HYDRODEC OF NORTH AMERICA, LLC

DEMONSTRATION TEST PLAN

June 15, 2016

Volume 1 of 1

DEMONSTRATION TEST PLAN

PCB DISPOSAL BY NON-THERMAL ALTERNATIVE METHODS
Hydrodec of North America LLC
2021 Steinway Boulevard SE
Canton, Ohio 44707

Proposed Test Dates: September 20 through September 22, 2016
Submission Date: June 15, 2016
Submission Number: 001

Submitted by:

Hydrodec of North America, LLC
2021 Steinway Boulevard SE
Canton, Ohio 44707

Submitted to:

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SECTION 1 – SUMMARY

Hydrodec of North America, LLC has designed a process that effectively treats transformer oils contaminated with polychlorinated biphenyls (PCBs). Hydrodec uses a hydrogenation process that chemically removes the chlorines from the PCB's rendering them harmless. The system is automated and consists of bulk shipment unloading, PCB storage tanks, a feedstock tank, heaters, reactors, heat exchangers, oil water and gas separation, and a recycle gas recovery system. Hydrodec currently owns a similar facility in Australia.

Hydrodec intends to use their technology at their facility located in Canton, Ohio.

The demonstration test will be conducted by Hydrodec at the Canton, Ohio facility (See Figures 1 and 2). The proposed dates for the demonstration test are September 20-22, 2016.

Address:

Hydrodec of North America, LLC
2021 Steinway Boulevard SE
Canton, Ohio 44707

FIGURE 1
USGS Map
(Canton East Quadrangle)

Site: Hydrodec, 8.4 Acres
Canton, Ohio

Scale: None

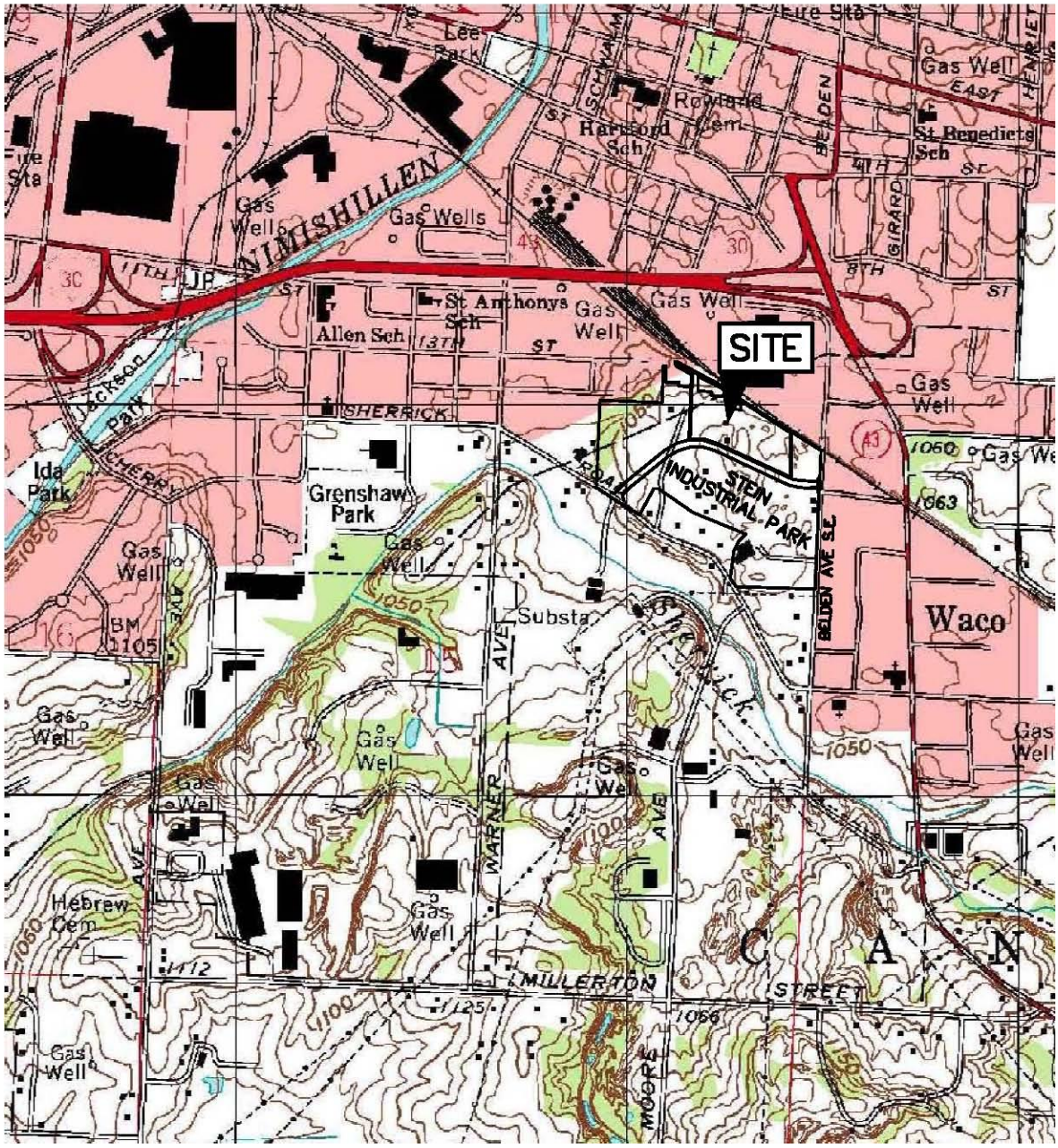
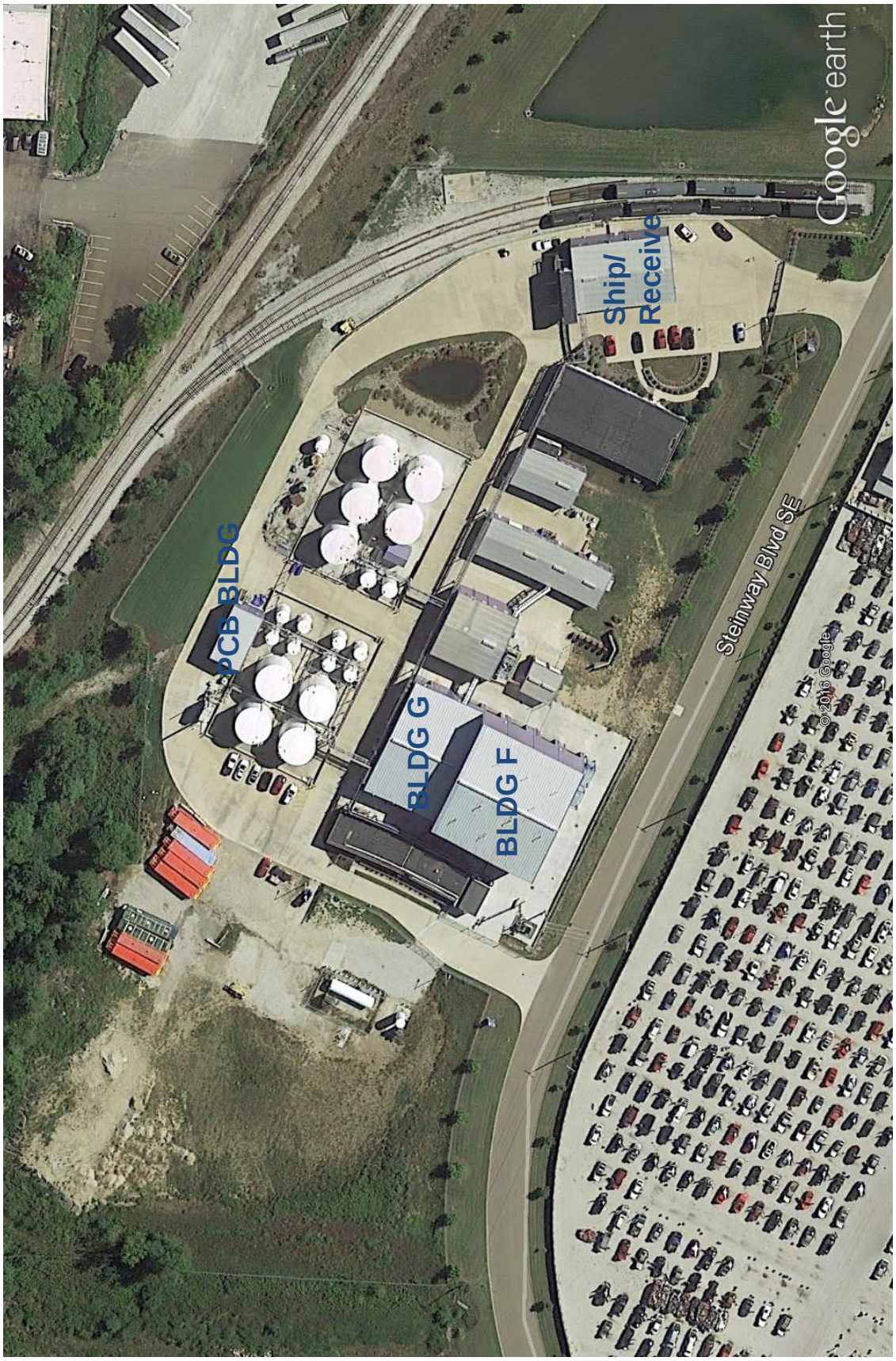


