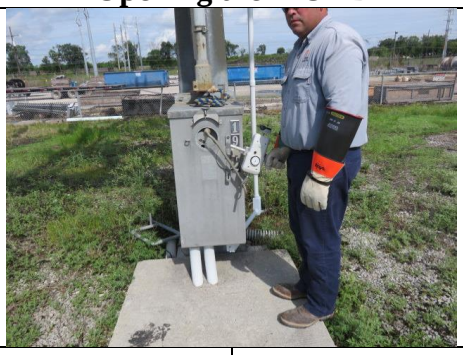
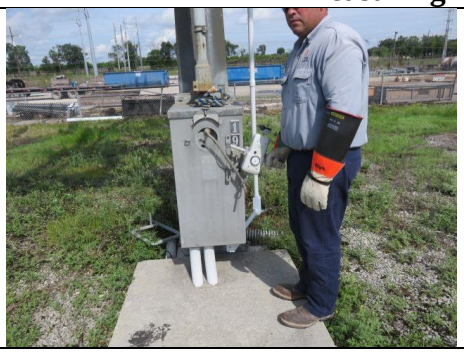
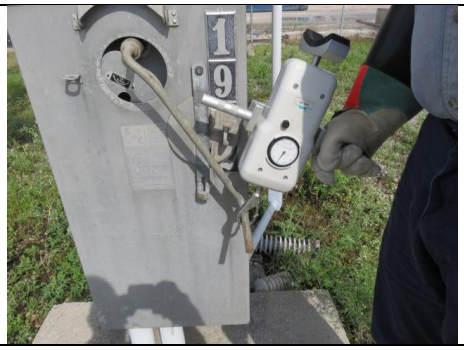
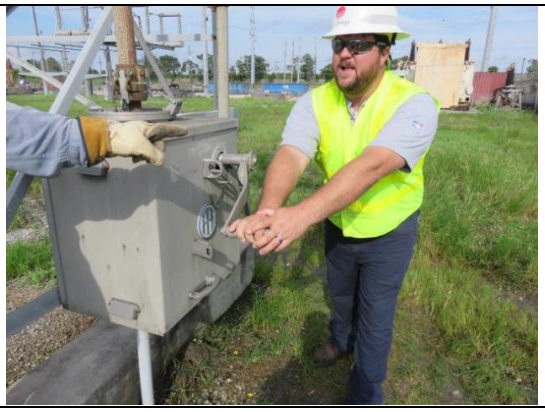
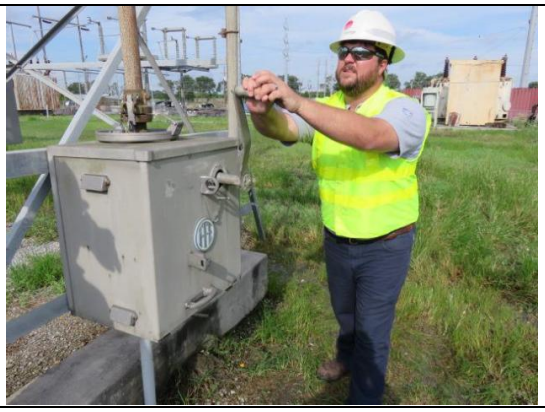
V. Methodology & Results - Assessment Conducted on MOAB and Ground Switch at Entergy Training Center in Bridge City, June 30, 2016

Location: 850 Bridge Avenue Entergy Training Center

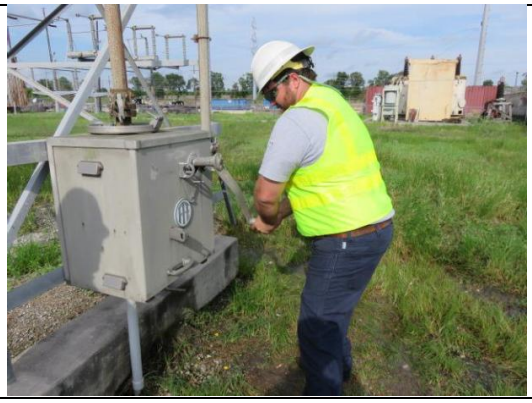
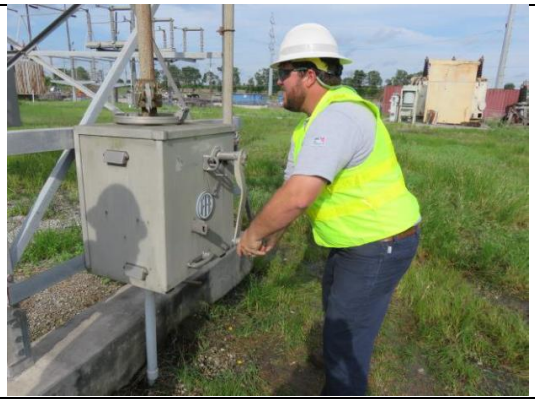
Assessment # 1: A Chatillon force gauge was utilized to directly measure the forces to manually open a motor operated air brake (MOAB) that fails to fully open prior to and after lubrication. Lubrication was conducted with a paint marker and grease balls. The dynamometer was connected directly to the MOAB handle to open the switch. The peak force was recorded on the dynamometer while turning the handle counter clockwise motion to open the switch.

