MSM	Master-Slave Manipulator
PoP	Proof-of-Principle
REA	Remote Excavator Arm
REC	Radiochemical Engineering Complex

1.0 Introduction

A concrete saw is used to reduce the B-Cell floor to manageably sized pieces. The saw is an industry-proven tool (Figure 1) that is readily available and supported by the manufacturer for part replacement and services. However, modifications to the saw are necessary to support remote operations.

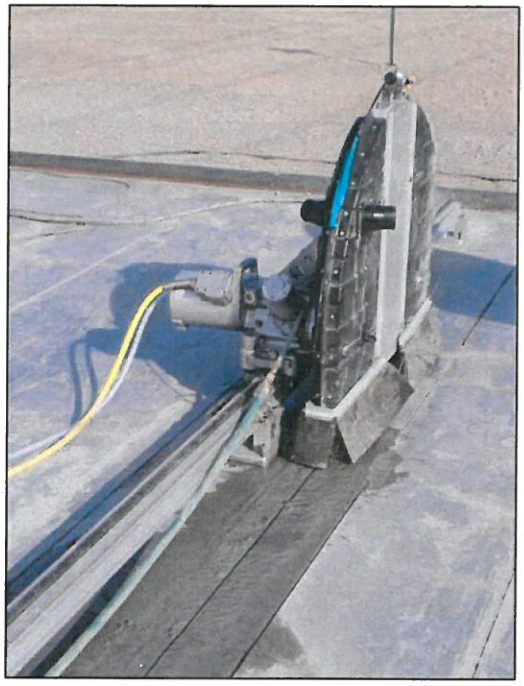

Figure 1 – Commercial Concrete Saw During Proof-of-Principle Testing

2.0 Intended Function

The saw is mounted to a deployment frame that is remotely positioned using the B-Cell crane and the Remote Excavator Arm (REA) is used for fine positioning (Figure 2). Out of the box, the saw is designed to be remotely controlled from distances of up to 100 ft away from the cutting operations. The operator pendant allows for remote selection of cutting direction, cutting speed, and depth of cut. The saw is equipped with water-cooled motors and blades capable of cutting a 6- to 10-in. thick concrete floor, stainless-steel cladding, and embedded structural shapes all at one time.

Once installed, the floor saw is operated in the control trailer from the human-machine interface. This is done by using cameras and the audio feedback from the Radiochemical Engineering Complex (REC).