Figure 2 - Site Map



Hydrodec of North America, LLC – Site Map

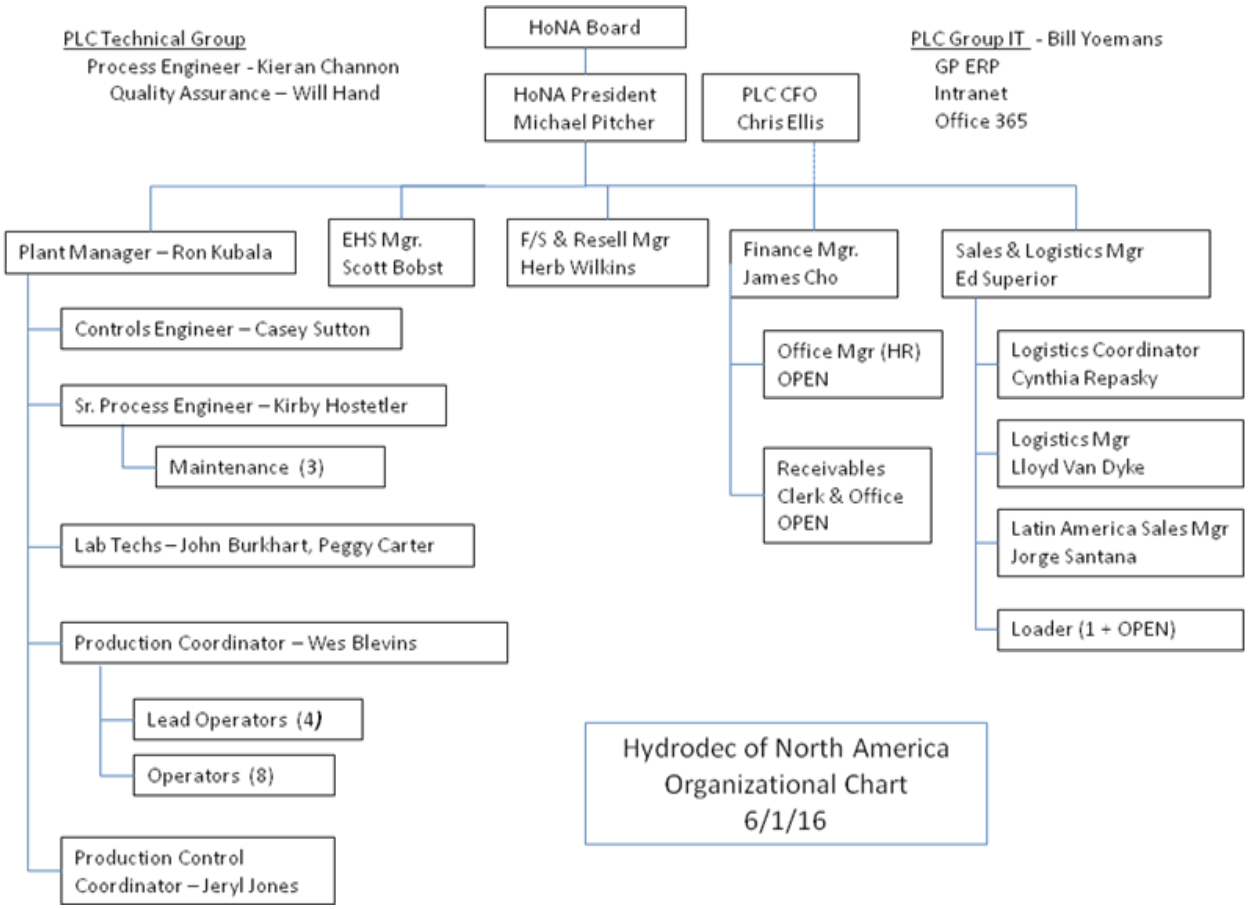
SECTION 2 – PROJECT ORGANIZATION

The Hydrodec facility has qualified operating staff to adequately meet the demands of safely processing PCB contaminated transformer oil. All Hydrodec equipment is operated by Hydrodec personnel, with supplemental staffing from qualified subcontractors such as laboratories, remedial service contractors or technical contractors. Figure 2-1 provides the organizational chart for Hydrodec of North America, LLC.

Hydrodec has authorized the Plant Manager to have overall responsibility for the process. The Senior Process Engineer is the lead resource for the unit, and is the principal technical resource for the unit. The Plant Manager, Production Coordinator and the Senior Process Engineer will review all test plans, operating data and any design changes that may be incorporated to improve the operation of the system. Normal operation of the system uses one Inside Operator and two Outside Operators per shift, who are supervised by the Production Coordinator. The Production Coordinator will have responsibility for the day-to-day operations, monitoring, recordkeeping, reporting, equipment maintenance, and personnel on-job training. The production Coordinator may also perform the duties of the Inside or Outside Operators to provide coverage for scheduled work breaks. All Plant Operators have environmental treatment equipment and chemical plant operation experience. These personnel are thoroughly trained by Hydrodec in operating the system, in the use of appropriate personal protective equipment, and in Hydrodec safety procedures.

The Quality Control Manager, Health, Safety & Environmental Manager, Controls Engineer, and Laboratory Technicians provide support services for operating the facility.

Figure 2-1 Hydrodec of North America, LLC Organization Chart



Project Team Member Assignment Description
The following is a brief description of the roles and responsibilities of our key team members. All field personnel will meet the minimum safety training requirements of the OSHA 1910.120 Hazardous Waste Operations and Emergency Response (HAZWHOPER) training standard, in addition to the information provided below.

Plant Manager, Ron Kubala
Mr. Kubala is responsible for numerous operational and oversight functions in the Hydrodec manufacturing operation. He provides interface between the site operations personnel, technology providers and various regulatory agencies. Mr. Kubala is a degreed chemical engineer and has over 35 years of engineering and plant management experience in the chemical industry, including 4 years treating PCB-containing transformer oil.