Opening the MOAB	
	
Pre-Lubrication Measurements	Post-Lubrication Measurements
58 lbs	54 lbs
63 lbs	50 lbs
73 lbs	48 lbs
Average: 64.66 lbs	Average: 50.66 lbs
Comparison of Pre- and Post- Lubrication Forces: Lubrication reduced the average peak force by 22%	

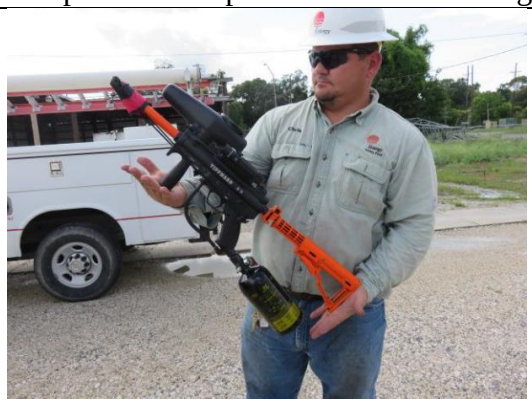
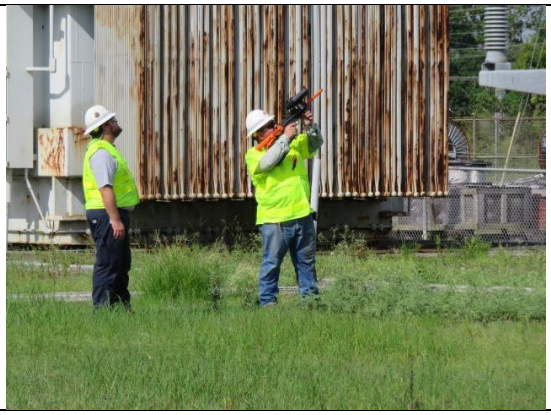
Measuring Force to Open a MOAB	
	
Force gauge dynamometer was connected to handle of MOAB	

After l;ubrication, opening the MOAB should be conducted standing as shown (on the side of the MOAB). This is the best position to be in to operate the handle as it reduces the amount of trunk twisting and back strain.

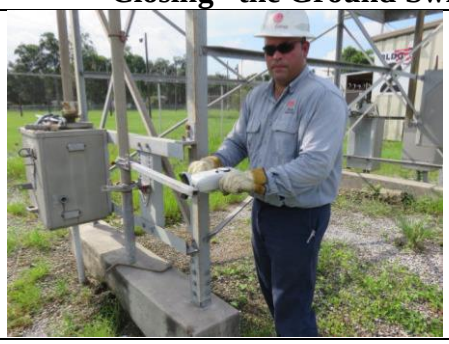



Avoid standing directly in front of the MOAB while turning the switch handle as shown above as this position of operation causes twisting of the trunk and increases the risk of a back strain.

The use of a paint marker with grease balls proved to be effective in reducing forces to manually open a MOAB and close a ground switch. The use of the paint marker allowed lubrication to be conducted from a safe distance. Safety briefing related to the proper and safe use of the paint marker should always be conducted as part of a JSA to ensure safety and accuracy in hitting that targets with the grease balls.

Analysis of Push and Pull Forces on Closing a High Voltage Ground Switch Operated with a Push and/or Pull Handle prior to and after Lubrication.

Closing* the Ground Switch - Pre-Lubrication Measurements	
	
Pushing Forces	Pulling Forces
120 lbs	162 lbs
111 lbs	170 lbs
125 lbs	148 lbs
Average: 118.66 lbs	Average: 160 lbs
Comparison of Push/Pull Force on Ground Switch Pre-Lubrication: Pushing requires 26% less force on average than pulling	

*Note: Greater force is required to close than open the ground switch as opening the ground switch is assisted by gravity.

Closing* the Ground Switch - Post-Lubrication Measurements	
Pushing Forces	Pulling Forces
73 lbs	100 lbs
78 lbs	98 lbs
74 lbs	100 lbs
Average: 75 lbs	Average: 99.33 lbs
Comparison of Push/Pull Force on Ground Switch Post-Lubrication: Pushing requires 24.5 % less force on average than pulling	
Comparison of Pre and Post-Lubrication Effects on Push/Pull Forces: Average pushing force was reduced by 37% (from 118.66 lbs to 75 lbs)	

Conclusions:

Lubrication is effective at reducing forces to open the MOAB and closing the ground switch. Pushing is less strenuous than pulling to close the ground switch

Recommendations:

1. The use of paint markers and grease balls proved to be an effective means of lubrication performed at a distance. Being able to lubricate from a distance in charged settings increases safety for the employee. Training with the paint marker should be conducted to increase accuracy in hitting that targets with the grease balls. Safety briefings need to be conducted prior to each use of the pain marker.

2. Lubrication is effective to reduce forces and should be conducted prior to opening MOABs and closing ground switches.

3. Operation of the handle to open a MOAB should be conducted with the employee standing on the side of the box moving the handle forward in line with the front of the body to avoid twisting of the trunk. Avoid operating the handle facing the front of the box in order to reduce twisting of the trunk. (see photos)

4. Push, rather than pull, on the handle to close a ground switch. Pushing requires less force and places the back in a safe position which will recue the risk of a sprain or strain.

VI. Cost and Disability Analysis for Ergonomically-Related Musculoskeletal Disorders

1. Lumbar (Low Back Pain) – Non-specific

RTW* DURATION IN DAYS

Job Classification	Minimum	Optimum	Maximum
Sedentary	0	1	14
Light	0	3	14

.MSD Description	Hospital Charges	Physician Fees / Diagnostics / Meds	Total including indirect admin costs*
Lumbago; Low Back Pain; Low Back Syndrome; Lumbalgia	$11,243.00	$1,200.00	$37,329.00
Lumbosacral Neuropathy and Radiculopathy, Unspecified; Radicular Syndrome of Lower Limbs	$17,408.00	$2,400.00	$59,424.00
* Based on estimated normal recovery time without complications			

***RTW = Return to Work**