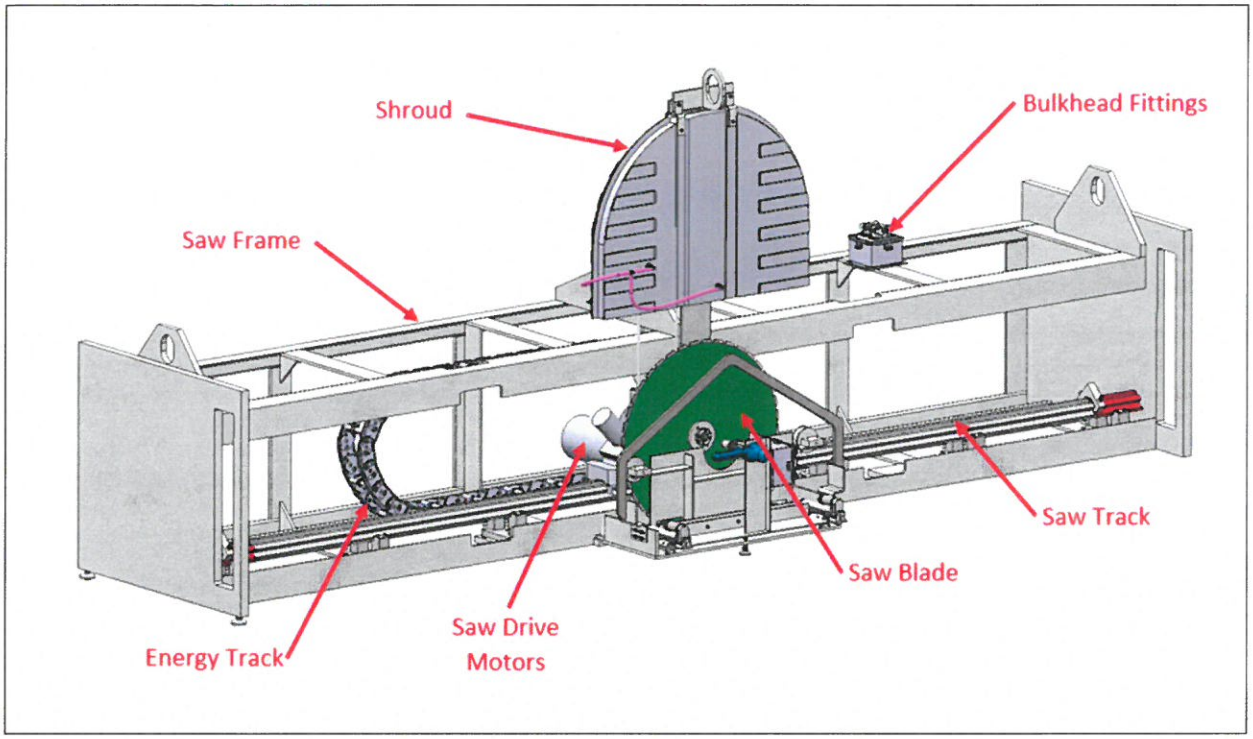

Figure 2 – Overview of Floor Saw Mounted in Remote Frame

The saw is designed with a water circuit that cools the blade and drive motors during operations, thus providing cooling and lubrication to the blade in conjunction with dust suppression during cutting operations. Due to the concern that the addition of water into B-Cell could drive contaminants deeper into the soil, the saw was originally configured to perform dry cutting. However, Proof-of-Principle (PoP) results showed that dry cutting is not practical due to blade heating and warping. Based on PoP, the saw will utilize water to cool the blade. The water is directed at the saw blade as a low flow mist. The actual water flow is expected to be very low with a minimum flow of 4 gallons per hour to the saw blade (KUR-1782P-RPT-014, *Proof-of-Principle Engineering Evaluation Report*, Section 4.1.1.1.2). The ideal flow of water will be verified during mockup testing.

The deployment frame is a simple design. It is stiff enough to support the saw and track while being lifted and positioned by the B-Cell crane or one of the REAs. It is designed with enough weight that it will not move during cutting operations. A PoP evaluation utilized a simulated frame and weight system to verify the saw is stable during cutting operations (KUR-1782P-RPT-014, *Proof-of-Principle Engineering Evaluation Report*, Section 4.1.1.2.1). The saw frame has three support feet for placement on the floor. These three location points ensure that the saw is always stable even if the floor surface is not flat. The length of the frame will allow the saw to cut from the expansion joint to the middle of the floor (Figure 3).

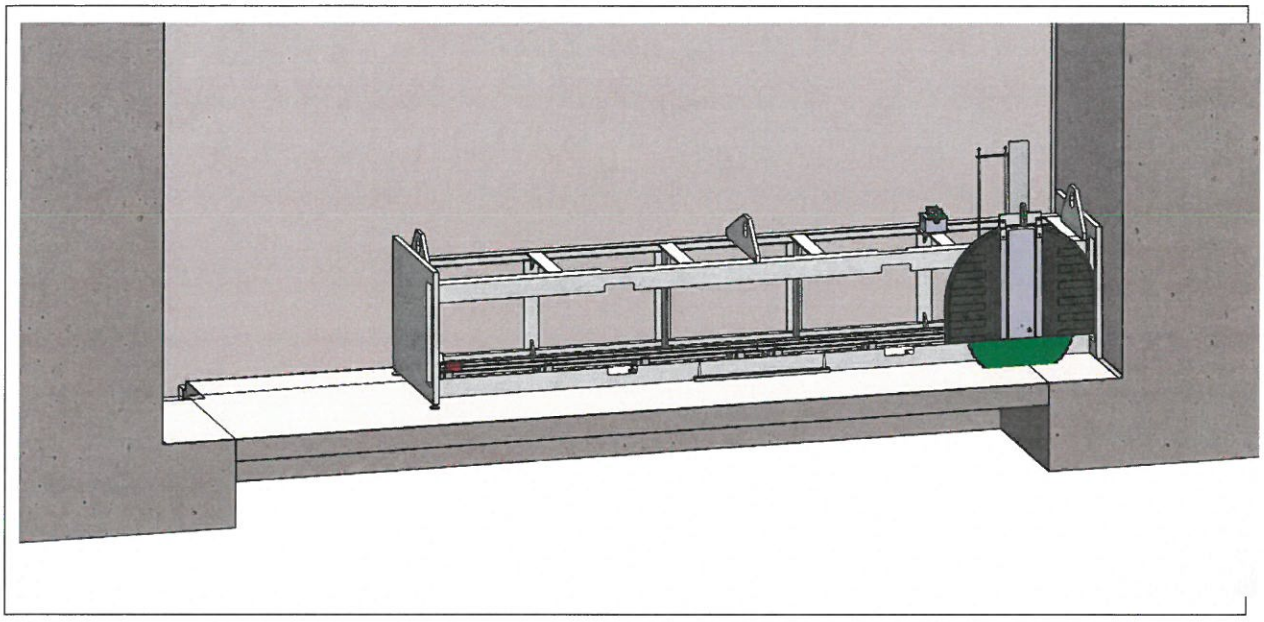

Figure 3 – Cross Section of Saw Cutting Floor in the Corner of B-Cell

The saw can be placed in wide array of positions and can section the floor in multiple ways. Operations will decide on how to cut the floor between the footers (floating slab) into 2 ft^2 sections approximately 4 in. deep (Figure 4). This depth will cut through all the liner and rebar material leaving only a small concrete section below. This decreases the cut time significantly and reduces the amount of highly contaminated soil that would be disturbed. After these cuts are made, the Upper REA and hammer can be used to crack out each of the blocks.

Once the floor is totally sectioned, the REAs (equipped with buckets) are used to lift and handle the sectioned pieces of the floor. As a backup, the Upper REA (equipped with the hammer and shear attachments) can be used to rubblize the concrete and size reduce the steel embeds.