Senior Process Engineer/Maintenance Coordinator, Kirby Hostetler
Mr. Hostetler has a degree in Chemical Engineering and has worked at various levels in the chemical processing industry for 20 years. Mr. Hostetler verifies that the operating, monitoring, sampling, and record keeping plans are being followed. He performs periodic reviews of the data generated and is capable of understanding and critically evaluating these data. He has the authorization of management to stop or request alterations to the operation if the data quality is not acceptable. He manages capital improvement projects, utilizing in house and outside contractors. Mr. Hostetler has been involved in mechanical integrity and preventative maintenance during his career. He directs maintenance on the site such as; implementing preventative maintenance procedures, repairing equipment, welding, spare part procurement, and electrical maintenance. He also supervises specialty service contractors such as instrument calibration technicians, manufacturer's representatives, and other specialty services.

Production Coordinator, Wes Blevins
Mr. Blevins has been involved in chemical processing for 8 years with 4 years as an operator and 4 years as the Production Coordinator for Hydrodec. He is capable of independent plant operation and collection of process samples according to the approved sampling and analysis plan. He provides support, organization and guidance to operations. He also aids in the diagnostics and troubleshooting of the process and its support functions.

HSE Manager, Scott Bobst, PE
The HSE Manager is responsible for regulatory compliance on the project. The HSE Manager continues to maintain contact with the operation to assure that the regulatory requirements are being met according to the plans and permits. Mr. Bobst has a BS in Chemical Engineering and a BA in Chemistry, is a registered Professional Engineer in the state of Ohio, and has been working in the environmental and safety field for over 20 years.

William Hand (Quality Manager): Mr. Hand is a Chemist with 15 years of experience in the sampling and analysis of transformer oils, and over 10 years of experience in PCB destruction technology. He is also a member of the ASTM committee responsible for development and maintenance of Standard test methods for PCB analysis.

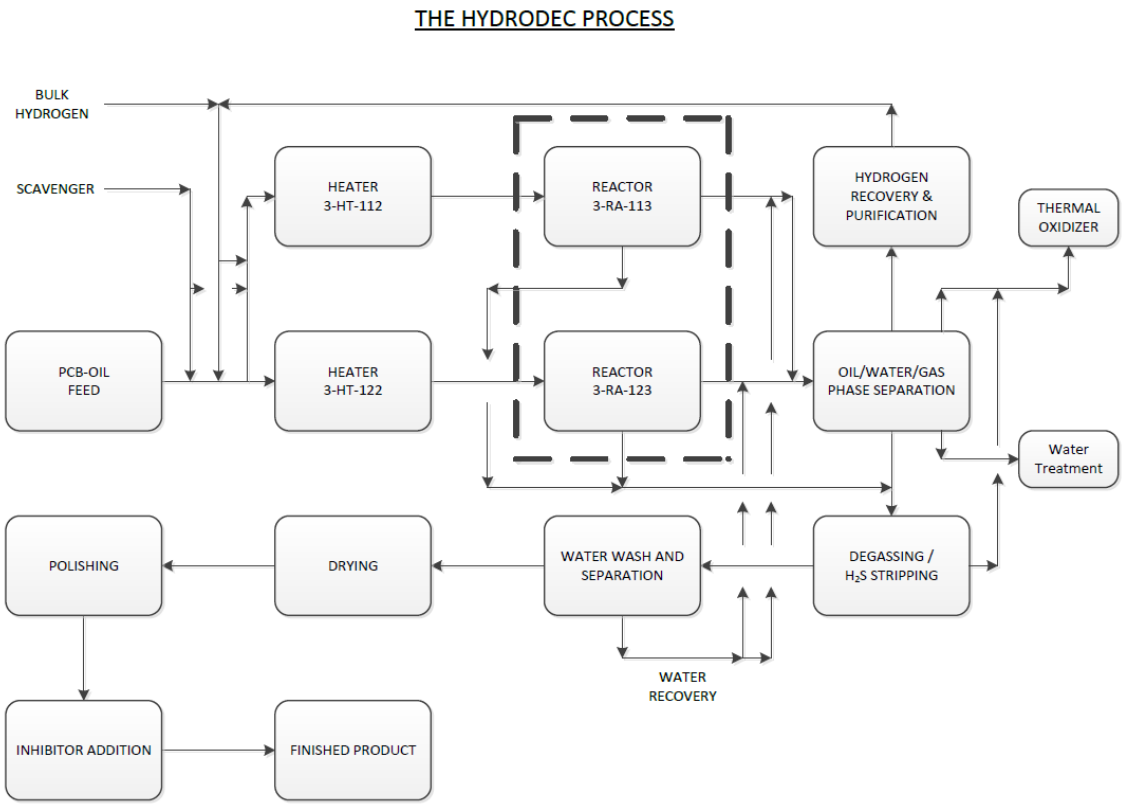
Onsite Laboratory, John Burkhart and Peggy Carter
Mr. Burkhart has been involved in laboratory analyses for 14 years. He has worked as a Laboratory Technician at Hydrodec for the last 7 years. Mrs. Carter has a BS in Chemistry and an MA in Business-Organizational Development. She has over 35 years experience as a chemist and has been a Laboratory Technician at Hydrodec since 2011. PCB analyses are performed in accord with the principles of ASTM D4059. Other analytical procedures are also performed using consensus methods from SW-846, EPA Methods, ASTM, or similar reference standards.

SECTION 3 – PROCESS ENGINEERING DESCRIPTION

3.1 General Description

The Hydrodec technology was developed specifically for the purpose of refining used oils and organic chemicals. It is as near to a closed loop near zero emission process for the complete treatment of PCBs as is available in the world at this point in time. The Canton facility consists of six reactor trains. The following provides a description of the Hydrodec process as it flows through one of these trains. Figure 3-1 provides a Process Flow diagram.

Figure 3-1
Process Flow Diagram



3.2 Hydrogenation

The PCB contaminated transformer oil requiring destruction is collected in feedstock tanks which feed an oil surge tank. From the feed oil surge tank it is introduced to the process at a defined pressure. The oil is pre-heated by passing it counter-current to a hot hydrogenation reactor effluent stream and through a heat exchanger. Fresh and recycled hydrogen, together with the scavenger, are then introduced.

The combined flow is heated to reaction temperature in a continuous direct contact finned electrical heater then enters the hydrogenation reactor at defined temperature and pressure. The reactor comprises a packed bed of a conventional hydro-treating catalyst.

During reaction, nitrogen or sulfur, also present as heteroatoms in the mineral oil, are largely converted to ammonia and hydrogen sulfide. Aged oil oxidation products present in the feed oil are also hydrogenated with the oxygen being removed as water.

In addition to extraction of heteroatoms and hydrodechlorination of PCB compounds, and depending on the carrier oil composition, a small quantity of hydrogen can be consumed in hydrogenating, to a small degree, the oil itself. This results in the possible generation of some saturated light hydrocarbon vapors and liquids in the boiling range below that of the parent oil and these are subsequently separated out within the hydrotreating system.

3.3 Reactor Effluent

Product oil leaving the Reactor (reactor bottoms) passes first to a Heat Exchanger where it is cooled against incoming feed oil.

Product oil leaving Heat Exchanger passes to a let-down valve where the pressure is reduced ahead of a Low Pressure Separator. Overhead vapors from this separator contain dissolved non-condensable hydrocarbons along with trace H_2S. The vapors pass to a Low Pressure Caustic Scrubber for trace residual hydrocarbon condensation and H_2S removal prior to venting to a thermal oxidizer.

Once the oil exits the Low Pressure Separator, it is cooled via heat exchangers before being sent to the degassing process where H_2S and other gases are removed. The effluent from the degassing process is then washed with sufficient de-mineralized wash water to ensure that a liquid phase is present to dissolve and wash out the Scavenger Salt system while minimizing the quantity of aqueous effluent to be discharged from the plant. The washed oil product is then passed to a phase separator after which the final oil product is recovered for polishing. The aqueous phase containing the Scavenger Salt system is re-used as quench water for the reactor gases, before being passed to a Waste Water surge tank prior to off-site shipment.

