

APPENDIX E

CONSTRUCTION QUALITY ASSURANCE PLAN

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1.0 INTRODUCTION

1.1 PURPOSE AND ORGANIZATION OF REPORT

This Construction Quality Assurance Plan (CQAP) has been developed to present the quality assurance program to be implemented during the construction activities associated with the Operable Unit-3 (OU-3) biosparge Remedial Action (RA) at the Hooker Chemical/Ruco Polymers Superfund Site (Hooker/Ruco Site) in Hicksville, New York. The CQAP has been prepared to ensure that the RA elements are constructed to meet or exceed all design criteria, plans, and specifications.

The CQAP is organized as follows:

- i) Section 1.0 presents the purpose and organization of the report, and background information;
- ii) Section 2.0 provides a description of the project;
- iii) Section 3.0 outlines the project organization and responsibilities;
- iv) Section 4.0 presents the personnel qualification requirements;
- v) Section 5.0 presents the project meeting requirements;
- vi) Section 6.0 describes the inspection and testing activities required to ensure that construction and materials comply with all design specifications and plans; and
- vii) Section 7.0 describes documentation requirements of construction quality assurance (CQA) activities.

Construction specifications for the RA construction activities are presented in Appendix C of the 100% Final Design Report, and the construction drawings are presented in Appendix B.

2.0 PROJECT DESCRIPTION

As presented in the 100% Final Design Report, the major components of the RA activities to be implemented at the Hooker/Ruco Site are as follows:

- i) installation of the air and liquid injection wells;
- ii) installation of the vadose zone and groundwater monitoring wells;
- iii) construction of the biosparge remedy control facility, including system mechanical and electrical installations, building structural and architectural installations, and site grading, paving, and landscaping installations;
- iv) construction of the underground piping to transfer air and liquid supplements to the injection wells;
- v) installation of an air compressor and liquid supplement storage/mixing unit;
- vi) commissioning of the biosparge system; and
- vii) obtaining access on private properties, where needed.

Details and sequencing of the RA to be implemented at the Hooker/Ruco Site are provided in the 100% Final Design Report.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The U.S. Environmental Protection Agency (USEPA) has designated Mr. Syed Quadri as the remedial project manager for implementation of the OU-3 Administrative Order (AO) for the Hooker/Ruco Site.

The AO directs Occidental Chemical Corporation (OCC) and Ruco Polymers Corporation to perform the design and implement the remedy described in the September 29, 2000 Record of Decision (ROD). Miller Springs Remediation Management, Inc. (MSRMI), an affiliate of Glenn Springs Holdings, Inc. (a wholly owned subsidiary of Occidental), is responsible for the management and implementation of remedial programs to be undertaken by OCC.

MSRMI has retained Conestoga-Rovers & Associates (CRA) as the Supervising Contractor for implementation of the RA activities at the Hooker/Ruco Site. The Supervising Contractor is responsible for implementing the RA activities, and reports directly to MSRMI. Additional contractors and subcontractors will be selected to perform specific tasks during the RA construction activities.

A brief description of the duties of the key personnel is presented below. A project organization chart is presented on Figure E3.1.

3.1 MSRMI PROJECT MANAGER

Mr. Stephen Whyte is the MSRMI Project Manager. The duties of the MSRMI Project Manager are as follows:

- i) overall responsibility for the project to ensure that the objective of compliance with the AO is met in a safe and timely manner;
- ii) participation in key negotiations with USEPA;
- iii) managerial guidance to the Supervising Contractor's Project Manager; and
- iv) provide monthly/quarterly progress reports to USEPA.

3.2 SUPERVISING CONTRACTOR'S PROJECT MANAGER

Mr. Jim Kay is the Supervising Contractor's Project Manager. The duties of the Supervising Contractor's Project Manager are generally as follows:

- i) provides overall project management in support of the MSRMI Project Manager;
- ii) ensures professional services provided by Supervising Contractor are safely performed in a cost effective and high quality manner;
- iii) ensures all resources of Supervising Contractor are available on an as-required basis; and
- iv) participates in key technical negotiations with USEPA and provides managerial and technical guidance to the on-Site Field Construction Manager.

3.3 ON-SITE FIELD CONSTRUCTION MANAGER

The duties of the on-Site Field Construction Manager are generally as follows:

- i) ensures all work is performed safely;
- ii) provides day-to-day Site management;
- iii) provides managerial guidance to contractors and sub-contractors;
- iv) provides technical representation at meetings as appropriate;
- v) retains testing firms to perform quality assurance field/laboratory tests;
- vi) prepares and reviews reports;
- vii) reports to Supervising Contractor's Project Manager;
- viii) provides supervision of Supervising Contractor's on-Site project activities;
- ix) serves as the CQA Officer (CQAO)
- x) provides field management of CQA activities;
- xi) reviews design criteria, plans and specifications, submittals, and shop drawings for clarity and completeness so that the CQAP can be implemented;
- xii) coordinates technical submission and shop drawing review with the Design Engineer;
- xiii) coordinates design modification and technical memoranda review with the Design Engineer;
- xiv) informs CQA support personnel of CQA requirements and procedures;

- xv) ensures that all Site activities are recorded and are reported as required;
- xvi) ensures that CQA test results and observations are accurately recorded and interpreted;
- xvii) identifies work that should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval;
- xviii) rejects defective work and verifies that corrective measures are implemented;
- xix) interacts daily with the RA contractor to provide assistance in modifying the materials and work to comply with the specified design;
- xx) records meeting discussions and prepares and submits meeting minutes; and
- xxi) prepares reports and documentation described in Section 7.0.