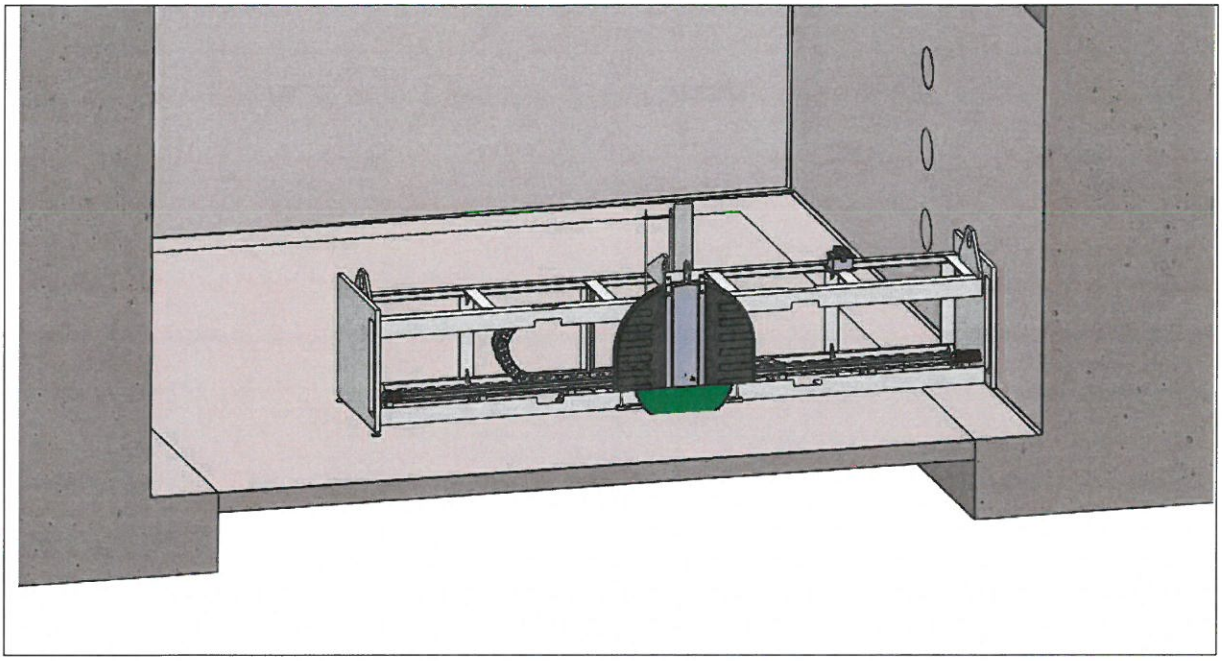

Figure 4 – Saw Positioned in B-Cell Cutting Floor

Saw Blade Change

The saw blade vendor has advised that only one saw blade will be required for the entire floor cutting operation. Based on the partial cutting method of the floor (cutting to 4-in. depth and then finishing using the hammer), the saw is required to cut 2,500 in-ft to segment the entire floor. During PoP, a single blade was demonstrated to cut 3,100 in-ft. This was done consuming only 55 percent of the cutting segments thickness (teeth) on the saw. This is more than the cut amount required to segment the floor and thus supports the vendor's estimate of only one blade required. However, in the event a blade change is required during the segmenting process, a method for changing a blade is provided.

The saw has been slightly modified in three ways to allow for a remote blade change. The first modification extends the travel of the shroud (instead of completely removing it) to clear the blade; the second modification reconfigures the saw blades; lastly, is the addition of the blade change tool.

In order to change the blade on the standard saw, the blade shroud must be removed to provide access to the blade. Although removal of the blade shroud is easily accomplished using remote methods, reinstallation would be very difficult. To address this difficulty, the blade shroud has been modified so that it can be lifted out of the way and held in position without removal from the saw. This required that the standard shroud locating pins be replaced with extended slide pins. The pins have been topped with a stop (top bar) to keep the shroud from being lifted off the saw. The shroud guide rail has been extended, and a lifting bail added to the shroud that provides a locking function to hold the shroud in the raised position (Figure 5).