3.4 Reactor Gases

Reactor gases contain primarily excess hydrogen and are recycled back to the reactor feed. As they exit the reactor, gases are water quenched and passed to a High Pressure Separator. Vapor from the High Pressure Separator passes to a High Pressure Vent Condenser where it is cooled. Condensate, which is mainly water and small quantities of condensable hydrocarbons, is combined with the reactor bottoms before final wash water injection and product oil recovery.

Non-condensable gases from the High Pressure Separator comprise mainly hydrogen, but also contain light hydrocarbons and some H_2S. These are passed to a High Pressure Caustic Scrubber where H_2S is removed and collected into the caustic solution. Scrubbed gases are then chilled in a chiller, partially re-heated, passed through a sub-micron coalescer then recompressed for recirculation.

Build up of non-condensable hydrocarbon gases (methane, ethane) carried in the recycle gases are removed from the system through a slow bleed of purge gas flow from the Low Pressure Separator, then topping up the recycle line with fresh hydrogen. Purged gases are passed to the Thermal Oxidation Unit for oxidation after which the product gases are released to the atmosphere.

3.5 Process Performance

The process described above has been in use successfully for the destruction of PCBs and production of high quality transformer oil at the Hydrodec facility located in Australia for a period in excess of ten years. The Australian facility reactor is identical in size and flow through as each reactor currently being operated in the Canton facility. The Canton processing plant has been in operation using the same technology since 2008, and has been processing PCB contaminated material since 2012..

Re-refining PCB contaminated transformer oil on a continuous process basis has yielded complete removal of PCB within the limits of detection using ISO 17025 certified laboratory analysis and with >99% recovery of the oil as re-refined transformer oils within the limits of accuracy of normal process mass balance measures. Results of the typical refining process relative to ASTM Standard D3487 for transformer oils are as follows.

Test Description	Test Method	Typical Values	ASTM D3487
Physical			
Aniline Point, (°C)	ASTM D611	73	63 min
Color	ASTM D1500	L0.5	0.5 max
Flash Point, (°C)	ASTM D92	153	145 min
Interfacial Tension @ 25°C, (mN/m)	ASTM D971	48	40 min
Pour Point, (°C)	ASTM D97	-57	-40 max
Relative Density @ 15°C/15°C	ASTM D1298	0.884	0.91 max
Viscosity @ 100°C, (cSt)	ASTM D445	2.36	3.0 max
Viscosity @ 40°C, (cSt)	ASTM D445	8.88	12.0 max
Viscosity @ 0°C, (cSt)	ASTM D445	56	76.0 max
Visual Examination	ASTM D1524	Clear and bright	
Electrical			
Breakdown Voltage, 2 mm gap, (kV)	ASTM D1816	54	35 min
Impulse Breakdown Voltage, (kV)	ASTM D3300	>200	145 min
Gassing Tendency, (µL/min)	ASTM D2300	Complies	+30 max
Power Factor @ 100°C, (%)	ASTM D924	0.038	0.30 max
Chemical			
Oxidation Stability, RPVOT (minutes)	ASTM D2112	298	195 min
Inhibitor Content (%)	ASTM D2668	0.29	0.30 max
Corrosive Sulfur	ASTM D1275	Not corrosive	Not corrosive
Water Content, (mg/kg)	ASTM D1533	15	35 max
Acid Number, (mg KOH/g)	ASTM D974	<0.01	0.03 max
PCB Content	ASTM D4059	Not detectable	Not detectable
Health Safety and Environment			
Polycyclic Aromatic Compounds, (wt %)	IP 346	<3.0	N/A
Modified Ames Assay	ASTM E1687	PASS	N/A

In addition, the oil produced by this process has been extensively tested by independent facilities and has been consistently demonstrated to be of comparable quality to other transformer oils in the market.

3.6 Emissions and By-Products

There are three exit points for materials from the process. These are the product oil, the wastewater and the oxidizer emission. In relative proportion the mass flow from each of these points is as follows

Product Oil - 90+%

Wastewater - <10%

Oxidizer Emission - <1%

The product oil has been shown non-detectable for all organochlorine chemicals.

3.6.1 Waste Water

Waste water is derived from the final oil wash and the water quench of the recycle gas. It has been shown free of chlorinated organic chemical but contains the scavenger salt system and trace product oil.

3.6.2 Oxidizer Emission

Process gaseous emissions are treated by a regenerative thermal oxidizer (RTO) with a greater than 99% destruction removal efficiency. Plant emissions and the RTO are covered under Ohio EPA air permit number P0117927.

SECTION 4 – PROCESS OPERATIONS TEST

This demonstration test will use PCB contaminated transformer oil (and potentially also capacitor oil) at a blended to a concentration of 100-200mg/kg. It is currently anticipated that sufficient oil will be available to conduct three runs.

The plant will be started, using normal operating conditions, on non-PCB feed oil and stabilized before being switched to trial feedstock. At commencement of each stage, the pre-prepared feedstock will be introduced to the plant which will then be run for approximately six hours at constant conditions. Sampling will occur during each run as described in Section 5 below. After each run the plant will be switched to non-PCB feedstock. After 18 hours, the next PCB feedstock will be introduced for sampling. Three runs of PCB feedstock in total will completed.

Hydrodec will use >200 ppm PCB oil and blend with non-PCB oil to feed the reactor at 100-200 ppm during the demonstration test. For the demonstration test. ***Hydrodec plans to accept and blend approximately 3-5 Kg of pure askarel to bring the feed tank concentration to approximately 5,000 ppm PCB. This will demonstrate that Hydrodec can accept and treat any level of PCB oil.*** Treated oil will be sampled then combined with treated non-PCB oil, dried, polished, and collect in the Q and C tanks for additional sampling.

The first run will be a demonstration of operating at the maximum flow rate permitted by our current operating permit. The subsequent runs will be to demonstrate the process capability at increased flow rates, with a view to expansion of the current operating conditions, as follows:

Parameter	**Current Permit Conditions**	**Target Permit Conditions**
Reactor Feed Oil Flow (kg/hr)	650 max	750 max
Reactor Temperature (°C)	280 – 330	280 – 330
Reactor Pressure (psi)	495 min	495 min
Recycle Gas Flow (kg/hr)	17.5 min	17.5 min
Scavenger Flow Rate (kg/hr)	5 min	2 min
Quench Water Flow (kg/hr)	80 min	30 min

PCB destruction in the process is dependent on the hydrogen pressure and flow rate, and the operating temperature. Scavenger flow rate is maintained in order to produce an excess of scavenger in the recycle gas stream, and is not linked to PCB destruction capability. Similarly, quench water flow rate is controlled at such a level to wash salts from the gas steam and maintain a target temperature in the downstream separation vessel, and is not linked to PCB destruction capability. Modelling of the effect of these parameters is provided in Appendix D.