3.4 CQA OFFICER

The duties of the CQA Officer are to review CQC and CQA documentation and construction and testing activities to ensure the RA construction activities are being conducted in accordance with the specifications.

3.5 CQA SUPPORT PERSONNEL

The duties of the CQA Support Personnel are as follows:

- i) reports directly to the on-Site Field Construction Manager;
- ii) conducts CQA tests and inspections as indicated in this CQAP to confirm construction and material quality are as specified;
- iii) accurately records test results and inspections; and
- iv) immediately notifies on-Site Field Construction Manager whether or not test results comply with design specifications.

3.6 QA TESTING LABORATORY

The testing laboratory that will conduct CQA tests will be identified by the Supervising Contractor prior to the commencement of the RA construction activities. The duties of the testing laboratory are to provide QA testing of construction materials and methods, as requested by the CQA Officer and/or the CQA Support Personnel, to confirm that the

quality of the construction materials and methods are in accordance the construction specifications and drawings.

3.7 GENERAL CONTRACTOR

The duties of the General Contractor, as they relate to QA/QC, are as follows:

- i) performs all work in a safe manner;
- ii) retains qualified testing firms (for example laboratory, geotechnical), for Construction Quality Control (CQC) testing of materials and workmanship to ensure that construction materials and methods meet specified requirements;
- iii) submits samples and/or materials for testing to determine if samples/materials meet specified requirements, and submits test results directly to the on-Site Field Construction Manager;
- iv) records CQC activities in the Contractor's Site log book and submits a regular construction QC report to the on-Site Field Construction Manager ;
- v) carries out construction activities according to design specifications, construction drawings, and reviewed shop drawings;
- vi) implements the CQC requirements specified in the construction specifications;
- vii) provides quality materials and workmanship to ensure that materials and methods meet the specified requirements;
- viii) submits to the on-Site Field Construction Manager required submittals including CQC reports, updated schedules, fabrication reports, etc.; and
- ix) prepares and submits shop drawings and submittals, and construction permits and inspection requests as required by the construction specifications and governing agencies.

4.0 PERSONNEL QUALIFICATIONS

4.1 ON-SITE FIELD CONSTRUCTION MANAGER

The on-Site Field Construction Manager will have the following qualifications:

- i) graduate of a recognized college in a technically related field;
- ii) minimum 5 years experience in the oversight and implementation of construction and CQA activities; and
- iii) good management and communication skills.

4.2 CQA SUPPORT PERSONNEL

The CQA Support Personnel will have the following minimum qualifications:

- i) degree from a recognized college in engineering technology, or equivalent; or a minimum of 2 years experience in construction and CQA inspection procedures; and
- ii) working knowledge of all relevant codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

4.3 GENERAL CONTRACTOR

The selected General Contractor will assign experienced personnel to supervise the implementation of the remedial construction activities. In particular, the selected contractor will assign experienced personnel to the following critical remedial construction activities:

- i) installation of the injection, groundwater monitoring, and vadose zone monitoring wells;
- ii) construction of the mechanical and electrical well head installations;
- iii) construction of the air and liquid injection facility, including system mechanical and electrical installations, building structural and architectural installations, and site grading, paving, and landscaping; and

iv) construction of the air and liquid supplement delivery system.

Experienced personnel will have a thorough knowledge of testing procedures, and equipment and documentation procedures required for implementation of the RA construction activities.

The General Contractor will designate an on-Site Project Superintendent empowered to act on behalf of the General Contractor in all matters pertaining to the RA construction activities.

5.0 PROJECT MEETINGS

Project meetings as detailed herein will be held during the RA construction period to ensure that all tasks are accomplished according to schedule and that they are completed in accordance with the RA plans and specifications. These progress meetings may be attended, as necessary, by the MSRMI Project Manager, Supervising Contractor's Project Manager, on-Site Field Construction Manager, CQA Support Personnel, property owner representatives, general contractor representative(s), USEPA, and NYSDEC.

The on-Site Field Construction Manager will take minutes for all meetings held on Site during the RA construction activities. Copies of the minutes will be forwarded to all organizations present at the meetings.

5.1 PRECONSTRUCTION MEETING

Purpose: To introduce all parties involved in the RA construction activities, resolve any uncertainties in the RA drawings and specifications, review levels of responsibility, reporting requirements, and Site health and safety requirements, and to discuss the project sequencing and anticipated delays.

