2017 Safety Award Entry

Category: Best Safety Innovation

Technical Division: Landfill Gas & Biogas

Entrant: Aria Energy

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SWANA Member Number: 978027

Title of Entry: Radiator Bearing Replacement Procedures

Jurisdiction: Multiple States

Approximate Population: Unknown
Executive Summary

As one of North America’s premier Landfill Gas (LFG) companies, Aria Energy provides engineering, design, construction, operations and maintenance services for LFG to energy facilities. We own and/or operate a diversified portfolio of 42 LFG recovery and processing projects across 16 states, collectively representing 265.3 MWe of energy capacity. Aria Energy has over 150 employees. Our portfolio includes 29 owned projects that generate electricity and 6 owned projects that produce pipeline-quality renewable natural gas (RNG) or medium Btu gas. We also provide operations and maintenance (O&M) services to 7 projects owned by third parties. We have developed or constructed more than 50 projects over the last 25 years and have successfully integrated four acquisitions since 2008. Our business is built around our core values of safety, customer focus, teamwork, ethics, integrity and respect.

Section 1 - Safety Innovation

In 2016, Aria Energy was awarded the Best Safety Innovation award for our employee-run safety initiatives that include the Safety Subcommittees, Employee Run Safety Committee, and the Safety Board, which urge front-line employees to drive the safety program, as opposed to top officials stressing the programs. Over the course of the year, the Safety Program continued to effectively work toward improving the safety at Aria Energy. This included the completion of two inspections of all stations, noise profiles for all plants, creation of Competent Person Qualifications at all sites, lifting and rigging equipment monthly and annual inspections, fall protection monthly and annual inspections, man down system implementation at 7 sites, man down site profiles at 15 sites, close-out of the Man Down Subcommittee, close-out of Working from Heights Subcommittee, ladder identification and documented inspections, airspace sampling by industrial hygienists at 4 sites, calibrations of safety equipment, Daily Toolbox Training implementing SWANA Safety Monday, Wednesday SDS/JHA review, Job Hazard Analysis (JHA) and Energy Control Plan (ECP) completion.

Unfortunately, even with all our safety efforts, an injury accident occurred in late October 2016. During a radiator bearing replacement, the radiator shaft pulley was lowered onto two chain hoists strung across the frame with blocks to keep the pulley from falling onto the concrete. During this process, the pulley slipped off and struck a workers hand, pinning a finger between the 40 pound pulley and the concrete. The injury resulted in a torn ligament and stitches.

A safety stand down was issued, halting any ongoing or future work related to radiator bearing replacement until an updated procedure could be put in place. Safe radiator bearing replacement procedures were projected to be completed, reviewed, formatted and live no later than February 12, 2017. This would result in over 3 months between the accident occurring and a new procedure being implemented. With a portfolio of 42 projects, there was a risk that other facilities would need to be shut down during that time. Richard DiGia, President & CEO of Aria Energy challenged the safety committee with a more aggressive goal of December 20, 2016. Approximately 20 employees across the company were assigned roles as part of the initiative following a structured 6 step procedure and review process. This process ensured the new procedure would be applicable to all facilities and equipment types, whether the facility produces electricity or renewable natural gas.
Safety Initiative – Safe Radiator Bearing Replacement Procedures

November 4, 2016

After reflecting on our Safety Stand Down this week I feel it is imperative we develop an immediate response plan to eliminate the risks encountered during bearing replacement. Efforts are already under way to develop procedures and provide the tools necessary to safely replace radiator bearings. Together through the engagement of the Employee Run Safety Committee, Plant Lead Operators and Management this initiative will be driven to completion. Safe radiator bearing replacement procedures will be completed, reviewed, formatted and GO-LIVE no later than December 20, 2016.

The deliverable will be a comprehensive and safe procedure to replace radiator bearings, including proper equipment such as a portable bench/catch platform that minimizes the drop length of the removed component.