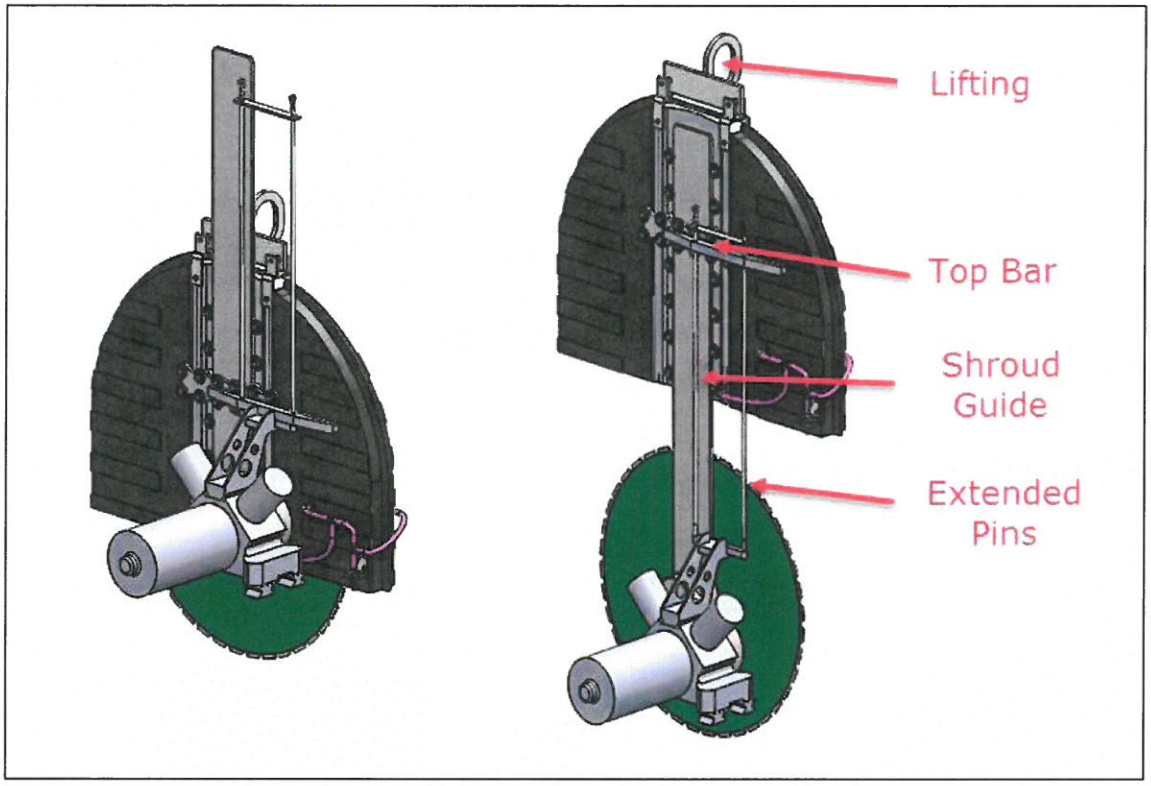

Figure 5 – Saw Blade Shroud Modification

The second modification reconfigured the saw blade. Originally, the blade was attached to the saw using a loose bolt and retaining washer. Loose parts complicate the installation of the blade so the blade and attachment components have been modified. The existing inner blade washer has been modified to accept another alignment dowel. The alignment dowels have also been lengthened and have a tapered end. The fastening screw has been replaced with a blade retaining stud. This stud protrudes past the alignment dowels and has a tapered end to aid in alignment. The blade will be fastened to a modified outer blade flange. This assembly will have a captive nut that resists rotation. This will allow the impact device to rotate the blade with the nut until the alignment dowels insert the blade assembly. Once the alignment is made, the nut can be tightened down with the impact wrench (Figure 6).

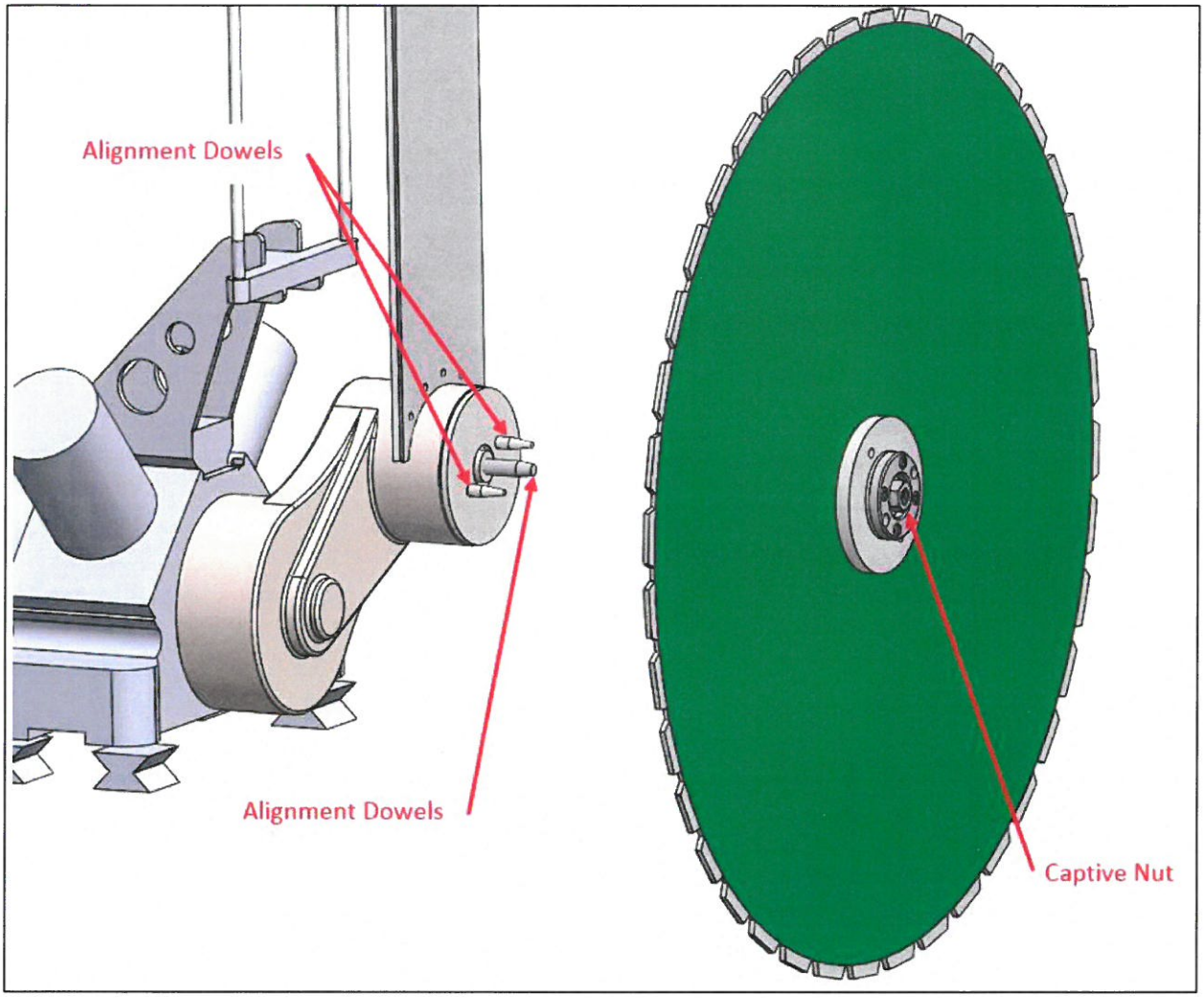

Figure 6 – Saw Blade Modification

Lastly is the addition of the blade change tool. This tool incorporates an impact wrench to remove and install the captive saw blade nut; a blade cradle that will hold the blade as it is removed and installed; a linear actuator to move the wrench slider assembly to and from the blade; and a magnetic connector to engage the wrench slider assembly to the blade cradle assembly (Figure 7).