Topics:

- i) introduce each organization and Site personnel;
- ii) review of general scope of work and requirements of the AO;
- iii) present CQAP, General Contractor's Site-specific Health and Safety Plan, and other relevant documents;
- iv) review the activities to be conducted during the RA construction;
- v) review roles of each organization relative to the design criteria, plans and specifications within the CQAP;
- vi) determine any need to modify the CQAP that may be necessary to ensure that the construction is performed to meet or exceed the specified design criteria;
- vii) review lines of authority and communication;
- viii) discuss the established procedures or protocol for observations and tests including sampling strategies;
- ix) discuss the established procedures or protocols for handling construction deficiencies, repairs, and retesting;

- x) review methods for documenting and reporting inspection data;
- xi) review methods for distributing and storing documents and reports;
- xii) review work area delineation, security, and safety protocol;
- xiii) discuss the location for storing construction equipment and materials, and the protection of these items during inclement weather;
- xiv) discuss the protection of uncompleted construction work during off-hours and during inclement weather;
- xv) conduct a Site tour to review construction areas, safety areas maintained by General Contractor and equipment and stockpile storage locations;
- xvi) identify procedures to resolve disputes or misunderstandings during construction;
- xvii) review of emergency plans and contingency plans; and
- xviii) review of endpoint activities and procedures for project completion.

5.2 PERIODIC MEETINGS

Purpose: As required to review work schedule progress and if a problem or deficiency is present or likely to occur. This meeting is intended to be an informal meeting held on an as-needed basis.

Topics: To be determined prior to each periodic meeting.

5.3 MONTHLY PROGRESS MEETINGS

Purpose: To provide an RA construction progress update to MSRMI, Engineer, NYSDEC, and USEPA.

Topics:

- i) present General Contractor's Health and Safety report for previous month's activities;
- ii) review the work activities for the previous month;
- iii) present comparison of actual progress to scheduled work activities, noting of schedule slippages and actions implemented to rectify schedule slippages;

- iv) summarize work activities scheduled for the next month; and
- v) review potential remedial construction problems/conflicts for the next month's remedial construction activities and proposed solutions to the potential problems/conflicts.

6.0 INSPECTION AND TESTING ACTIVITIES

6.1 SCOPE

Throughout the implementation of the RA construction activities there will be numerous inspections and testing requirements for specific work tasks. The inspection and testing requirements will ensure compliance with the remedial design as presented in the construction specifications and applicable building and electrical codes, as well as ensure completion of the work tasks to the highest level of quality.

Inspections and testing will provide a qualitative means of monitoring the quality and progress of work performed.

The components of each work task that may require some form of inspection or testing are as follows:

- i) Injection Well Installation
 - a) location,
 - b) installation,
- ii) Underground Piping Installation
 - a) alignment and level,
 - b) excavation,
 - c) traffic barricading,
 - d) forcemain installation,
 - e) restrained joint and pipe wrapping installation,
 - f) pressure and leak testing,
 - g) air valve installation,
 - h) isolation valve installation,
 - i) bedding and backfilling, and
 - j) pavement/concrete restoration;
- iii) Site Preparation
 - a) clearing and grubbing,
 - b) grading,
 - c) potable water connections,
 - d) excavation and compaction of subgrade;

- iv) Buried Conduits
 - a) trench excavation and bedding,
 - b) installation of conduits,
 - c) backfilling and grading;
- v) Cast-in-Place Concrete Work
 - a) installation of form work, shoring, bracing, and waterstops,
 - b) placement of steel reinforcing, wire fabric, and accessories,
 - c) placement and curing of concrete,
 - d) concrete coating and floor seal;
- vi) Steel and Metal Fabrication
 - a) installation of metal fabrication including fence, gates, and bollards,
 - b) installation of modular building,
 - c) connections/tolerances;
- vii) Mechanical Components
 - a) air compressor and liquid supplement storage and distribution systems,
 - b) pressure testing of equipment, tanks, and piping;
- viii) Electrical Components
 - a) power distribution and lighting; and
- ix) Regrading, Backfilling, and Paving Activities
 - a) level and thickness control,
 - b) compaction.

6.2 INSPECTIONS

Throughout the period of RA construction the quality of work completed and material used for each of the work tasks will be maintained at its highest possible level through regular inspections of the work. The on-Site Field Construction Manager and CQA support personnel will complete inspections on a periodic basis throughout the construction activities, as required.

In general, inspections to be conducted by the on-Site Field Construction Manager and CQA support personnel include the following:

- i) daily inspections of the work progress;
- ii) inspections of material as it is delivered to the Site to check for damage during delivery;
- iii) comparison of the material delivered to the Site to the design specifications to ensure that the proper material has been delivered to the Site;
- iv) inspection of materials after they have been installed to ensure that it has not been damaged during installation;
- v) a pre-construction inspection will be performed prior to beginning work on any work task. A pre-construction inspection will include the following:
 - a) a review of contract requirements to ensure that all materials and/or equipment have been tested according to applicable standards and specifications,
 - b) ensure that provisions have been made to provide required quality control testing, and
 - c) examination of the work area to ascertain that all applicable preliminary work tasks have been completed;
- vi) General inspections will be performed periodically as the amount of work completed warrants an inspection. A general inspection will include the following:
 - a) examination of the quality of workmanship,
 - b) testing of materials for compliance with the construction specifications,
 - c) any omissions, and
 - d) general progress of work performed; and
- vii) A final inspection will be performed upon completion of each work task to ensure compliance with the construction drawings and specifications and to ensure that deficiencies identified in the general inspections have been corrected.

