

DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION

**FCE Summary Report**

<b>Facility :</b> J. H. Campbell Plant		<b>SRN :</b> B2835
<b>Location :</b> 17000 Croswell		<b>District :</b> Grand Rapids
		<b>County :</b> OTTAWA
<b>City :</b> WEST OLIVE	<b>State:</b> MI	<b>Zip Code :</b> 49460
<b>Compliance Status :</b>		Compliance
<b>Source Class :</b> MAJOR	<b>Staff :</b> Kaitlyn DeVries	
<b>FCE Begin Date :</b> 8/29/2017	<b>FCE Completion Date :</b>	8/28/2018
<b>Comments :</b> FY 2018 FCE		

**List of Partial Compliance Evaluations :**

Activity Date	Activity Type	Compliance Status	Comments
08/20/2018	Scheduled Inspection	Compliance	Throughout the 2018 Fiscal year, Air Quality Division (AQD) staff Kaitlyn DeVries conducted partial inspections of the Consumers Energy, JH Campbell Coal Fired electric generating facility located at 17000 Croswell, Port Sheldon, Michigan. The purpose of these inspections was to determine compliance with the facility's renewable operating permit (ROP) MI-ROP-B2835-2013b, and PTI No. 18-15A, which was issued in June 2018 and will be rolled into the ROP during the renewal, which is currently in house with AQD. The observations made during each visit will comprise this Full Compliance Evaluation (FCE) for Fiscal Year 2018.

Activity Date	Activity Type	Compliance Status	Comments
08/03/2018	CEM RATA	Compliance	The Continuous Emission Monitoring System (CEM) Relative Accuracy Test Audit (RATA) for Units 1 & 2 for CO <sub>2</sub> , SO <sub>2</sub> , and NO <sub>x</sub> was received on time and complete. The results meet the acceptable 40 CFR Part 75 Appendix A Relative Accuracy (RA) performance specifications of =10%, ± 15.0 ppm, or ± 0.200 lb/mmBtu. The results also meet the reduced annual RATA frequency conditions of = 7.5%, ± 12 ppm, or ± 0.00015 lb/mmBTU, as applicable per Appendix B of Part 75.
08/03/2018	MACT (Part 63)	Compliance	The 2nd Quarter MATS PM CEMS report for Unit 3 was received on time and complete. The report indicates compliance with the 30 boiler operating day rolling average limit of 0.030 lb/mmbtu with an average of 0.00049152 lb/mmbtu and 99.7% - 100% monitor availability

Activity Date	Activity Type	Compliance Status	Comments
08/03/2018	Excess Emissions (CEM)	Compliance	<p>The 2nd Quarter Excess Emissions Report for Units 1&amp;2, and Unit 3 was received on time and complete. Additionally, the Unit 3 Continuous Opacity Monitor (COM) Assessment was received.</p> <p>Unit 1 data indicates a total of 47174 minutes (786.23 hrs) of operating time with no COMS or CEMS downtime or excess emissions.</p> <p>Unit 2 data indicates a total of 57754 minutes (962.57 hrs) of operating time. The SO2 CEMS had total of 31.0 hrs (3.30% monitor downtime) due to monitor trouble. This didn't result in any excess emissions.</p> <p>Unit 3 data indicates a total of 103834 minutes (1730.57 hrs) of operating time with 150 minutes (0.14%) COMS monitor downtime, but no associated excess emissions. The downtime was due to calibrations and filter audits. The NOx and SO2 CEMS reported a total of 1617.23 hours of operation with 5 hours (0.31%) monitor downtime for the NOx CEMS with the same amount of downtime for the SO2 CEMS. Neither had any associated excess emissions. The downtime for both was due to maintenance and troubleshooting being done on the analyzer. The opacity filter audits for Unit 2 were also conducted and indicated passing results.</p>