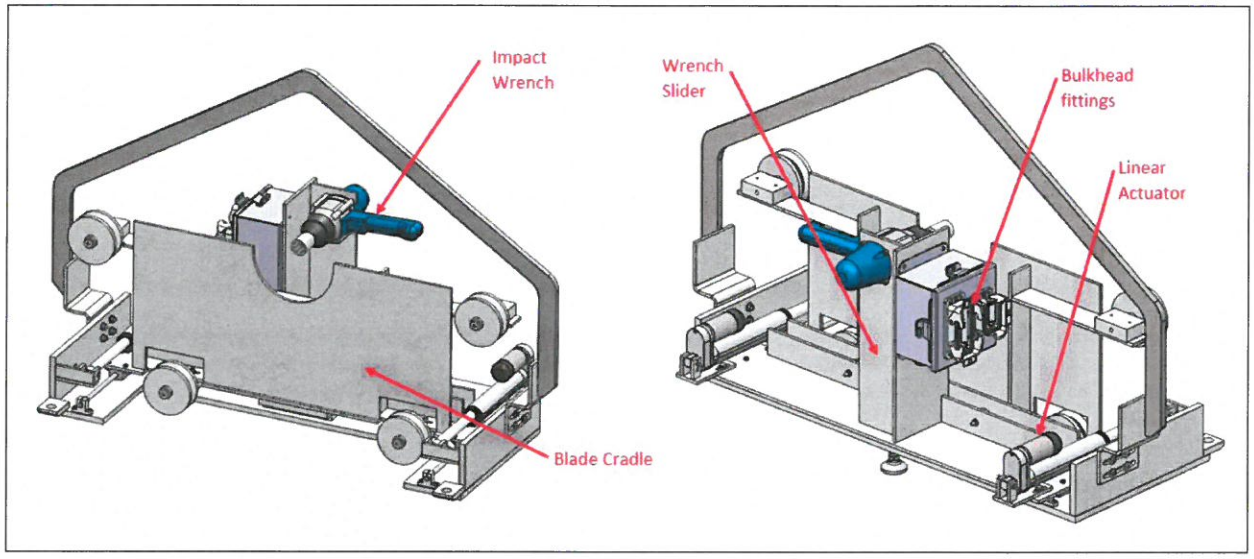

Figure 7 – Blade Change Tool

If a blade needs to be changed, the saw is moved to the designated location in the saw frame, and the blade is moved to a fully raised position. The blade shroud is lifted using the crane and locked in the up position. The blade change tool is picked up in the Airlock with the B-Cell crane and placed into B-Cell where it is moved to the saw frame. The blade change tool is connected to the frame by landing it on the two vertical mounting pins (Figure 8).