These inspections will be performed by the on-Site Field Construction Manager or the CQA support personnel, and the results of the inspections will be recorded in the Log Book, and will be summarized in the Remedial Action Report. Results of the pre-construction, general and final inspections will be provided to all parties involved in the inspection.

The components of each work task to be inspected, the types of inspections required and the frequency of the inspections are summarized in Table E6.1.

6.3 TESTING

In addition to the daily CQA inspections of the construction activities, CQA material testing will be performed as required. CQA material testing will be performed to ensure compliance with material specifications and design criteria as presented in the construction specifications.

The CQA testing requirements, methods of testing, testing frequency, key acceptance criteria, and potential corrective measures for each of the RA construction work task components are summarized in Table E6.2. For convenience, the CQC testing requirements specified in the construction specifications as well as the CQA testing requirements are summarized in Table E6.2. In general, the CQA testing requirement is to conduct a frequency of testing of about 10 percent of the CQC testing requirements.

If a particular test for a contractor material or work activity continually or frequently fails, the on-Site Field Construction Manager may increase the rate of CQA testing as determined appropriate for the material/activity that fails.

CQC testing will be performed by the General Contractor to measure and control the characteristics of the materials and installation procedures used in RA construction activities in order to demonstrate that the materials and installations meet the requirements of the construction specifications. The minimum requirements for CQC testing are specified in the construction specifications.

7.0 CQA DOCUMENTATION

7.1 GENERAL

This section details the documentation requirements for the CQAP. The proper, thorough, and accurate documentation of all construction and CQA site activities is important in ensuring quality installation.

7.2 ON-SITE FIELD CONSTRUCTION MANAGER SITE LOG BOOK

The on-Site Field Construction Manager will record quality control activities in a Site Log Book to be kept on Site at all times. The Log Book will generally include the following information as appropriate to the work activities:

- i) date, weather conditions;
- ii) all Site activities;
- iii) decisions made regarding approval of units of material or of work, and/or corrective actions to be taken in cases of substandard quality;
- iv) submittals made by suppliers verifying material quality;
- v) quality control test and inspection results;
- vi) construction delays, and causes;
- vii) areas affected by delays;
- viii) construction problems and corrective actions;
- ix) personnel on Site;
- x) present phase of construction;
- xi) material and/or equipment delivered to site (including equipment demobilization);
- xii) inspections made;
- xiii) quality control tests performed and results of tests taken on previous workday;
- xiv) changed conditions/conflicts encountered;
- xv) remarks; and
- xvi) safety meeting updates.

7.3 CQA INSTRUMENT CALIBRATION

The CQA Support Personnel will record calibrations of test equipment performed by the General Contractor in the Log Book maintained on Site, if calibration is required. Actions taken as a result of recalibration will be recorded in the Log Book.

7.4 CQA INSPECTION LOG BOOK

All CQA observations and tests results will be recorded by the CQA Support Personnel in the Log Book. The Log Book will be kept on Site and maintained by the on-Site Field Construction Manager.

7.5 PROBLEM/CORRECTIVE ACTIONS

A problem is defined as material or workmanship of a significant nature that does not meet the construction specifications or drawings. Documentation of a problem/corrective action may include the following information:

- i) description of the problem;
- ii) probable cause;
- iii) when the problem was identified;
- iv) suggested corrective action;
- v) documentation of correction; and
- vi) final results.

In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document problems could help to avoid similar problems in the future.

7.6 TECHNICAL MEMORANDA

Significant modifications or changes to the design will be documented in Technical Memoranda, and submitted by MSRMI to USEPA for review and approval. Technical memoranda must include the following information to document the design modification or change:

- i) identification and location of proposed modification or change, including relevant drawing numbers and specification sections;
- ii) description of proposed modification or change;
- iii) the basis for the proposed modification or change;
- iv) the impact of the proposed modification or change on the construction schedule;
- v) documentation of approval of proposed technical modifications or design changes by the Supervising Contractor; and
- vi) required time frame for completion of approval by USEPA.

USEPA must approve the Technical Memoranda prior to implementing the modification or change. A Technical Memorandum must also be submitted by MSRMI for any design changes or modifications deemed necessary by the USEPA.

Technical Memoranda will only be prepared for those changes which are a material modification to the Final (100%) Design. Minor field modifications will be recorded in the as-built drawings.

7.7 DRAFT REMEDIAL ACTION REPORTS

In accordance with Paragraph XI.C of the AO Scope of Work, a Draft Remedial Action Report will be submitted within 30 days of the Final Inspection of the Phase I System. A second Draft Remedial Action Report will be submitted within 30 days of the Final Inspection of the entire biosparge system which will encompass both the north fence and the remainder of the middle fence. The Draft RA Reports will be prepared in accordance with the Remedial Action Work Plan and the schedule therein. The Draft RA Reports will summarize RA events, performance standards and construction quality control, construction activities, final inspection, certification that the remedy is Operational and functional, and operation and Maintenance (O&M) expectations.

7.8 REMEDIAL ACTION REPORT

In accordance with Paragraph XI.C of the AO, within 30 calendar days after receipt of USEPA comments on the Draft RA Report, a Remedial Action Report will be submitted

to the USEPA. The Remedial Action Report shall conform to the USEPA comments regarding the Draft RA Report.

