



Construction Philosophy

CO₂ Capture – BOD & Tender Specifications

AEB Amsterdam

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Abbreviations

Abbreviation	Definition
AEC	Afval Energie Centrale / Waste to Energy Plant
AWP	Advanced Work Packaging
CWA	Construction Work Area
EPC	Engineering, Procurement and Construction
FEED	Front End Engineering Design
FO	Fibre Optic
HRC	Hoog Rendement Centrale / High Efficiency (Power) Station
HSE	Health Safety & Environment
ISBL	Inside Battery Limit
JB	Junction Box
LMRA	Last Minute Risk Assessment
LV	Low Voltage
MCP	Motor Control Panel
MOF	Material Off Loading Facility
MTO	Material Take-Off
OCAP	Organic CO ₂ for Assimilation by Plants
OSBL	Outside Battery Limit
PAR	Pre-assembled Piperack
QA/QC	Quality Assurance/Quality Control
QMS	Quality Management System
RAMS	Risk Assessment Method Statement(s)
RCU	Remote Control Unit
SPA	Safe Plan of Action
U/G	Underground
W/H	Warehouse

1 Introduction

1.1 Project AURORA Definition

AEB Amsterdam is a waste processing company located in the Netherlands and currently owned by the City of Amsterdam. AEB is one of the largest waste processing plants in Western Europe processing over 1.4 million tonnes of waste every year. The AEB Amsterdam site has two (2) waste incineration units namely the AEC (Afval Energie Centrale) and the HRC (Hoog-Rendement Centrale). Waste is incinerated in these two facilities to combinedly generate electric power and heat to be supplied to the public grid and the district heating network respectively. The flue gases resulting from the incineration process are at present directly exhausted to atmosphere through 6 flue gas lines by the AEC (4 joint flue gas line lines) and HRC (2 joint flue gas lines) main stacks.

AEB Amsterdam has the ambition to realize a post-combustion CO₂ capture (incl. CO₂ conditioning) plant (PCC Plant) as part of the AURORA project to capture 507 kt (kilotons) of CO₂ annually from about 38% (mass basis) of the total flue gases of the HRC and AEC units.



Figure 1-1 AEB waste incineration plant (source: internet/public domain)

The captured CO₂ shall be in principle delivered in gaseous form to a backbone (OCAP) for further transport and possible storage/utilization. However, an additional CO₂ liquefaction plant could also be installed to deliver liquid CO₂ to nearby greenhouses. For the previous phase of project development, various pre-FEED activities have been completed for the CO₂ capture project and AEB Amsterdam is currently in the tendering process for a FEED/EPC contract.

The key elements of the AURORA project:

- CO₂ Capture Plant and a CO₂ Conditioning Unit, overall called *PCC plant* to deliver gaseous CO₂ to the OCAP Grid (backbone) or to a potential onsite CO₂ Liquefaction Plant.
- Potential CO₂ Liquefaction Plant including Liquefaction, Storage, Truck Loading and Evaporation to deliver either liquefied CO₂ to Greenhouses or gaseous CO₂ (regasification) back to the OCAP Grid.
- All physical interfaces between the new CO₂ Capture Plant, CO₂ Conditioning Unit, CO₂ Liquefaction Plant, and the existing AEC and HRC installations.

1.2 Plot Location/Layout

The AEB Amsterdam waste incineration plant is located in the Westpoort area of Amsterdam, The Netherlands (Coordinates: 52° 24'01" N, 4° 47'27" E). The site mean elevation is +1.4 m above NAP (Nieuw Amsterdam Peil).

Figure 1-2 below shows the location of the existing HRC, AEC units and the proposed area for the PCC plant at the existing AEB Amsterdam site. The main flue gas stacks for the HRC and AEC plants are also shown. Layouts of flue gas lines in Block 10 (L11, L12) and Block 20 (L23, L24) are in principle mirror of each other.