Activity Date	Activity Type	Compliance Status	Comments
07/18/2018	ROP Other	Compliance	The 2nd Quarter Fugitive Dust Report was received on time and complete. The report indicates that the following activities were used to control dust: spraying dust suppression agent while unloading, using the coal pile irrigation system, fueling the plants directly from the trains to minimize the height of the coal piles, suspending dozer operations during times of increased wind, foam dust suppression on the conveyors, using rollers to compact ash in the fill area of the landfill, daily surveillance of the area, grass and straw were placed on exposed surfaces within the ash facility, dust suppression application on areas of lakeshore avenue via a water truck, as well as 12.46 inches of rain to supplement the activities. No dust complaints were received during the time period. No further action is necessary at this time.
06/29/2018	Telephone Notes	Compliance	Telephone notes regarding PEAS call.
06/27/2018	Stack Test Observation	Compliance	Unit 2 MATS Stack test observations
05/24/2018	ROP SEMI 2 CERT	Compliance	Postmarked 3/14/18: This report was received on time and complete. No deviations were reported for the reporting period.
05/24/2018	CAM Excursions/Exceedances	Compliance	Postmarked 3/14/18: This report was received on time and complete. No CAM excursions or exceedances were reported for the reporting period.
05/24/2018	CAM monitor downtime	Compliance	Postmarked 3/14/18: This report was received on time and complete. No CAM downtime was reported for EUCOALHAND, but Various instances of downtime as reported for EUBOILER3 and FGBOILER12 for the COMS unit, and was returned to normal operations after corrective action was taken. All downtime was previously reported in the excess emissions reports. No excess emissions were associated with the downtime.

Activity Date	Activity Type	Compliance Status	Comments
05/24/2018	MACT (Part 63)	Compliance	<p>The 1st quarter MATS test report for Unit 1 was received on time and complete. Consumers Energy (CE) is utilizing quarterly stack testing to demonstrate compliance with the Particulate Matter (PM) and Hydrogen Chloride (HCl) requirements promulgated by 40 CFR Part 63 Subpart UUUUU. During testing, Unit 1 was operating within the maximum normal operating load requirement range of 90 - 110% of the design capacity and was burning 100% western coal. Results indicate a PM emission rate of 0.0004 lb/mmBTU. This emission rate is compliant with the MATS limit of 0.03 lb/mmBTU and the low emitting EGU (LEE) limit of 0.015 lb/mmBTU. HCl results show an emission rate of 0.00005 lb/mmBTU. This is compliant with the MATS limit of 0.0020 lb/mmBTU and the LEE limit of 0.0010 lb/mmBTU.</p>

Activity Date	Activity Type	Compliance Status	Comments
05/24/2018	Excess Emissions (CEM)	Compliance	<p>The 1st Quarter Excess Emissions Report for units 1, 2, and 3 pursuant to MI-ROP-B2835-2013b was received on time and complete. The quarterly opacity monitor assessment for Unit 3 was also included in the submission.</p> <p>Unit 1 data indicates a total of 88335 minutes (1,472.25 hrs) of operating time with no COMS or CEMS (SO<sub>2</sub>) monitor downtime or excess emissions.</p> <p>Unit 2 data shows a total of 70260 minutes (1171 hrs) of source operating time with no COMS or CEMS (SO<sub>2</sub>) monitor downtime or excess emissions.</p> <p>Unit 3 data indicates a total of 110270 minutes of operating time with 120 minutes (0.11%) COMS monitor downtime, but no excess emissions. The downtime was due to calibrations and filter audits. The NO<sub>x</sub> and SO<sub>2</sub> CEMS reported a total of 1726.02 hours of operation with 2 hours (0.12%) monitor downtime for the NO<sub>x</sub> CEMS and no monitor downtime for the SO<sub>2</sub> CEMS. No excess emissions were reported for any pollutant. The downtime for the COMS was due to calibrations and filter audits. The NO<sub>x</sub> downtime was due to monitor recalibrations. The opacity filter audits for Unit 3 were also conducted, and indicated passing results.</p>
05/24/2018	ROP Annual Cert	Compliance	<p>Postmarked 3/14/18: The annual compliance report pursuant to MI-ROP-B2835-2013 and 2013b was received on time and complete. No deviations were reported for the reporting period.</p>