7.9 STORAGE OF RECORDS

During RA construction, the On-Site Field Construction Manager will maintain a copy of the construction drawings and specifications, CQAP, and CQAP documentation in the Site office. Once the RA construction is complete, the Supervising Contractor or MSRMI will retain all CQA documents (originals). Retention of all records and documents will be in accordance with the AO.

TABLE E6.1
 SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS
 OU-3 BIOSFARGE REMEDY
 HOOKER/RUCO SITE
 HICKSVILLE, NEW YORK

<i>Key Work Task Component to be Inspected</i>	<i>Key Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Contractor Submittals to Superintending Contractor</i>
A. SITE PREPARATION				
• Silt Fence (if applicable)	<ul style="list-style-type: none"> • Is silt fence stored properly? • Does silt fence meet specifications? • Has silt fence been damaged during delivery? • Has silt fence been installed as specified? • Does silt require removal from along silt fence? • Is silt fence in satisfactory condition? • Has haybale been installed as specified? • Does silt require removal from along haybale? • Is haybale in satisfactory condition? 	<ul style="list-style-type: none"> • Visual • Check Specification • Visual • Visual • Visual • Visual • Visual • Visual • Visual 	<ul style="list-style-type: none"> • Periodic during storage • Upon delivery to site • Upon delivery to site • Once daily during installation (minimum) • After rain events • Once weekly during construction • Once daily during installation (minimum) • After rain events • Once weekly during construction • Daily as required • Daily as required 	<ul style="list-style-type: none"> • Manufacturer's recommendations • None • None • None • None • None • None • None • None • None
• Clearing and Grubbing	<ul style="list-style-type: none"> • Have all above ground portions of trees, shrubs, and other cleared vegetation been removed? • Have all above ground portions of trees, shrubs, and other cleared vegetation been chipped and managed as specified? 	<ul style="list-style-type: none"> • Visual • Visual 	<ul style="list-style-type: none"> • Daily as required • Daily as required 	<ul style="list-style-type: none"> • None • None
• Temporary Construction Facilities	<ul style="list-style-type: none"> • Have temporary construction facilities been provided as specified? 	<ul style="list-style-type: none"> • Check Specification • Visual 	<ul style="list-style-type: none"> • Periodic during installation 	<ul style="list-style-type: none"> • None
• Security Fence Components and Fittings	<ul style="list-style-type: none"> • Do fence components and fittings meet specifications? • Has fence been constructed as specified? • Have temporary utilities been provided as specified? 	<ul style="list-style-type: none"> • Check Specification • Visual • Check Specification • Visual 	<ul style="list-style-type: none"> • Each source of components and fittings • Periodic during construction • Periodic during installation 	<ul style="list-style-type: none"> • Manufacturer's product specifications • None • Electrical permit
• Utilities	<ul style="list-style-type: none"> • Have all utilities been located and marked appropriately? 	<ul style="list-style-type: none"> • Visual 	<ul style="list-style-type: none"> • Prior to excavation 	<ul style="list-style-type: none"> • Survey of utility locates
• Traffic Control / Barricades	<ul style="list-style-type: none"> • Are all temporary traffic controls in place as specified? 	<ul style="list-style-type: none"> • Visual 	<ul style="list-style-type: none"> • Periodic during construction 	<ul style="list-style-type: none"> • Traffic Control Plan

TABLE E6.1
 SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS
 OU-3 BIOSPARGRE REMEDY
 HOOKER/RUCO SITE
 HICKSVILLE, NEW YORK

<i>Key Work Task Component to be Inspected</i>	<i>Key Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Contractor Submittals to Supervising Contractor</i>
B. BURIED PIPING				
• Pipe	• Does pipe meet specifications?	• Check Specification	• Each source of pipe • Upon delivery to site	• Source of pipe • Material property sheets • Test reports
• Granular Bedding	• Has pipe been installed as specified? • Does granular material meet specifications? • Has granular material been placed as specified?	• Visual • Check Specification • Visual	• Periodic during installation • Each source of granular material • Periodic during installation	• None • None • None
C. MODULAR BUILDING				
• Building	• Has building been installed as specified? • Existing anomalies not accounted for in Geotechnical Report	• Check Specification • Visual • Visual	• Upon delivery to site • Periodic during construction • Periodic during construction	• Manufacturer's product specifications • Details of anomalies
• Engineered Fill/Gravel Base	• Gravel gradation specifications • Gravel base specified • Compaction specifications	• Check supplier's gradation • Visual (grade stakes or level) • Compaction	• Prior to delivery on site • Upon completion • During compaction	• Grain size distribution curve • None • Compaction results
D. CONCRETE WORK				
• Concrete	• Concrete mixes conform to design specifications, ACI, 301, 318 • Pipe configuration below floor slab meet design specification • Concrete placing comply with ACI 306 if air temperature is below 40° F • Concrete placing comply with ACI 305 if air temperature is above 77° F • Poured in-place concrete protected from mechanical disturbance and vibration during hardening • Time from the mixture of concrete batch to placement of concrete • Composite samples collected in accordance with ASTM C172	• Verify supplier's concrete mix • Visual (tape measurement) • Visual • Visual • Visual • Visual • Visual	• Prior to delivery to site • Prior to concrete placing • During concrete placing • During concrete placing • During concrete placing • Per truckload • Per load of concrete	• Certification that mix will produce concrete of specified quality and yield • None • None • None • None • None • None