The initiative will cover four facility categories with differences in component design:

1. Millersville
2. Sacramento
3. IES/LES Facilities
4. RNG Facilities

The initiative will follow a structured 6 step Procedure Creation and Review Process:

1. Procedure DRAFT due November 25 1st
2. Level 1 Peer Review due November 30th
3. Final Peer Review due December 7th
4. Procedure Formatting due December 12th
5. Final Approval Rev-0 due December 15th
6. Training and GO-LIVE no later than December 20th

Responses like this are part of the commitment to continuous improvement in our safety practice and procedures driving to zero accidents and zero injuries. As a proud member of the team at Aria Energy and seeing what we as a team can and have accomplished, I am confident we will be successful in improving workplace safety with this initiative.
Section 2 - Measured Results

Aria Energy safety program results are measured against the industry standard of Injury Rate and Severity ( Restricted Days and Lost Time Days). Additionally, we look at whether or not injuries continue to occur after implementation of the new procedure.

Section 3 – Baseline for Comparison

We used 2015 numbers as a baseline to measure the continued improvement of Aria Energy’s Safety Program. After the initial implementation of Aria Energy’s new Safety Program in 2015, Injury Rates decreased 45% to 2.57. While we were excited by this initial improvement, there is still room for improvement. An additional baseline we used was whether we were able to eliminate reoccurrence, since an injury had occurred performing a radiator bearing replacement.

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<th>2015</th>
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<td>Rate</td>
<td>2.57</td>
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<tr>
<td>Lost Time Days</td>
<td>93</td>
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<tr>
<td>Restricted Days</td>
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Section 4 – Implementation

Three days after the email encouraging an expedited solution to the Radiator Bearing Replacement Procedures, the operations team was informed that a tool had been fabricated in the Florida Region, which had the potential to be a solution for all Aria’s facilities. Days later, the tool was shipped to the facility where the injury occurred. It was tested and found to be a viable solution at that facility. The Safety Committee was notified the successful field test of the tool and subsequently advised it be rolled out to the entire fleet. Since the tool would be utilized on different equipment, field data was collected to develop final tool dimensions for production and dissemination to fleet.

On December 14th, production of Pulley Swing tools began. The tool assists operators in lowering the equipment, rather than it being able to freely drop, which created the potential for injury. Video footage of the equipment being installed and used was recorded to develop a comprehensive procedure and instructional video. On December 20th, the Radiator Bearing Replacement Procedure (Attachment A) was completed and an instructional video was published on YouTube. Mass production of the Pulley Swing tool began out of Aria Energy’s Oakfield, NY shop. Sites were furnished with one tool per site upon availability from the fabricator.

Section 5 – 2016 Results

Aria Energy continued to see remarkable improvement in Injury Rate, Lost Time Accidents and Days Restricted in 2016. Aria Energy saw improvement in the organization’s injury rate and the severity of injuries. The Injury Rate decreased 27% to 1.87, there were no Lost Time Days and the number of
Restricted Days decreased from 164 to 64. No injuries related to Radiator Bearing Replacement occurred after implementation of the new procedure.

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**Section 6 – Best Safety Innovation**

In 2016, The Employee Run Safety Committee and Safety Subcommittees continued to drive employee safety culture at Aria Energy. Safety Indicators show significant improvements to safety performance. Aria Energy is immensely proud of the commitment our employees continue to have to this program. Working together over the course of 2016, they were able to expedite a solution to improving a procedure. This set a new standard for the timeframe for developing procedures. We believe our program deserves this award because of the continued improvement as the program evolves and new innovations are being implemented.
**Lower Radiator Bearing Replacement 1.2**

**General**
*As you perform your daily checks, you may suspect a radiator bearing failure if you hear excessive noise and vibration emanating from the radiator during operation. Prior to this repair you must review the Job Hazard Analysis and Energy Control Plan.* The JHA will identify the hazards that you may encounter while performing the repair so you can be prepared to work safely and the ECP will specify the LOTO procedure to safely remove the energy sources prior to beginning the work.

**Scope**
This procedure is designed to outline the process necessary to safely replace a lower radiator bearing.

This repair involves removing a large pulley from the bottom of the radiator shaft to access the radiator bearing. Special care and caution **MUST** be used during removal and installation to ensure that the operators do not lose control of the pulley. It is heavy (between 60-100lbs) and has the potential to cause injury. A Custom Pulley Tool MUST be used to handle the pulley during this repair and can be procured through the normal requisition process if you do not already have one on site.