TABLE 4.1

PARAMETER	TEST 1	TEST 2	TEST 3
PCB Oil Concentration (PCB Tank)(mg/kg)	2000-5000	2000-5000	2000-5000
PCB Oil Concentration (Blend Outlet)(mg/kg)	100-200	100-200	100-200
Reactor Feed Oil Flow (kg/hr)	650 max	700 max	750 max
Reactor Temperature (°C)	280 min	280 min	280 min
Reactor Pressure (psi)	495 min	495 min	495 min
Recycle Gas Flow (kg/hr)	17.5 min	17.5 min	17.5 min
Scavenger Flow Rate (kg/hr)	5 min	2 min	2 min
Quench Water Flow (kg/hr)	80 min	30 min	30 min
Final PCB Concentration (mg/kg)	<2	<2	<2
Treated Oil Quantity (gallons)	1200	1300	1400

SECTION 5 – SAMPLING AND MONITORING PLAN

5.1 SAMPLING

The proposed sampling for the demonstration test consists of the following three materials:

- Initial feedstock PCB oil
- Treated Oil
- Waste water

5.1.1 Oil Samples

Initial PCB oil samples from each run of oil will be taken by collecting a sample of feedstock oil from the PCB Tank outlet and the Reactor feedstock sample port at the beginning, middle and end of a 6-hour run. Samples of treated oil will be taken from the reactor outlet filter sample port 15 minutes after each feed oil sample during the 6-hour run. In addition, three QA field duplicate samples will be taken for each test run (one each of PCB Tank oil, Reactor feedstock and treated oil). Flush samples will be taken from the same sample locations as during PCB processing (excluding the bulk processed oil) at the beginning, middle and end of the 18 hour flush period.

A total of 26 samples will be taken during each run of feedstock including feedstock, treated oil, QA, Bulk liquid, and wastewater samples.

SAMPLE TYPE	TEST 1	Flush	TEST 2	Flush	TEST 3	Flush	Total # Samples
PCB Oil – PCB Tank Outlet (ASTM D4059)	3	3	3	3	3	3	18
PCB Oil – Reactor Feed (ASTM D4059)	3	3	3	3	3	3	18
Treated Oil - output (ASTM D4059)	3	3	3	3	3	3	18
QA Field Duplicate (EPA Method 8082)	3	3	3	3	3	3	18
Bulk Sample (Q or C Tanks)	1		1		1		3
Wastewater (EPA 608)	1		1		1		3
Total Number of Samples	14	12	14	12	14	12	78

5.2 MONITORING

The following operating parameters to be monitored will include but not be limited to:

Location	Parameter	Typical Range
Reactor Train	Oil Flow Rate	500-800kg/kr
Reactor Train	Reactor Temperature	280-330 DegC
Reactor Train	System Pressures	3400-3600 kpa
Reactor Train	Recycle Gas Flow	17.5-30 kg/hr
Reactor Train	Scavenger Flow	2-10 kg/hr
Reactor Train	Quench Water	30-100 kg/hr
Stage 2	System Pressure	2,600-3,400kpa

SECTION 6 – SAMPLING/ANALYSIS PROCEDURES

6.1 SAMPLING PROCEDURES

The samples described in Section 5.0 will be taken in accordance with EPA methodology for representative sampling. The QAPP provides a detailed discussion on the sampling procedures for the Hydrodec process.

6.1.1 Process samples

The sampling procedures for the Demonstration Test are summarized in the following table:

TABLE 6-1
Summary of Sampling Procedures

Analyte	Method	Matrix	Sample Volume	Holding time	Preservation
PCBs	ASTM 4059	Oil	2oz Glass	180 days	N/A
PCBs	EPA 608	Water	32oz Glass	7 days	N/A

PCB oil will be sampled directly from the PCB storage tank and from the feedstock tank TK-005 prior to being fed into the process. Samples of the treated oil will be taken from the reactor sampling port.

Samples will be collected directly into 2 oz. glass containers and taken directly to the lab where they will be logged on the laboratory sample log sheet.

Wastewater samples will be taken from bulk wastewater tanks collecting process waste water. Samples will be collected directly into 32oz glass bottles and taken directly to the lab where they will be logged and prepared for shipment to Crystal Laboratories.

6.2 ANALYSIS PROCEDURES

The analysis of the PCB in the PCB oil and in the treated oil will be conducted in accordance with EPA guidance. The QAPP (Appendix B) provides a detailed discussion on the sample analysis procedures. The on-site Hydrodec lab will be used for operational evaluation and analysis of the samples.

SECTION 7 – MONITORING PROCEDURES

As stated in section 5.2 the following process parameters to be monitored will include but not be limited to:

Location	Parameter
Reactor Train	Oil Flow Rate
Reactor Train	Reactor Temperature
Reactor Train	System Pressure
Reactor Train	Recycle Gas Flow
Reactor Train	Scavenger Flow
Reactor Train	Quench Water Flow
Stage 2	System Pressure

All monitoring data will be recorded on Hydrodec daily monitoring logs which are completed approximately every 2 hours during all Hydrodec oil processing activities. A copy of this log is provided in Appendix C.

SECTION 8 – DATA REPORTING

A data summary sheet will be prepared for each test run. This summary sheet will be used to present the key data in the Demonstration Test Report. An example of the data summary sheet is given in Table 8-1.

TABLE 8-1

DEMONSTRATION TEST DATA SUMMARY SHEET

PCB Treatment Log

Record Number	1	2	3
Date/Time of treatment start			
Date/Time of treatment end			
Treatment run time (hours)			
Feed oil flow rate kg/hr)			
Reactor Temperature (degC)			
Reactor pressure psi)			
Recycle gas flow kg/hr)			
Scavenger flow (kg/hr)			
Quench wastewater (kg/hr)			
PCB level prior to treatment (ppm)			
Aroclor 1260 and under level prior to treatment			
Short Interval parameters collected by historian? (yes/no)			
Volume of PCB oil treated (gallons)			
PCB concentration of oil post treatment (ppm)			
Volume of PCB contaminated water (gallons)			
PCB concentration of contaminated water (ppm)			
Name of each client of PCB waste treated			
Operators			
Supervisor			

Notes:

SECTION 9 – MISCELLANEOUS TESTS

All the monitoring devices described in Section 7 are monitored continually by the Delta V system, and operator checks are performed every 2 hours. In addition, the safety equipment will be inspected and/or tested prior to the start of the demonstration test.

SECTION 10 - WASTE HANDLING AND DISPOSAL

Two waste streams will be generated as a result of this test and include wastewater and miscellaneous debris including sample gloves, wipes, etc. Both of these waste streams will be sampled and analyzed prior to offsite shipment for pre-treatment and disposal as applicable. It is anticipated that the liquid waste stream will be transported offsite for treatment at EnviroClean Services located in Wooster, Ohio. The solid waste stream will be transported and treated/disposed by Enviroserve.

PCB contaminated solids such as PPE, oil-dry, rags, lab bottles, wipes, etc. These materials are placed into 55-gallon steel drums and are transported to Wayne Disposal in Belleville, MI for proper management.

SECTION 11 - TEST SCHEDULE

Table 11-1 provides the proposed schedule for the demonstration test.

TABLE 11-1 SCHEDULE

ACTIVITY	SCHEDULE
Kickoff meeting	Tuesday 9/20
Initiate Sampling – Test 1	Tuesday 9/20
Conduct Test 1	Tuesday 9/20
Debrief and initiate flush	Tuesday 9/20
Complete flush	Wednesday 9/21
Kickoff Meeting	Wednesday 9/21
Sampling – Test 2	Wednesday 9/21
Conduct Test 2	Wednesday 9/21
Debrief and initiate flush	Wednesday 9/21
Complete flush	Thursday 9/22
Kickoff Meeting	Thursday 9/22
Sampling – Test 3	Thursday 9/22
Conduct Test 3	Thursday 9/22
Debrief and initiate flush	Thursday 9/22
Complete Flush	Thursday 9/22
Closeout meeting	Thursday 9/22
Contingency day	Friday 9/23

APPENDIX A

CHAIN OF CUSTODY FORM

APPENDIX B

QA PLAN

Quality Assurance Plan

Hydrodec of North America, LLC Demonstration Test

2021 Steinway Boulevard, SE
Canton, Ohio 44707

June 2016

QUALITY ASSURANCE PLAN
HYDRODEC OF NORTH AMERICA, LLC
PCB DEMONSTRATION TEST

2021 STEINWAY BOULEVARD, SE
CANTON, OHIO

JUNE 2016

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DEMONSTRATION TEST PLAN
HYDRODEC OF NORTH AMERICA, LLC
JUNE 2016

This Quality Assurance Plan (QAP) was prepared for the Hydrodec PCB Demonstration Test.