TABLE E6.1
SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS
OU-3 BIOSPARGE REMEDY
HOOKEK/RUCO SITE
HICKSVILLE, NEW YORK

<i>Key Work Task Component to be Inspected</i>	<i>Key Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Contractor Submittals to Supervising Contractor</i>
D. CONCRETE WORK (cont'd.)	<ul style="list-style-type: none"> Specimens from each sample are molded and secured in accordance with ASTM C31 Concrete thickness and grade meet design specification Reinforcement material specifications Reinforcement placement complying with ACI 301, 318, 350 Formwork complies with ACI 301 Formwork complies with specifications Anchor bolts/anchors complies with specifications Correct placement of anchor bolts/anchors in concrete 	<ul style="list-style-type: none"> Visual Visual Check manufacturer's Conform to drawings Visual Shop drawings Visual Visual (tape measurement) 	<ul style="list-style-type: none"> During specimen collection During concrete placing Upon delivery to site Prior to pouring concrete Prior to pouring concrete during installation Prior to concrete placement Before and after concrete pouring Prior to concrete placement 	<ul style="list-style-type: none"> None None Manufacturer's specifications None Certificates, test reports or other proof of conformity, shop drawings Shop Drawings None None
E. STEEL WORK	<ul style="list-style-type: none"> Materials conform to ASTM Fabrication and erection Connections Tolerances Do specifications of mechanical components meet design specifications? Are mechanical components being assembled according to specifications? 	<ul style="list-style-type: none"> Visual Check supplier's specifications Visual 	<ul style="list-style-type: none"> Periodic during installation Upon delivery to site Periodic during assembly 	<ul style="list-style-type: none"> Certification that work has been carried out in accordance with specifications Manufacturer's operating and maintenance literature Shop drawings Contractors written verification and guarantee
F. MECHANICAL COMPONENTS	<ul style="list-style-type: none"> Do supply electrical components meet design specifications? Are electrical components being assembled and installed according to specifications? Check equipment calibration 	<ul style="list-style-type: none"> Check supplier's procurement document and supplied material and components Visual Test 	<ul style="list-style-type: none"> Upon delivery to site Periodic during assembly Before installation/start-up 	<ul style="list-style-type: none"> Certificate of Acceptance Test results upon successful completion of installation None
G. ELECTRICAL AND INSTRUMENTATION COMPONENTS	<ul style="list-style-type: none"> Site Electrical Service, Instrumentation, Yard Lighting, Grounding, Wiring, etc. 			

TABLE E6.1
 SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS
 OU-3 BIOSPARGE REMEDY
 HOOKER/RUCO SITE
 HICKSVILLE, NEW YORK

<i>Key Work Task Component to be Inspected</i>	<i>Key Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Contractor Submittals to Supervising Contractor</i>
H. BURIED CONDUITS • Depth and Alignment of Excavation	<ul style="list-style-type: none"> • Has trench been excavated to design elevation and line? • Do pipe and fittings meet specifications? • Has pipe been laid to design depth? • Has pipe been damaged or filled with soil during installation? 	<ul style="list-style-type: none"> • Survey • Check supplier's specifications • Visual • Visual 	<ul style="list-style-type: none"> • Periodic during excavation • Upon delivery to site • Periodic during excavation • Periodic during excavation and at end of installation 	<ul style="list-style-type: none"> • Final elevations, grades and alignment • Manufacturer's certification • Elevations • None
<ul style="list-style-type: none"> • Bedding Material • Imported Backfill 	<ul style="list-style-type: none"> • Does bedding material meet gradation specifications? • Does imported backfill meet specifications? • Is stockpile being properly stored and handled? • Does backfill meet gradation specification? 	<ul style="list-style-type: none"> • Check supplier's gradation • Check supplier's specifications • Visual • If backfill is imported check supplier's gradation 	<ul style="list-style-type: none"> • Prior to delivery to site • For each source of material prior to delivery to site • Periodic • Prior to delivery to site 	<ul style="list-style-type: none"> • Grain size distribution curves • Certification and test results • None • Grain size distribution curves
<ul style="list-style-type: none"> • Native Fill • Storage and Handling of Backfill 	<ul style="list-style-type: none"> • Does backfill contain unsuitable materials? • Does native fill contain unsuitable materials? • Are stockpiles free of foreign materials? • Are stockpiles far enough apart to prevent intermixing? 	<ul style="list-style-type: none"> • Visual • Visual • Visual 	<ul style="list-style-type: none"> • Minimum 1 test per 5,000 cu yd of material removed at source • Minimum 1 test per 5,000 cu yd of material removed at source. • Periodic • Periodic • Periodic 	<ul style="list-style-type: none"> • Grain size distribution curves • Certification and test results • None • None • None

TABLE E6.1
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 OU-3 BIOSPARGE REMEDY
 HOOKER/RUCO SITE
 HICKSVILLE, NEW YORK