Activity Date	Activity Type	Compliance Status	Comments
05/07/2018	MAERS	Compliance	<p>ROP Certification form for MAERS received 3-15-18. There were several changes to how emissions are reported. Much of the emissions that were previously reported under EUASHNEW are now reported under EUBYPRODUCT. Two (2) diesel engines were removed from service, and the MAERS inventory. The facility appropriately used MAERS emission factors, CEMS, and Stack test data as basis for the emissions. Control efficiencies for such items as PM and some metals for the boilers is accounted for in the emission factor used for calculating emissions. While the AQD calculated emissions for those pollutants do not have the CE's entered, the facility reported emissions are correct, and no changes have been made. Ammonia estimates are high, but are accounted for due to the ammonia slip associated with the SCR's for the boilers. No changes have been made to the report. 5.7.2018. KDeVries</p>
04/30/2018	ROP Annual Cert	Compliance	<p>The Annual Compliance Report pursuant to MI-ROP-B2835-2013 and 2013a for section 2 was received on time and complete. No deviations were reported for the reporting period. No further action is necessary at this time.</p>
04/30/2018	ROP SEMI 2 CERT	Compliance	<p>The Semi-Annual Compliance Report pursuant to MI-ROP-B2835-2013 and 2013a for section 2 was received on time and complete. No deviations were reported for the reporting period. No further action is necessary at this time.</p>

Activity Date	Activity Type	Compliance Status	Comments
04/30/2018	MACT (Part 63)	Compliance	<p>The Semiannual Compliance with MATS, 40 CFR Part 63 Subpart UUUUU for Units 1, 2, and 3 was received on time and complete. No malfunctions or work practice standard deviations were reported for any of the three (3) boilers. Additional compliance information for each unit is outlined below.</p> <p>Unit 1: Unit 1 complies with the provisions outlined in MATS using Stack test data for PM and HCl, but uses Certified Hg and diluent CEMS for Mercury. No monitor downtime or excess emissions were reported for the 2602 hours of operation for the reporting period.</p> <p>Unit 2: Unit 2 complies with the provisions outlined in MATS using Stack test data for PM, and HCl, but uses Certified Hg and diluent CEMS for Mercury. No excess emissions were reported for the reporting period, but a total 0.6% monitor downtime was reported due to equipment malfunctions and quality assurance testing. The 0.6% downtime accounted for 16 of the 2687 hours of operation for the reporting period.</p> <p>Unit 3: Unit 3 complies with the provisions outlined in MATS using Certified CEMS for PM, Hg, and SO2. A total of 1.43% Hg CEMS monitor downtime was reported due to equipment malfunctions and quality assurance testing. A total of 0.7% PM CEMS monitor downtime was reported due to equipment malfunctions and quality assurance testing. Only 0.05% SO2 CEMS monitor downtime was reported, with the downtime due to monitor malfunctions.</p> <p>No further action is required for any of the units.</p>



Activity Date	Activity Type	Compliance Status	Comments
04/18/2018	ROP Qrtly Cert	Compliance	The 1st Quarter Fugitive Dust Report was received on time and complete. Several dust control measures were used including reliance on rain and snowfall. Dust suppression agents were used during the unloading process, and on conveyors while handling the coal. Grooming of the coal storage piles and the use of a water truck were also used during this time period. The company also reports conducting daily surveillance of the ash storage facility, and revising their fugitive dust plan, which was submitted to AQD. AQD did not receive any dust complaints during this time period. No further action is necessary at this time.
02/21/2018	Stack Test Observation	Compliance	Unit 1 MATS Stack Test Observations
02/21/2018	Scheduled Inspection	Compliance	The partial inspection was in conjunction with testing on Unit 1 that was occurring that day. The purpose of the inspection was to determine compliance with the facility's renewable operating permit (ROP) MI-ROP-B2835-2013b. During this partial compliance evaluation (PCE), only Unit 1 was evaluated.

Activity Date	Activity Type	Compliance Status	Comments
02/05/2018	Excess Emissions (CEM)	Compliance	<p>The 4th Quarter Excess Emissions Report for units 1, 2, and 3 pursuant to MI-ROP-B2835-2013b was received on time and complete. The quarterly opacity monitor assessment for Unit 3 was also included in the submission.</p> <p>Unit 1 data indicates a total of 51928 minutes of operating time with no COMS or CEMS (SO2) monitor downtime or excess emissions.</p> <p>Unit 2 data shows a total of 114075 minutes of source operating time with no COMS or CEMS (SO2) monitor downtime or excess emissions.</p> <p>Unit 3 data indicates a total of 132480 minutes of operating time with 138 minutes (0.10%) COMS monitor downtime, but no excess emissions. The downtime was due to calibrations and filter audits. the NOx and SO2 CEMS reported a total of 2208 hours of operation with 4 hours (0.18%) monitor downtime for the NOx CEMS and no monitor downtime for the SO2 CEMS. No excess emissions were reported for any pollutant. The downtime for the COMS was due to calibrations and filter audits. The NOx downtime was due to monitor malfunctions, which were subsequently resolved. The opacity filter audits for Unit 3 were also conducted, and indicated passing results.</p>