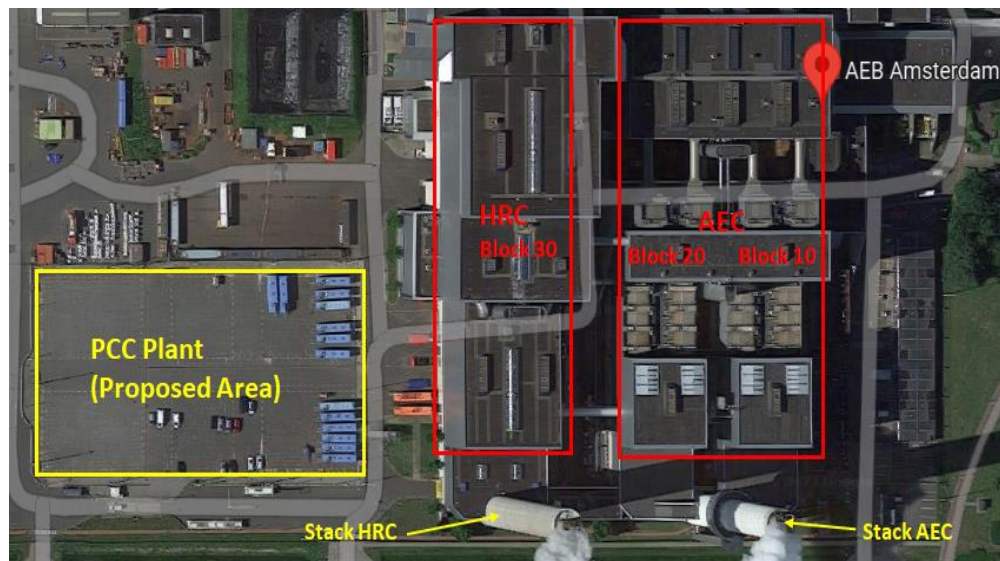


Figure 1-2 Plot Layout HRC, AEC and PCC plant

1.3 Objective of this Document

The objective of this document is to outline a feasible path of the construction execution strategy for project Aurora.

The current construction execution strategy assumes the combination of pre-modularization, pre-fabrication (pipe racks, piping spools, insulation elements etc.) and a stick-build construction method.

Advanced work packaging (AWP) is considered as a path of construction to ensure the safest and most efficient way of construction execution with the intention to meet the highest level of quality assurance.

This Construction Philosophy defines the scope of work, methods, interfaces, and responsibilities required to execute, control, and manage the expected construction works for the AURORA project in the next project phases. In this respect, this document further outlines roles and responsibilities of involved parties in the safe execution of it.

2 Assumptions & Approach

It assumed that what currently seems to be an open available space suitable for temporary facility area located at the West off AEB Premises (across the Oostzeeweg Road) and owned by Bio Energy Netherlands will NOT be available as well as there will NO opportunity to transport the modules via this area.

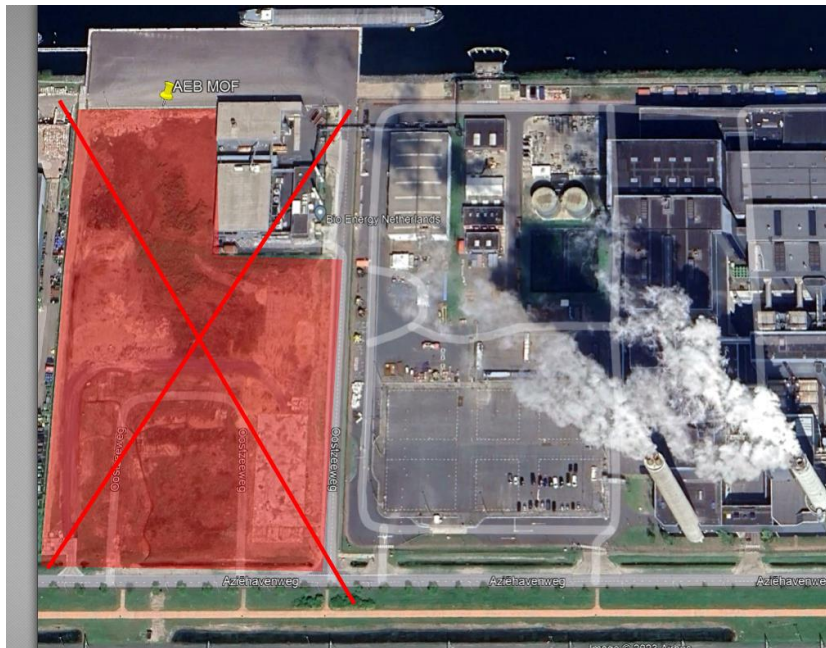


Figure 2-1 Assumed non-availability of adjacent premises Bio Energy Netherlands

It is further assumed that:

- The PCC plant scope is considered to be pre-modularised to the best of its practical ability.
- Improved MOF (Material Off Loading Facility) located North of Bio Energy Netherlands area, will be accessible and will be utilised for the receipt of the modules and thereafter transportation to site via North-West Corner of the Oostzeeweg Road.
- The security Fence line opposite to the current warehouse shall be modified e.g., relocated closer to the warehouse in order to create a wider "transportation envelope" for the purpose of getting the modules and major equipment transported to the project location (see sketch below).
- The pipelines and pipe bridge supporting it shall be re-modified e.g., raised higher to facilitate "Transportation Window" for modules transportation (see Figure 2-2).
- An additional area required for the temporary staging will be available at the TMA Logistics approximately 5 km west of AEB facilities.