_____

Scott Bobst, Hydrodec Project Manager

_____

William Hand, Hydrodec Quality Manager

_____

Winston Lue, U.S. EPA Project Manager

QUALITY ASSURANCE PROJECT PLAN DISTRIBUTION LIST

The following have received a copy of this Quality Assurance Project Plan:

Scott Bobst, Hydrodec Project Manager
William Hand, Hydrodec Quality Manager
Winston Lue, U.S. EPA Project Manager

ACRONYM LIST

ASTM – ASTM International

CFR – Code of Federal Regulations

COC – Chain of Custody

EPA – Environmental Protection Agency

HASP – Health and Safety Plan

MDLs – Method Detection Limits

OAC - Ohio Administrative Code

O&M – Operation and Maintenance

OSHA – Occupational Safety and Health Administration

PARCCS – Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity

PCBs – Polychlorinated Biphenyls

PE – Performance Evaluation

PPE – Personal Protective Equipment

PQL – Practical Quantification Limit

QA – Quality Assurance

QAP – Quality Assurance Plan

QC – Quality Control

QLs – Quantitation Limits

SOPs – Standard Operating Procedures

SRMs - Standard Reference Materials

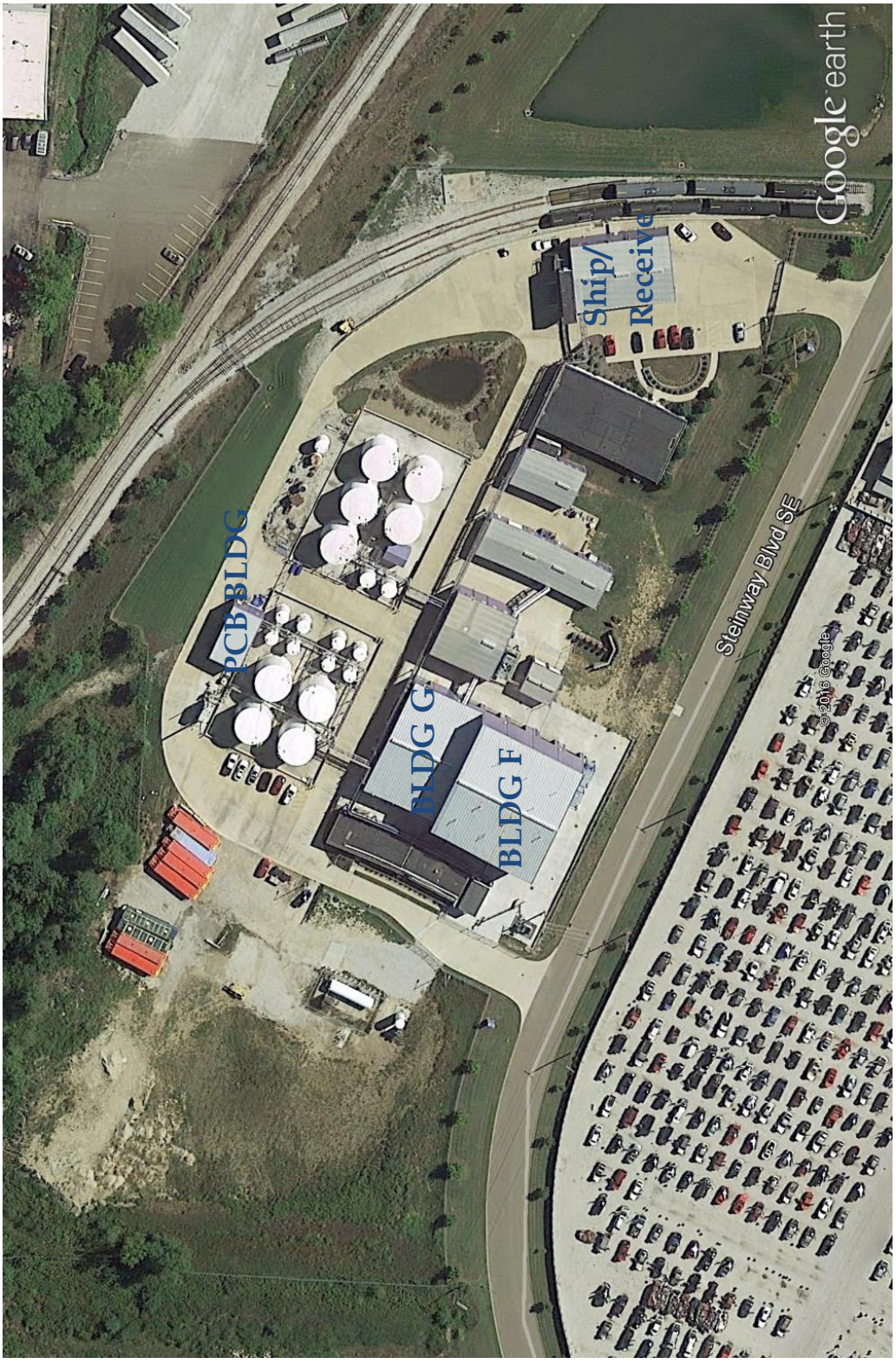
1.0 PROJECT MANAGEMENT

The purpose of this document is to describe the personnel, procedures, and methods for ensuring the quality, accuracy, and precision of data associated with the Hydrodec PCB Demonstration Test. Following the procedures outlined in this Quality Assurance Plan (QAP) will ensure that the project data meet industry standards. This QAP will be valid for up to 5 years, and it will be reviewed prior to any additional Demonstration Tests. Any updates will be documented and sent to all recipients of the QAP as part of the Demonstration Test Plan. If substantial changes are anticipated during the project period (new laboratories, additional analyses, new methods, etc.), a call will be arranged with all parties that reviewed this QAP to determine how this document will be revised.

1.1 Project Organization and Responsibility

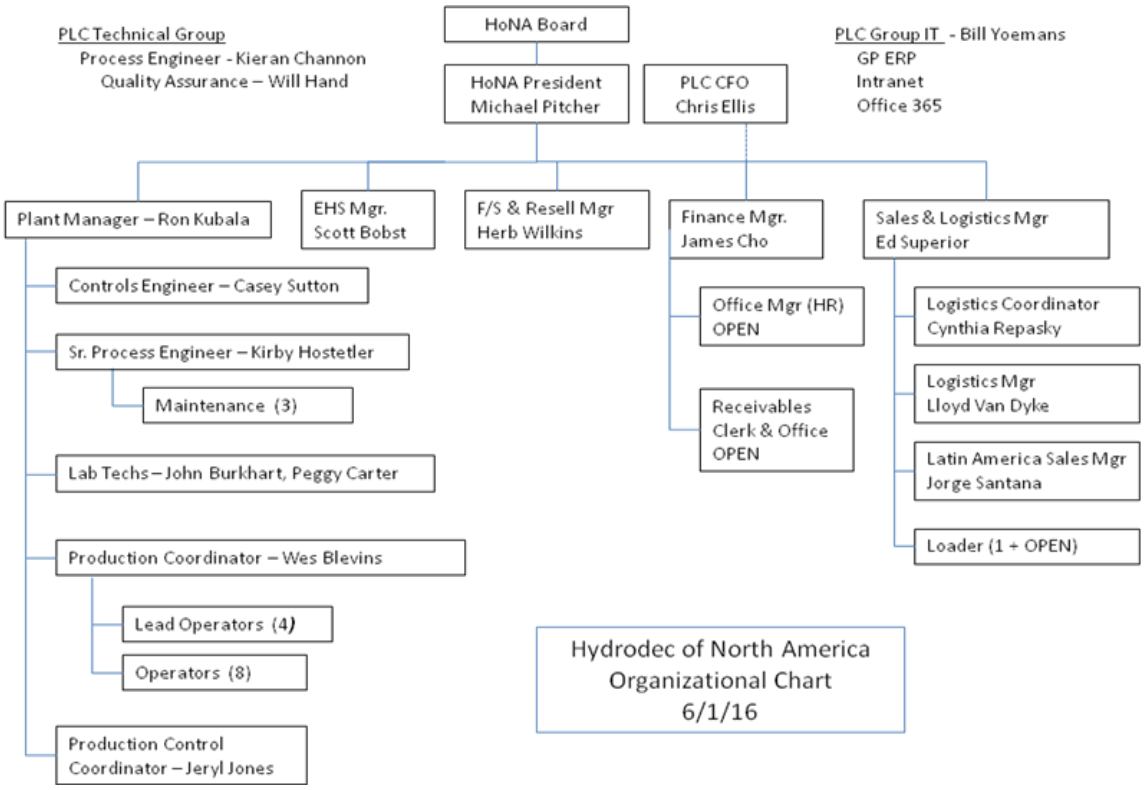
Figure 2 presents the organizational structure for the Hydrodec project. All lines of communication, management activities, and technical direction within this project team will follow this organization arrangement. Any directions or communications from the U.S. EPA will be given to the Hydrodec Project Manager. The U.S. EPA project manager will be notified of all proposed changes in personnel.