Activity Date	Activity Type	Compliance Status	Comments
01/23/2018	MACT (Part 63)	Compliance	<p>The Particulate Matter (PM) and Hydrogen Chloride (HCl) stack test report for 40 CFR Part 63 Subpart UUUUU (MATS) for Unit 2 was received on time and complete. This testing satisfies the requirements of testing for Quarter 4 of 2017. For this test, Unit 2 was burning 100% Western Subbituminous coal and operating within the maximum normal operating load requirement range of 90 and 110% of the design capacity. The report indicates a three (3) run average of 0.0005 lb/mmBTU for PM, which is compliant with the MATS limit of 0.030 lb/mmBTU and the low emitting electric generating unit (LEE) limit of 0.015 lb/mmBTU. Similarly, the three (3) run average for HCl was 0.00005 lb/mmBTU, which is compliant with the MATS limit of 0.0020 lb/mmBTU and the LEE limit of 0.0010 lb/mmBTU. These results can be used to support qualification as LEE facility for PM and HCl. Three (3) consecutive years of quarterly testing is required to obtain LEE status. This test is the 6th quarterly test demonstrating LEE Status for Unit 2.</p>

Activity Date	Activity Type	Compliance Status	Comments
01/22/2018	ROP Qrtly Cert	Compliance	<p>The required Quarterly Fugitive Dust Report for Q4 2017 was received on January 16, 2018. Consumers Energy J.H Campbell (JHC) summarized the activities used to control fugitive dust in the report. Several different fugitive dust measures were taken, including reliance on precipitation and snow cover, for much of December. Other dust control measures were minimizing the disturbance of the coal on the piles, spraying a dust suppression agent during the unloading process, use of a foam dust suppression system on select coal conveyors within the handling system, daily surveillance of the yard, operation of the irrigation system until the system was winterized, minimizing dozer operation when wind conditions were not favorable, grooming and compacting the coal storage piles, using a water truck along lakeshore avenue, and installing straw matting on the unit 3 bottom ash ponds. No dust complaints were received during this timeframe. No further action is necessary at this time.</p>
01/02/2018	Malfunction Abatement Plan	Compliance	<p>An MMAP per PTI No. 18-15 was received for Units 1 and 2.</p>

Activity Date	Activity Type	Compliance Status	Comments
01/02/2018	MACT (Part 63)	Compliance	<p>The 4th quarter MATS test report for Unit 1 was received on time and complete. Consumers Energy (CE) is utilizing quarterly stack testing to demonstrate compliance with the Particulate Matter (PM) and Hydrogen Chloride (HCl) requirements promulgated by 40 CFR Part 63 Subpart UUUUU. During testing, Unit 1 was operating within the maximum normal operating load requirement range of 90 - 110% of the design capacity and was burning 100% western coal. Results indicate a PM emission rate of 0.0009 lb/mmBTU. This emission rate is compliant with the MATS limit of 0.03 lb/mmBTU and the low emitting EGU (LEE) limit of 0.015 lb/mmBTU. HCl results show an emission rate of 0.0001 lb/mmBTU. This is compliant with the MATS limit of 0.0020 lb/mmBTU and the LEE limit of 0.0010 lb/mmBTU.</p>

Activity Date	Activity Type	Compliance Status	Comments
12/13/2017	Excess Emissions (CEM)	Compliance	<p>The quarterly Excess Emissions and Quarterly Opacity Monitor Assessment for Units 1, 2 &amp; 3 pursuant to MI-ROP-B2835-2013a was received on time and complete. The results for each unit are outlined below.</p> <p>Unit 1: No excess opacity or SO2 emissions were reported for the quarter. Similarly, no COMS or SO2 CEMS downtime was reported.</p> <p>Unit 2: No Excess opacity or SO2 emissions were reported for the reporting period. A total of 0.24% COMS downtime was reported, and 0.08% SO2 CEMS monitor downtime was reported. The downtime for both was primarily due to calibrations and audits on the systems.</p> <p>Unit 3: The report for unit 3 indicated no excess emissions for opacity, NOx, and SO2. A total of 0.09% COMS downtime, 1.27% NOx CEMS downtime, and 0.09% SO2 CEMS downtime was reported. Downtime was primarily due to calibrations, filter audits, troubleshooting, and maintenance.</p> <p>Opacity monitor audits were also received for all three (3) units. All audits indicated passing results; no issues were noted for any of the units.</p>