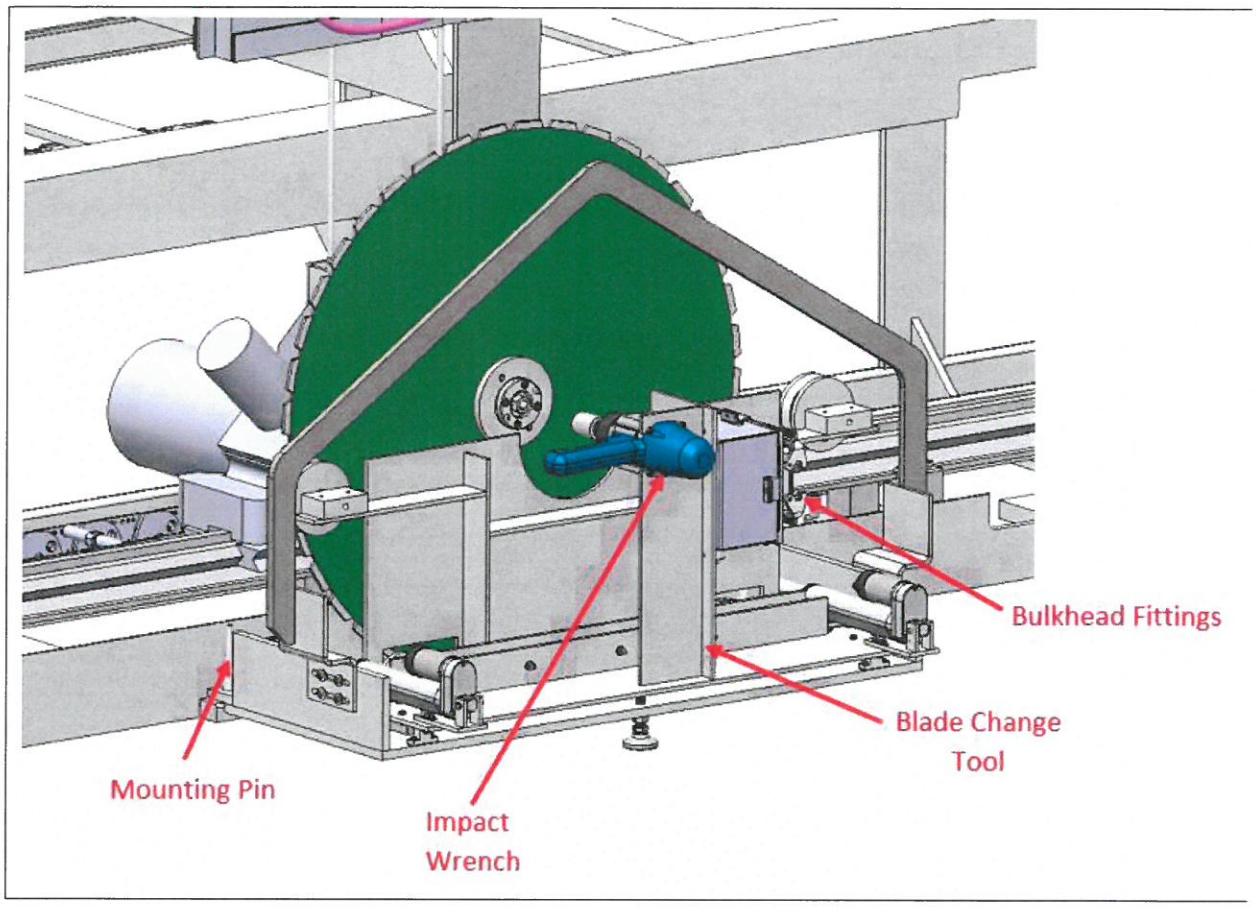

Figure 8 – Saw Frame with Blade Change Tool Attached

After the blade change tool has been installed, the electric linear actuator on the blade change tool is retracted, pulling the wrench slider and blade cradle toward the saw. Then the blade is lowered to engage the v-groove wheels on the blade cradle assembly. The linear actuator and the wrench slider assembly are then extended to move the impact wrench and socket back to clear the saw blade retaining nut. The blade is then lowered and moved along the track to center it in the blade cradle. The impact wrench is moved forward with the linear actuator, while rotating with a speed controller, to engage the impact socket with the blade retaining nut (Figure 9). The impact wrench is operated counter-clockwise to remove the nut and blade assembly. As the nut is removed, the linear actuators are slowly extended to retract the wrench assembly. The blade assembly is now free of the saw.