Figure 1 – Site Map



Hydrodec of North America, LLC – Site Map

Figure 2 – Project Organizational Chart



Responsibilities of key project personnel are outlined below.

Hydrodec Project Manager

1. Direct project activities.
2. Responsible for project planning.
3. Review site reports for consistency with objectives stated in work plans.
4. Provide final signatures.
5. Responsible for planning, coordinating, monitoring, and evaluating demonstration test plan.
6. Resolve technical problems.
7. Meet with team members to discuss and review analytical results prior to completion of final reports.
8. Responsible for demonstration test final report.

Hydrodec Quality Manager

1. Ensure that sampling methodology and COC procedures are being followed.
2. Assist in any QA/QC issues with process or laboratory questions, as needed.
3. Conducts Audits.
4. Maintain a record of samples submitted to the laboratory, the analyses being performed on each sample, the final analytical results, and Data Validation Reports (DVRs).
5. Review of QAP as warranted.

U.S. EPA Project Manager

1. Review the QAP
2. Review the final report.

Laboratory Technician

1. Responsible for samples submitted for analysis.
2. Responsible for summarizing quality assurance/quality control (QA/QC) requirements for the project
3. Maintain laboratory schedule and ensure that technical requirements are understood by laboratory personnel.
4. Provide technical guidance to Hydrodec Project Manager.
5. Ensure accuracy of the laboratory data.
6. Responsible for evaluating adherence to policies and ensuring those systems are in place to provide QA/QC as defined in the QAP.
7. Initiate and oversee audits of corrective action procedures.
8. Perform data reviews.

1.2 Facility History/Background Information

The Hydrodec property, as well as the entire Stein Industrial Park, entered into the Ohio Voluntary Action Program (brownfields). A covenant-not-to-sue was received from the Ohio EPA in July of 2009. Construction by Hydrodec began in August of 2007 with the majority of the facilities being completed in October 2008. Plant commission began in October of 2008 and currently processes used oil. The Hydrodec site is approximately 8 acres with operation taking place on approximately 5 of those acres.

1.3 Project Description and Schedule

Hydrodec of North America, LLC has designed a process that effectively treats transformer oils contaminated with polychlorinated biphenyls (PCBs). Hydrodec uses a hydrogenation process that chemically removes the chlorine from the PCB's rendering them harmless. The system is automated and consists of bulk shipment unloading, PCB storage tanks, a feedstock tank, heaters, reactors, heat exchangers, oil, water and gas separation, and a recycle gas recovery system. Hydrodec currently owns a similar facility in Australia. The Australian facility has demonstrated the process effectively destroys PCB's without

hazardous emissions or bi-products. This Demonstration Test is to re-confirm that the process is effective at the Canton, Ohio facility after construction of the new plant. The Demonstration Test is scheduled for September 20-22, 2016. The project includes feeding PCB contaminated feedstock into the process while monitoring PCB levels of entering and exiting the reactor. Details of the project-specific sampling activities were provided in the Demonstration Test Plan. It also includes a project schedule.

Hydrodec's on site laboratory will be the primary laboratory used for analyses.

1.4 Data Quality

Analytical quality objectives are used to ensure that the analysis will accurately and adequately identify the PCB levels in the Hydrodec process, and to ensure that the analysis selected will be able to achieve the quantization limits.

The project quality objectives process is a series of planning steps designed to ensure that the type, quantity, and quality of data used in evaluation are appropriate for the intended usage.

Samples of oil will be collected for analysis as described in the Demonstration Test Plan order to confirm the effectiveness of the Hydrodec process.

The laboratory reporting limit for PCBs in oil is 1 mg/kg. Processed oil samples returning results of greater than 2 mg/kg will be quarantined for re-processing.

Crystal Laboratories reporting limit for PCBs in water is 0.1ug/L. Wastewater samples returning values of greater than 0.5ug/L will be quarantined for off site processing by a licensed facility.

1.5 QA/QC Objectives for Measurement

The overall QA objective for the project is to develop and implement procedures for sampling, COC, laboratory analysis, and reporting. Specific procedures for sampling COC,

laboratory instrument calibration, laboratory analysis, reporting of data, are described throughout this plan and in the Demonstration Test Plan

The quality control procedures for PCB analysis are provided in Appendix A – USC-LAB-PRC-009 – Analysis of PCBs in Oil By GC-ECD. Appendix A also provides a copy of USC-LAB-WKI-019 – PCB Sample Preparation.

Completeness is defined as the measure of the quantity of valid data obtained from a measurement system compared to the quantity that was expected under normal conditions. While a completeness goal of 100 percent is desirable, an overall completeness goal of 90 percent may be realistically achieved under normal field sampling and laboratory analysis conditions.

Methods used for the assessment of PARCCS for PCBs analytical results and target outcomes are listed below.

Parameter	**Method of Assessment**	**Target Values**
Precision	Replicate Analysis	<±10%
Accuracy	Laboratory Control Samples	<±15%
Completeness	Useable Data Obtained	≥90%

Representativeness and comparability are controlled by utilization of standardized processes for sample collection and handling of samples, and use of SOPs for the analysis of samples. Sensitivity is controlled by utilizing test methods with appropriately low reporting limits compared to the action levels, as described in Section 1.4.

1.6 Documentation and Records

Records generated during projects will be collected and maintained by Hydrodec. Hydrodec will use select documents for recording information during project activities. Records to be used for project documentation include sampling forms, laboratory data sheets, COC forms, and analytical results.

2.0 DATA GENERATION AND ACQUISITION

The purpose of the QAP is to produce reliable data that will be generated throughout the demonstration test by:

- Ensuring the validity and integrity of the data;
- Ensuring and providing mechanisms for ongoing control of data quality;
- Evaluating data quality in terms of PARCCS; and
- Providing usable, quantitative data for analysis, interpretation, and decision making.

2.1 Sampling Process Design

Sample locations, analytical parameter, and frequency of sampling are discussed in the Demonstration Test Plan. Laboratory test parameters for the sampling program will include analysis of PCBs (ASTM D4059).

QA/QC samples will be submitted in accordance with the Demonstration Test Plan.