Activity Date	Activity Type	Compliance Status	Comments
12/13/2017	CEM RATA	Compliance	<p>The Continuous Emission Monitoring System (CEMS) Relative Accuracy Test Audit (RATA) for Unit 3 was completed on September 18 and 19, 2017. The results meet the applicable 40 CFR 75 Appendix A relative accuracy (RA) performance specifications of = 10%, ± 15.0 ppm, or ± 0.200 lb/mmBtu. The results also meet the reduced annual RATA frequency conditions of = 7.5%, ± 12 ppm, or ± 0.00015 lb/mmBTU, as applicable per Appendix B of Part 75. The results were met for NOx, SO2, and CO2.</p>
12/13/2017	MACT (Part 63)	Compliance	<p>The 3rd Quarter MATS test report for Boiler Unit 2 was received on time and complete. Consumers Energy (CE) is currently utilizing stack testing for Hydrogen Chloride (HCl) and Particulate Matter (PM) to show compliance with the provisions of 40 CFR Part 63 Subpart UUUUUU. During testing, Unit 2 was firing 100% Eastern Coal and was within the maximum normal operation load range of 90 -100% design capacity. Results indicate a PM emission rate of 0.0006 lb/mmBTU, which is compliant with the MATS limit of 0.03 lb/mmBTU, and the low emitting EGU (LEE) requirement of 0.015 lb/mmBTU. HCl results show an emission rate of 0.0001 lb/mmBTU, which is also below the MATS limit of 0.0020 lb/mmBTU, and the LEE limit of 0.0010 lb/mmBTU.</p>

Activity Date	Activity Type	Compliance Status	Comments
11/20/2017	MACT (Part 63)	Non Compliance	<p>The Semiannual Compliance with MATS, 40 CFR Part 63 Subpart UUUUU for Units 1, 2, and 3 was received on time and complete. No malfunctions or work practice standard deviations were reported for any of the three (3) boilers. Additional compliance information for each unit is outlined below.</p> <p>Unit 1: Unit 1 complies with the provisions outlined in MATS using Stack test data for PM and HCl, but uses Certified Hg and diluent CEMS for Mercury. A total of 0.54% monitor downtime was reported, but no excess emissions was identified.</p> <p>Unit 2: Unit 2 complies with the provisions outlined in MATS using Stack test data for PM, and HCl, but uses Certified Hg and diluent CEMS for Mercury. No excess emissions were reported for the reporting period, but a total 6.04% monitor downtime as reported due to various calibration checks and equipment malfunctions. While this is slightly higher than the expected 5% maximum downtime, this is still acceptable.</p> <p>Unit 3: Unit 3 complies with the provisions outlined in MATS using Certified CEMS for PM, Hg, and SO<sub>2</sub>. The PM CEMS data was deemed "out of control from January 1 to March 27 due to a missed absolute correlation audit in Q4 of 2016. Hourly data collected during that time indicated compliance with the PM MATS limit, the highest hourly average being 0.00053 lb/mmBTU. While no excess emissions were reported, a total of 55.42% PM CEMS monitor downtime was reported, compared to the 0.80% for Hg, and 0.53% for SO<sub>2</sub>. Currently, Michigan does not have delegation for this regulation, but a November 6, 2017 letter was sent to EPA region 5 notifying them of this non-compliance.</p>