<i>Key Work Task Component to be Inspected</i>	<i>Key Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Contractor Submittals to Supervising Contractor</i>
I. MANHOLES/VAULTS • Common Backfill • Excavation • Precast Concrete Chambers and Appurtenances • Manhole Frame • Grout • Concrete • Gravel Base • Granular Backfill for Manhole Frames	• See Section H Buried Conduits • Does excavation meet design specifications? • Do manhole frames and appurtenances meeting design specifications? • Does manhole frame leak? • Are manholes installed to grade and plumb? • Does grout meet specifications? • See Section D Concrete Work • Does gravel meet gradation specifications? • Does compacted gravel meet design thickness? • Does granular backfill meet gradation specification?	• Measure layout and depth • Check supplier's specifications • Leakage test • Survey • Check suppliers specification • Check supplier's gradation • Visual (grade stakes) or survey • Check gradation from supplier	• Upon completion • 14 days prior to delivery to site • During installation • During installation • Upon delivery to site • Prior to delivery to site • Upon completion • Prior to delivery to site	• Elevations • Manufacturer's certification • Test results • Final elevations • Certification • Grain size distribution curve • Measurements • Grain size distribution curve
J. MECHANICAL COMPONENTS OF WELLS AND MANHOLES • Do specifications of mechanical components meet design specifications? • Are mechanical components being assembled according to specifications?		• Check supplier's specifications • Visual	• Upon delivery to site • Periodic during assembly	• Manufacturer's operating and maintenance literature • Shop drawings • Confirmation in writing that equipment was satisfactorily tested

TABLE E6.2

SUMMARY OF CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL TESTS
 OU-3 BIOSPARGE REMEDY
 HOOKE/RUCO SITE
 HICKSVILLE, NEW YORK

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Supervising Contractor												
A. Fill	<ul style="list-style-type: none"> Source Quality Control Maximum dry density Liquid Limit/Plasticity Index Grain size analysis Percent Expansion Maximum dry density and optimum water content Relative Density Moisture content Bulk wet density Grain size analysis 	<ul style="list-style-type: none"> ASTM D698 ASTM D4318 (Common Fill) ASTM D422 (Common Fill) ASTM C117 and C136 (Aggregate Types A1 and A2) ASTM D422 (Topsoil) ASTM D2435 (Common Fill) ASTM D698 (Common Fill) - Type A-2 ASTM D4253 and D4254 (Type A-1) ASTM D2216 ASTM D3017 ASTM D2216 (confirmatory) ASTM D2922 ASTM D1556 or D2167 (confirmatory) ASTM D422 (Common Fill) ASTM C117 and C136 (Aggregate Types A1, A2, and A3) 	<ul style="list-style-type: none"> Minimum 1 test per source area Minimum 1 test per source area Minimum 1 test per source area Minimum 1 test per 2000 c.y. Minimum 1 test per 200 c.y. Minimum 1 test per 200 c.y. Minimum 1 test per 200 c.y. Minimum 1 test per 200 c.y. One for every 10 moisture content determinations conducted in accordance with ASTM D9017 Minimum 1 test per 200 c.y. One for every 10 density determinations conducted in accordance with ASTM D2922 Minimum 1 test per 200 c.y. 	<ul style="list-style-type: none"> NA LL <35; PI <12 Maximum particle size per specification Maximum Expansion 1.5% As per specifications Minimum 95% SPD Maximum particle size per MAG 	<ul style="list-style-type: none"> 100 100 100 100 100 100 100 100 100 100 	<ul style="list-style-type: none"> 10 10 10 10 10 10 10 10 10 10 												
							B. Cast-In-Place Concrete	<ul style="list-style-type: none"> Source Quality Control Slump Total air content Compressive strength Bolt tightening 	<ul style="list-style-type: none"> Refer to section 03300, Part 1.2 ASTM C143 ASTM C231 or ASTM C173 ASTM C39 AISC recommendations for turn-of-nut tightening AWS standards for nondestructive testing 	<ul style="list-style-type: none"> Once from floor slab 	<ul style="list-style-type: none"> 3 inches plus or minus 1 inch. 5% plus or minus 1% 4,000 psi at 28 days 	<ul style="list-style-type: none"> 100 100 100 100 100 	<ul style="list-style-type: none"> 0 0 0 0 0 					
														C. Metal Fabrications	<ul style="list-style-type: none"> Bolts Welds Paint Film Thickness 	<ul style="list-style-type: none"> In accordance with AISC standards In accordance with AISC standards In accordance with AISC standards 	<ul style="list-style-type: none"> 100 100 100 	<ul style="list-style-type: none"> 0 0 10