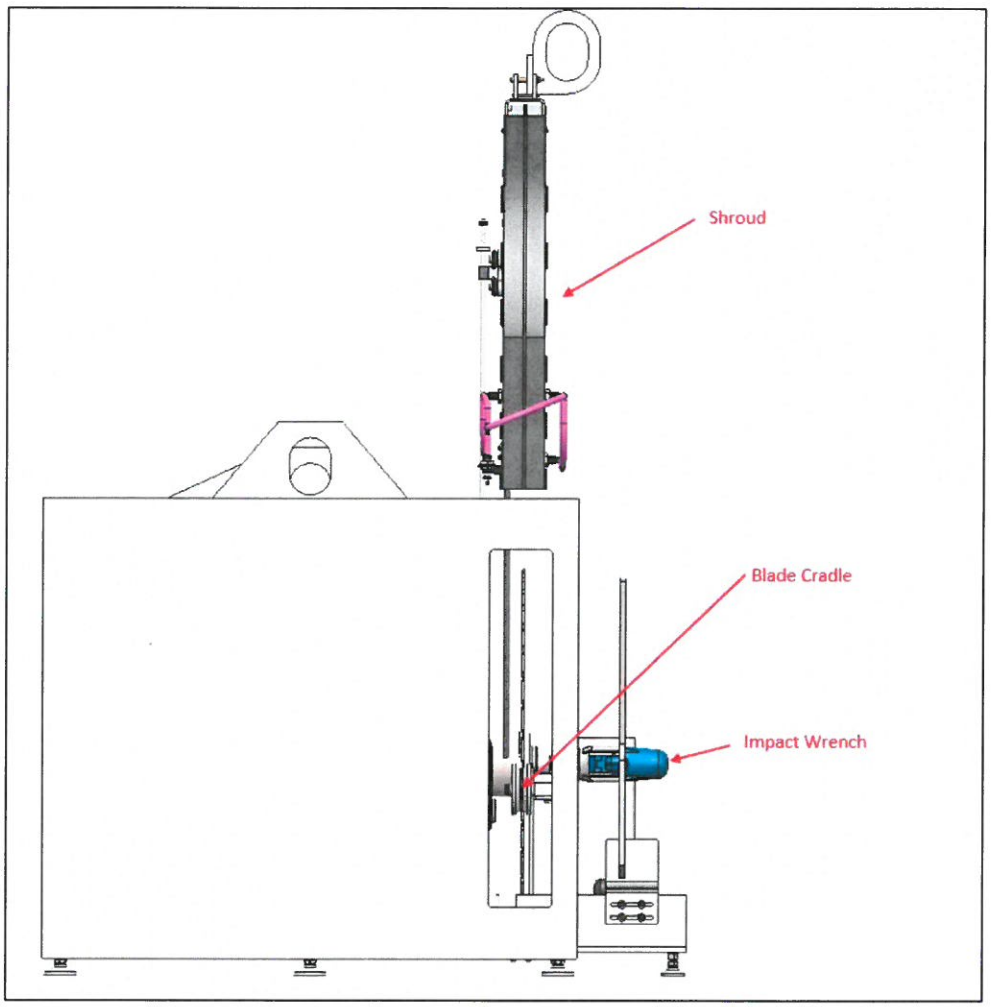

Figure 9 – Saw with Blade Change Tool Extended and Engaged with the Saw

The linear actuator is fully extended to move the wrench slider and blade cradle, with the blade, away from the saw. Stops on the blade change tool base will stop the blade cradle, separating the blade retaining nut from the impact wrench socket (Figure 10). The entire blade change tool with the used saw blade is then lifted into the Airlock and the old saw blade removed and replaced with a new blade. The blade change tool is then returned to the saw to install the new blade.

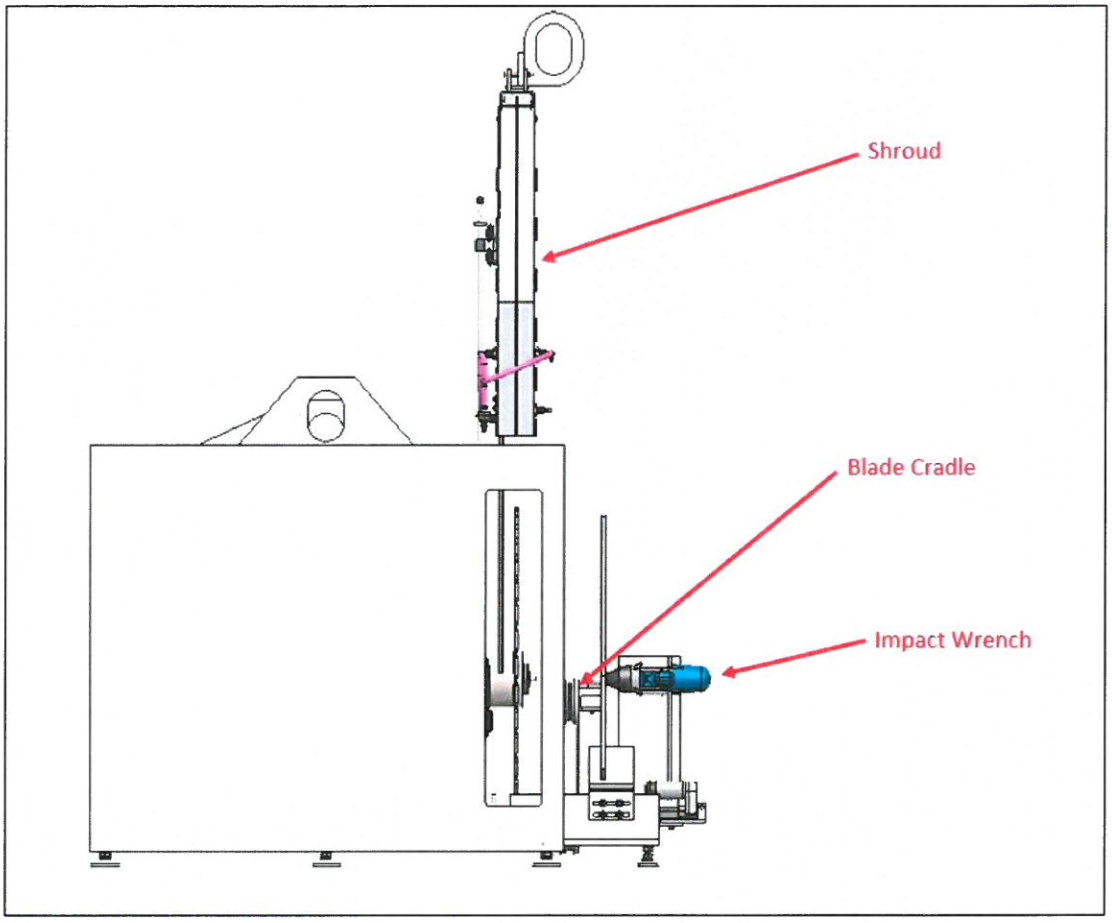

Figure 10 – Saw with Blade Change Tool Retracted for Blade Removal

The linear actuator is retracted to move the blade toward the saw. Once the blade retaining stud has entered the blade assembly, the blade is incrementally rotated clockwise to align the dowels on the modified inner washer; this is accomplished by using a speed controller and a momentary switch. Once the blade has rotated, the linear actuator will be retracted slightly to push the blade assembly onto the alignment dowels. If the dowels do not line up, the linear actuators are extended slightly and the incremental alignment process continues. When the blade is clocked to the same angle as the saw, the blade is pressed onto the saw and tightened with the impact wrench. The impact wrench is moved back and then the blade is raised and the linear actuator extended, moving the empty blade cradle and wrench slider away from the saw. The blade change tool is then hooked with the crane and moved to the Airlock for storage. The shroud is lowered and the saw is ready for use.

3.0 Installation Location and Methods

Install the floor saw in the Airlock using the provided lifting eyes, close the Airlock door, then open the B-Cell door. Use the A/D or A-Cell crane to position the saw frame in the B-Cell doorway and within the B-Cell crane operating envelope. Then lift the saw frame with either of the B-Cell cranes and install into the B-Cell. The saw will include bulkhead fittings on the top of the frame. A 4-in. penetration (BS010-04) is used to install the control cable and water delivery lines from the gallery. The saw frame

will be lifted to a window where Master-Slave Manipulators (MSMs) will insert the connectors to the bulkhead. In the gallery, the electrical and water connections for the saw are required. The saw will be set on the floor ready for operation.