Activity Date	Activity Type	Compliance Status	Comments
11/16/2017	Telephone Notes	Compliance	Telephone Conversation between Caryn Owens, DEQ in Cadillac and Beth Valenziano of the US EPA.
11/13/2017	MACT (Part 63)	Compliance	The Mercury (Hg) continuous emission monitor systems (CEMS) Relative Accuracy Test Audit (RATA) report was received on time and complete. This RATA is for Unit 3. Testing was done with the boiler operating at the normal, high level operation as defined in 40 CFR Part 75. The results indicate that the relative accuracy (RA) meet the alternative requirements of less than or equal to 2.5 ug/scm difference between the mean RM and the CEMS measurements, plus the confidence coefficient.
11/13/2017	MACT (Part 63)	Compliance	The required annual PM test and PM CEMS RRA Test Report per Subpart UUUUU was received on time and complete. This report also serves as the required once every three (3) year test outlined in the ROP. The PM test results of 0.0010 lb/MMBTU and 6.65 lb/hr show compliance with the ROP limits of 0.10 lb/MMBTU and 370 pph. This also shows compliance with the MATS limit of 0.03 lb/MMBTU. The RRA shows a positive correlation curve of $y=0.359 + 0.556x$ , where x equals the PM monitor response value. This correlation curve falls within the allowed 25% emission limit of 5.52 mg/wacm.

Activity Date	Activity Type	Compliance Status	Comments
11/07/2017	MACT (Part 63)	Compliance	<p>The Particulate Matter (PM) and Hydrogen Chloride (HCl) stack test report for 40 CFR Part 63 Subpart UUUUU (MATS) for Unit 1 was received on time and complete. This testing satisfies the requirements of testing for Quarter 3 of 2017. This test report also satisfies the PM testing required by the ROP at least once every three (3) years. For this test, Unit 1 was burning 100% Western Subbituminous coal and operating within the maximum normal operating load requirement range of 90 and 110% of the design capacity. For Unit 1, the report indicates a three (3) run average of 0.0006 lb/mmBTU for PM, which is compliant with the MATS limit of 0.030 lb/mmBTU and the low emitting electric generating unit (LEE) limit of 0.015 lb/mmBTU. Similarly, the three (3) run average for HCl was 0.00016 lb/mmBTU, which is compliant with the MATS limit of 0.0020 lb/mmBTU and the LEE limit of 0.0010 lb/mmBTU. These results can be used to support qualification as LEE facility for PM and HCl. Three (3) consecutive years of quarterly testing is required to obtain LEE status. This test is the 5th quarterly test demonstrating LEE Status for Unit 1.</p>

Activity Date	Activity Type	Compliance Status	Comments
11/06/2017	ROP Other	Compliance	The 3rd Quarter Fugitive Dust Report was received on time and complete. Consumers Energy J.H. Campbell identifies several different activities that were utilized to control fugitive dust. A total of 6.97 inches of rain provided much of the dust control measure, covering approximately 30% of the days for the reporting period. Other dust control measures included: brine application on the roadways along Lakeshore Avenue on two (2) instances in July and in August, grooming and compacting the coal storage piles, spraying a dust suppression agent on the coal when unloading, using a water truck for dust control on roadways, operating the coal pile irrigation system in auto mode except during periods of rain, and conducting daily surveillance of the ash storage facility. No further action is necessary at this time.
11/01/2017	ROP Semi 1 Cert	Compliance	The Semi-annual Deviation report pursuant to MI-ROP-B2835-2013 and 2013a, section 2, was received on time and complete. No deviations were reported for the combustion turbine, which is the only emission unit associated with this section. No further action is necessary.
11/01/2017	ROP Semi 1 Cert	Compliance	This report, pursuant to MI-ROP-B2835-2013a, Postmarked 9/15/17, was received on time and complete. No deviations were reported for the reporting period. No further action is necessary at this time.
11/01/2017	CAM Excursions/Exceedances	Compliance	This report was received on time and complete (Postmarked 9/15/17). No CAM excursions/exceedances were reported for the reporting period.

Activity Date	Activity Type	Compliance Status	Comments
11/01/2017	CAM monitor downtime	Compliance	This report was received on time and complete (Postmarked 9/15/17). COM's monitor downtime was reported for EUBOILER3 only. The monitor downtime was primarily due to filter audits and regular maintenance. All downtime was also previously reported in the quarterly excess emissions reports. Even though there was downtime reported, no excess emissions were associated with the downtime. No further action is necessary.
10/06/2017	Telephone Notes		Telephone Conversation re: Force Majeure language in PTI and not incorporated in ROP.
09/20/2017	Sample Results Review	Compliance	Test results from sample collected on 8/25/2017

Name: Kaitlyn Doshi Date: 01/28/2018 Supervisor: 