**The pulley can weigh between 60-100 lbs depending on its size. It requires a Custom Pulley Tool to remove and install safely. You are NOT permitted to perform this repair until you have one on site**

**Precautions and Preparations**
Prior to starting the repair, read this entire procedure and then assess your site specific conditions that will affect the repair process. These include, but are not limited to:

1. Size of components- Verify that you have the proper parts to perform the repair.
2. Working height- Some radiators are elevated beyond ground level access to the components. If your site has radiators that cannot be reached from the ground, you must procure a scissor lift, scaffolding, working platform, etc prior to beginning the repair. Coordinate the procurement of these necessary items with your Regional Manager.
3. Special Tooling
   a. Custom Pulley Tool **MUST BE USED** to remove/install the large pulley on the bottom of the radiator shaft.
   b. Tap and Die set- due to outside conditions, the threads of the bolt holes and jacking ports should be chased with a tap to clear out rust/debris. Failure to clean the threads could result in broken bolts and a more extensive repair process.
   c. Typically the inner race of the bearing is seized to the radiator fan drive shaft. It may be necessary to use a grinder with a metal cut-off wheel or a cutting torch to cut the old bearing off the radiator shaft.

This will require the following PPE:
1. Gloves
2. Kevlar Sleeves
3. FR clothing
4. Safety glasses
5. Face shield
6. Hard toe boots

**Procedure**

**Remove the Radiator from service**

*LOTO motor according to ECP (energy control plan). Verify all energy has been removed from the system.

Remove the guard for the pulley and belts-

In many cases, the bolts can be left in on one side to allow the guard to swing down out of the way and avoid being completely removed. Make sure the guard swings toward the Motor side, not the side with the fan assembly.

**Remove the Belts**-

1. Remove the belts.
   A. Loosen up the four bolts holding the motor mount on the radiator frame (Right image indicated in yellow).
   B. Loosen the adjustment bolts on the back of the motor mount (Left image indicated in yellow).
   C. Remove the belts.

*Measure from the end of the shaft to the Taperlock Bushing or mark the position on the shaft to ensure the Taperlock bushing is reinstalled in the same position on the shaft.
**Remove the Pulley**

*Install the Pulley Tool. See diagram below for instructions to drill ½” holes in the frame of the radiator. Drill them in line with the other bolt holes.*

*Slide the long ½” x 40” steel rod through the frame of the radiator and the pipe on the pulley tool and out through the other side of the frame of the radiator. Install the cotter pin in the end of the long rod.*
*Swing the tool up into the frame of the radiator and install the short ½ steel rods in each side of the rectangular steel of the pulley tool.

*Position the foot of the pulley tool to engage the inside of the pulley and tighten the set screws to hold it in place.
*Wrap the chain around the pulley to secure it to the pulley tool.

*Adjust the tool so that it will support the pulley when the taperlock is removed.

*Chase the threads of the Jacking Ports with a tap and lubricant.
* Loosen the set screw on the Taper Lock Bushing
* Remove the bolts and insert them into the jacking ports on the taperlock.
* Remove the Taper Lock Bushing by tightening each Jacking Bolt 1/2 revolution (180 degrees) then move to the next bolt. Continue in a circular pattern until the Pulley is pushed free of the Taper Lock Bushing and Key.
**Remove the bearing**
*Remove the grease fitting (zerk fitting) from the bearing.*
*Loosen the set screws on the bearing’s Inner Race. Remove the mounting bolts.*
*If the bearing does not slide off the shaft it will need to be cut off.*
*Don the appropriate PPE for cutting metal- FR Uniform, Kevlar sleeves, gloves, safety glasses, hearing protection, face shield.*
*Using a handheld grinder with a metal cut off wheel, cut two opposite sides of the bearing’s Outer Race.*
*Next, cut one side of the inner race (best to cut in the groove of the Keyway. Take a screw driver and drive it into the cut as a wedge to expand the inner race and remove it from the shaft.*

**Install the bearing**
*Clean the shaft with lubricant (WD 40 or penetrating oil) and emery cloth to remove any surface rust or debris. Wipe the shaft clean with dry cloth or rags and apply antiseize to the radiator shaft where the bearing will be. Slide the new bearing onto the shaft and install the mounting bolts.*

**Install the Pulley**

**Install the belts**

**Install the guard**

**Remove LOTO devices**

**Test operation and adjust if needed.**