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Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Supervising Contractor
D. Injection Systems • Entire System	• Pressure test	• CGA requirements	• Once. At facility startup		• 100	• Engineer will observe Contractor testing
	• Resistance to ground of system	• Test instrument manufacturer's recommendations • IEEE 142, fall of potential method			• 100	• Engineer will observe Contractor testing
	• Pressure test	• CGA requirements	• Once. After installation		• 100	• Engineer will observe Contractor testing
E. Tanks						
F. Programmable Controllers • Whole System	• Operational testing to verify proper operation and field wiring connections		• Once		• 100	• Engineer will observe Contractor testing
	• Operational testing to verify proper operation and field wiring connections		• Once		• 100	• Engineer will observe Contractor testing
G. SCADA Computer System • Whole System	• Operational testing to verify proper operation and field wiring connections		• Once		• 100	• Engineer will observe Contractor testing
	• Operational testing to verify proper operation and field wiring connections		• Once		• 100	• Engineer will observe Contractor testing
H. Intrusion Detection • Whole System	• Operational testing to verify proper operation	• NFPA 72H	• Once		• 100	• Engineer will observe Contractor testing
	• Operational testing to verify proper operation	• NFPA 72H and local fire department requirements	• Once		• 100	• Engineer will observe Contractor testing
I. Fire Alarm • Whole System	• Operational testing to verify proper operation	• CGA requirements	• Once	• No detectable leaks	• 100	• Engineer will observe Contractor testing
	• Test with piping		• Once		• 100	• Engineer will observe Contractor testing
J. Pipe and Pipe Fittings • Whole System	• Pressure testing	• CGA requirements	• Once		• 100	• Engineer will observe Contractor testing
	• Test with piping		• Once		• 100	• Engineer will observe Contractor testing
K. Valves						

TABLE E6.2
SUMMARY OF CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL TESTS
OU-3 BIOSFARGE REMEDY
HOOKE/RUCO SITE
HICKSVILLE, NEW YORK

<i>Work Task Component to be Tested</i>	<i>Type of Test</i>	<i>Standard</i>	<i>Frequency of Tests per Construction Specifications</i>	<i>Key Acceptance Criteria</i>	<i>Percentage of Test Frequency by Contractor</i>	<i>Percentage of Test Frequency by Supervising Contractor</i>
L. Grounding	<ul style="list-style-type: none"> Resistance of ground to system 	<ul style="list-style-type: none"> In accordance with test instrument manufacturer's recommendations 	<ul style="list-style-type: none"> Once 		<ul style="list-style-type: none"> 100 	<ul style="list-style-type: none"> Engineer will observe Contractor testing
M. Building Wire and Cable	<ul style="list-style-type: none"> Insulation on Cables and wiring sized 6 AWG and higher Resistance between each conductor and ground and between each pair of conductors in a circuit Resistance between motor terminals and ground 		<ul style="list-style-type: none"> Once Once Once 	<ul style="list-style-type: none"> 0.5 megohm phase-to-ground or 1.0 megohm phase-to-phase 0.5 megohm 	<ul style="list-style-type: none"> 100 100 100 	<ul style="list-style-type: none"> 0 0 0
N. Wiring Devices	<ul style="list-style-type: none"> Wall Switches Receptacle Devices GFCI Receptacle Devices Telephone Jacks 		<ul style="list-style-type: none"> Once Once Once Once 		<ul style="list-style-type: none"> 100 100 100 100 	<ul style="list-style-type: none"> Engineer will observe Contractor testing Engineer will observe Contractor testing Engineer will observe Contractor testing Engineer will observe Contractor testing
O. Enclosed Switches	<ul style="list-style-type: none"> Operational testing 	<ul style="list-style-type: none"> NEMA KS 1 	<ul style="list-style-type: none"> Several ON-OFF operations on each switch. 		<ul style="list-style-type: none"> 100 	<ul style="list-style-type: none"> Engineer will observe Contractor testing
P. Enclosed Circuit Breakers	<ul style="list-style-type: none"> Operational testing Verify circuit continuity on each pole in closed position 	<ul style="list-style-type: none"> NEMA AB 1 	<ul style="list-style-type: none"> Several ON-OFF operations on each switch. 		<ul style="list-style-type: none"> 100 100 	<ul style="list-style-type: none"> Engineer will observe Contractor testing Engineer will observe Contractor testing
Q. Enclosed Motor Controllers	<ul style="list-style-type: none"> Operational testing Verify circuit continuity on each pole in closed position 	<ul style="list-style-type: none"> NEMA AB 1 	<ul style="list-style-type: none"> Several ON-OFF operations on each switch. 		<ul style="list-style-type: none"> 100 100 	<ul style="list-style-type: none"> Engineer will observe Contractor testing Engineer will observe Contractor testing

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<i>Work Task Component to be Tested</i>	<i>Type of Test</i>	<i>Standard</i>	<i>Frequency of Tests per Construction Specifications</i>	<i>Key Acceptance Criteria</i>	<i>Percentage of Test Frequency By Contractor</i>	<i>Percentage of Test Frequency By Supervising Contractor</i>
R. Dry Type Transformers	<ul style="list-style-type: none"> • Production testing 	<ul style="list-style-type: none"> • NEMA ST 20 			<ul style="list-style-type: none"> • 100 	<ul style="list-style-type: none"> • Engineer will observe Contractor testing
S. Lighting	<ul style="list-style-type: none"> • Operational testing • Measure illumination levels 				<ul style="list-style-type: none"> • 100 • 100 	<ul style="list-style-type: none"> • Engineer will observe Contractor testing • Engineer will observe Contractor testing

Notes:

- * - Minimum criteria, unless identified otherwise
- NA - Not Applicable
- AISC - American Institute of Steel Construction
- ASTM - American Society for Testing and Materials
- ANSI - American National Standards Institute
- ASME - American Society of Mechanical Engineers
- EPA - United States Environmental Protection Agency
- NEMA - National Electrical Manufacturer's Association
- NFPA - National Fire Protection Association