2.2 Analytical Methods Requirements

In order to preserve the integrity of samples both before and during analyses, specific analytical methods and requirements for those methods will be followed. Samples will be collected in 2 oz glass bottles, prepared, and analyzed in accordance with the analytical methods outlined in the **Appendix A**. The Hydrodec Laboratory will coordinate all analytical services for this test and provide all sample containers.

2.3 Sample Handling and Custody Requirements

Proper sample handling and custody procedures are crucial to ensuring the quality and validity of data obtained through plant and laboratory analyses. Custody procedure will be used to document the authenticity of data collected during the Hydrodec project. An item is considered in custody if it is:

- In a person's possession;
- In view of the person after being in their possession;
- Sealed in a manner that it can not be tampered with after having been in physical possession; or
- In a secure area restricted to authorized personnel.

2.3.1 Sample Collection Documentation

Sample-handling procedures include process documentation, COC documentation, sample shipment, and laboratory sample tracking. Various aspects of sample handling and shipment, as well as the proposed sample identification system and documentation, are discussed in the following sections.

2.3.1.1 Sample Log

A sample log as provided in the Demonstration Test Plan will be used to document sample details. Entries will be completed by the plant operator and will include location, date and time of sample

2.3.1.2 Identification System

Each sample collected during the demonstration test will be given a unique identification code. Each unique sample identification will consist of the following:

- *Project Identification Code.* A one-letter designation will be used to identify the Hydrodec project from which the sample was collected, in this case, D – for Demonstration Test.

- *Run Number.* Each sample will be identified by the run number and will be assigned 1 through 6 based on alternating PCB feed oil and non-PCB feed oil.

- *Location Code.* Each sample will be identified by a location code as follows

FE – feedstock oil
CO – clean oil

- *Time Code.* Each sample will be identified as to the hour of the run in which the sample was taken ranging from 1 through 12.

- Example

D-1-FE-03 = oil sample taken from the first run from PCB feedstock during the third hour.

Sample bottle labels appropriate for the size of the container shall be provided by the Hydrodec Laboratory. The sample containers will be labeled at the time of sample collection but prior to being filled. Each label will indicate at a minimum:

- Sample identification;
- Date/time of sample collection;
- Sampler's initials; and
- Required analyses;

All labels will be completed in ink.

2.3.1.3 Sample Handling

The possession and handling of samples will be documented from the time of collection to delivery to the laboratory. Hydrodec personnel are responsible for ensuring that COC procedures are followed. Hydrodec will maintain custody of all samples until they are relinquished to the laboratory.

All samples must be catalogued on a COC form using sample identification codes. A copy of the COC form is included in **Appendix A** of the Demonstration Test Plan. The date and time of collection will be recorded on the form, as well as the number of each type of sample, and the type of analysis.

2.3.1.4 Sample Packaging and Shipping

Samples will be packaged and transported in a manner that maintains the integrity of the sample and permits the analysis to be performed within the prescribed holding time. Prior

to shipment, each sample container will be inspected for a label with the proper sample identification code.

Samples will be hand delivered to the Hydrodec Laboratory. The laboratory will be contacted in advance to expect shipment so that holding times of the samples will be conserved. The COC forms will accompany the samples. Upon relinquishing the sample container to the Laboratory, Hydrodec personnel will sign custody of the samples over to the laboratory by signing and dating the bottom of the COC form. One copy of the COC documentation will be retained by Hydrodec and a second copy will be retained by the laboratory.

2.3.2 Laboratory Chain of Custody

The Hydrodec Laboratory will perform laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data in accordance with their SOPs. The Laboratory Technician will be responsible for ensuring that laboratory custody protocol is maintained.

2.4 Quality Control (QC) Requirements

The QC requirements ensure that the environmental data collected is of the highest standard feasible as appropriate for the intended application. Facets of the quality control requirements are provided in the following sections.

2.5 Instrument Calibration and Frequency

The responsibility for the calibration of laboratory equipment rests with the laboratory.

Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and American Society for Testing and Materials (ASTM), or procedures provided by manufacturers in equipment manuals will be adopted. The proper calibration of laboratory equipment is a key element in the quality of the analysis done by the laboratory.

2.6 Data Management

Hydrodec personnel will collect operating parameter information throughout the demonstration test. A copy of this checklist is provided in the Demonstration Test Plan.

The Laboratory Technician will be responsible for laboratory data management.

3.0 ASSESSMENT/OVERSIGHT

Performance and system audits will be completed to ensure that the sampling activities and laboratory analyses are performed following the procedures established in this QAP, including the attached SOP, and the property-specific Demonstration Test Plan. The audits may be both internally and externally led, as further described below.

3.1 Technical Systems Audits

Generally, system audits are a qualitative measure of adherence to sampling QA measures overall, including sample collection handling, COC, and recording process data, as well as sample receiving, log-in, and instrument operating records in the laboratory.

3.1.1 Process Data

The Hydrodec Operations Coordinator will be present at the site during initial sampling activities and will be responsible for Process Operator sampling. The Operations Coordinator will provide the on-site guidance required during the project. The Operations Coordinator will be in daily contact with the Hydrodec Project Manager, who will then review compliance with the project objectives and sampling protocol outlined in this QAP. Any anticipated modifications to the sampling or monitoring procedures will be reported to the Hydrodec Project Manager.

Sample data precision will be determined by the collection and subsequent analysis of sample duplicates as described in the Demonstration Test Plan. Additionally, some duplicates may be selected for external laboratory confirmation.

3.1.2 Report Preparation

Prior to submittal to the U.S. EPA, all reports will undergo a peer review conducted by a project team within Hydrodec. All components of the report will be checked and initialed by a designated team member.

3.1.3 Laboratory Data

Laboratory results will be reviewed for compliance against the criteria for the level of reporting required.

3.2 Performance Evaluation Audits

Generally, performance audits are a quantitative measure of sample collection and laboratory analyses quality.

3.2.1 Field Audits

The Hydrodec Project Manager or his delegate will conduct audits of process activities. U.S. EPA may also conduct an independent audit. At least one audit will be completed near the beginning of the sample collection activities for each run. The audit will include the following checklist:

Item	Description of Field Audit Activities	Auditor Initials
1.	Review of sampling records	
2.	Review of process checklist	
3.	Examination of the sample label and identifications.	
4.	Review of the sample handling and packaging procedures	
5.	Review of COC procedures	

If deficiencies are observed during the audit, the deficiency shall be noted in writing and a follow-up audit may be completed if deemed necessary by the auditor. Corrective action procedures may need to be implemented due to the findings from the audit. Such actions will be documented in the project notebook.

3.2.2 Laboratory Audits

The Hydrodec Laboratory will perform all of the analytical services required during the assessments. The Hydrodec Laboratory will be responsible for all analytical work for this project using ASTM Method D4059. The Laboratory Technician will be responsible for

ensuring that the laboratory data precision and accuracy are maintained in accordance with specifications and laboratory SOPs.

4.0 DATA VERIFICATION /USABILITY

This section describes the QA activities that will be performed to ensure that the collected data are properly documented, and of known quality, and meet project objectives. All analytical data collected from the Hydrodec Demonstration Test will be verified.

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Data verification will be performed internally by the analytical group or the laboratory generating the data. Data verification may result in accepted, qualified, or rejected data.

Data verification will be performed by evaluation against the precision, accuracy and sensitivity targets identified in Section 1.5. Completeness will then be determined by determination of the number of valid analytical results compared to the number of expected results.

In order to perform the data verification, the reported data will be supported by complete data packages which include sample receipt and tracking information, COC records, tabulated data summary forms, and analytical data for all samples, standards.

APPENDIX A

LABORATORY PCB QC PROCEDURE AND SOP

APPENDIX C

DAILY MONITORING LOG

APPENDIX D

QUENCH WATER / SCAVENGER ANALYSIS