If the saw blade needs to be changed, the saw blade change tool will be moved into B-Cell using the same operations as the saw frame. The saw blade change tool will have bulkhead fittings that will be attached using MSMs to wire from the B-Cell gallery using the same penetration (BS010-04). When the blade change tool is relocated to the Airlock with the old blade, the electrical connectors will have to be disconnected with the MSMs. The electrical connectors will be reattached once the blade change tool is relocated into B-Cell with a new blade.

The controls for the saw blade change tool will be located on the main control cabinet located in the B-Cell gallery. Operations can be accomplished using local monitors to aid in viewing operations.

4.0 Description of Facility Preparation Required for Installation

No facility preparation is required for the saw.

5.0 Sequencing

The following items must be completed before the floor saw can be installed:

- Free debris in B-Cell removed
- Fixed debris in B-Cell removed
- Floor grout removed and floor cleaned as well as possible (interference less than 1-in. preferred)
- Upper REA installed (to help position saw)

The following items have potential interferences:

- If the Lower REA is installed, it will have to be relocated to allow the saw to cut in the corners.

6.0 Description of Interfaces

The following interfaces apply to the saw:

- Electrical power in the gallery
- Water supply in the gallery
- Water return collection and handling

7.0 Associated Equipment, Accessories, Special Tools, and Spare Parts Required

The only spare part for the saw is a second blade.

8.0 Equipment Disposition

The saw frame is designed to be sheared using the shear on the REA. There are reduced cross sections of the frame to allow this. The long items, such as the rail and cable chain, can also be sheared.

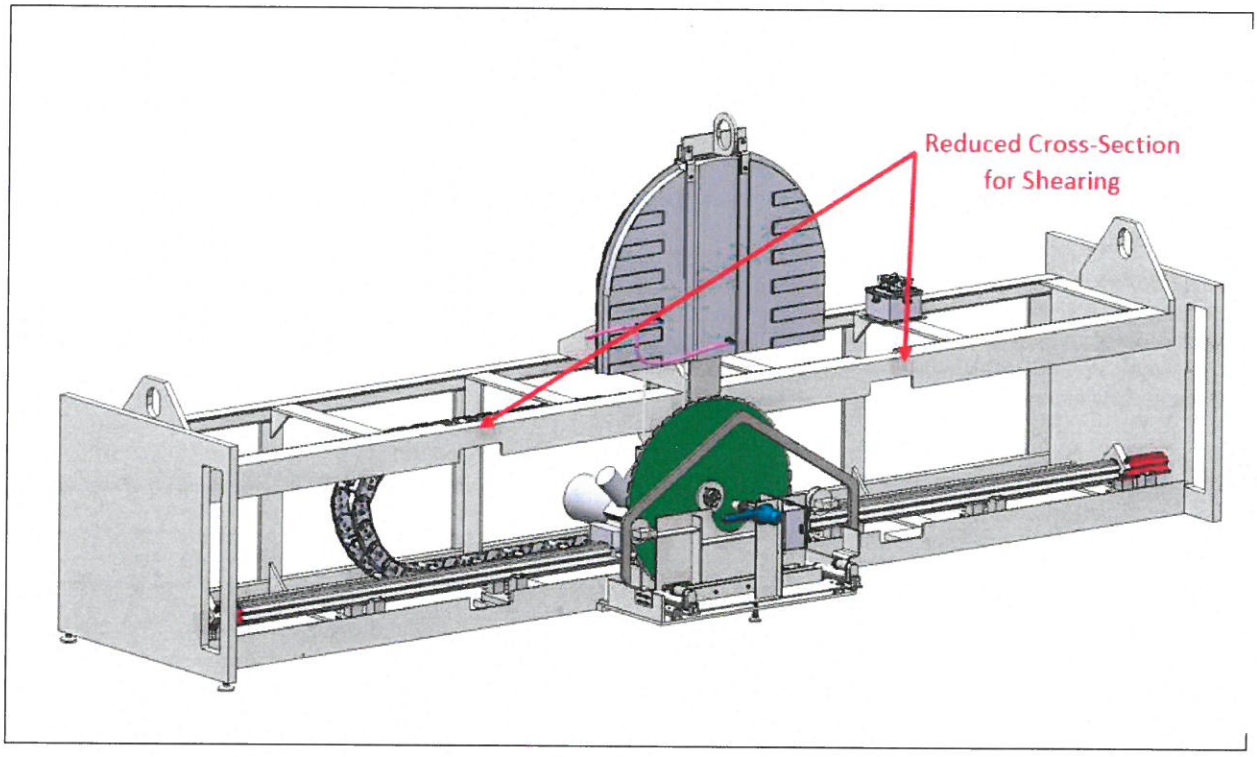

Figure 11 – Detail of Pre-Cut Sections on Frame for Size Reduction

After the frame has been size-reduced, the pieces can either be stored in A-Cell or disposed of outside the REC.

9.0 References

KUR-1782P-RPT-014, 2014, *Proof-of-Principle Engineering Evaluation Report*, Rev. 0, Kurion, Inc., Richland, Washington.