Figure 2-2 Required modifications to existing Pipe Bridge

- The current execution philosophy splits the Project in to TWO phases i.e., that the Brown Field scope could be and shall be carried out whilst the modules being prefabricated elsewhere. In that case, the actual PCC plot will be utilised as a temporary facility area to support this PHASE and thereafter downsized and relocated to the vacant area which is currently being used as bunded water storage (or any other alternative area within the AEB premises). These PHASE I works shall be completed, and the main PCC plot shall be ready (piling scope) and 'off the ground' intime before the modules' delivery dates. In summary (refer also to Figure 2-3):
 - **PHASE I** – Early Works, Modification works within the existing AEB area (Brownfield)
 - **PHASE II** – Construction works within Green Field (PCC Plant Scope)

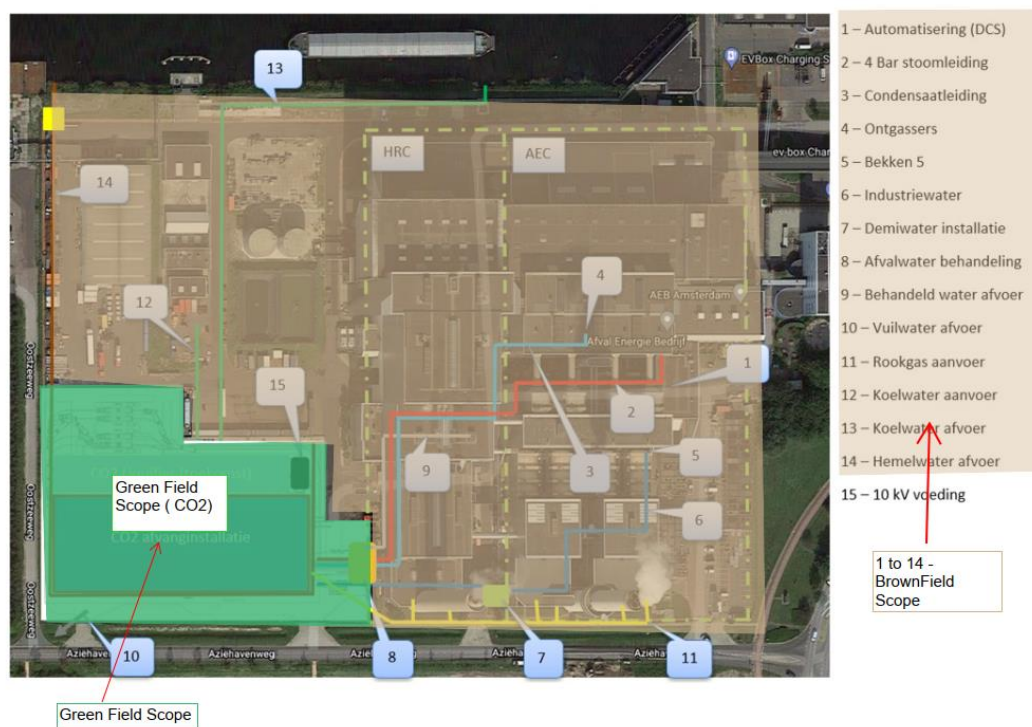


Figure 2-3 Scope split into two phases (Brown Field and Green Field)

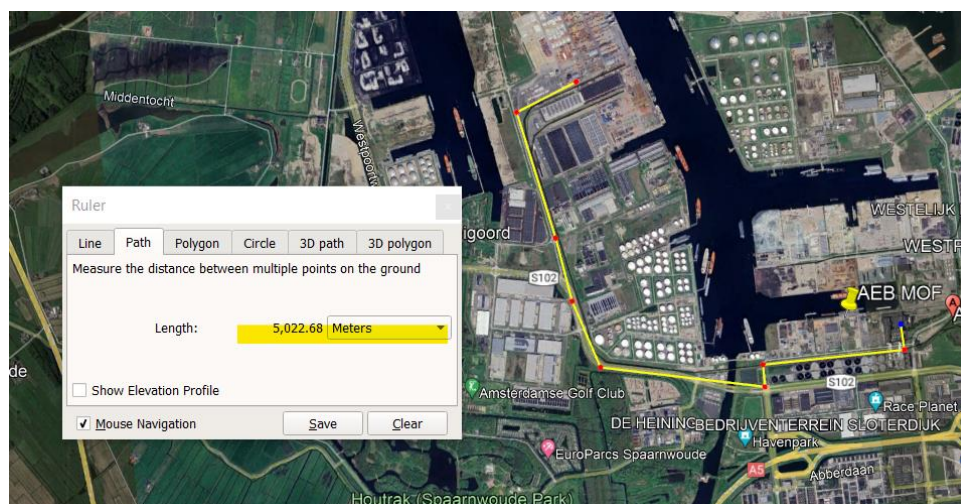


Figure 2-4 TMA Logistics Area



Figure 2-5 Transportation route from MOF to Site and required fence relocation line near W/H

2.1 Scope of Work

2.1.1 Civil

- Pre-digging
- Site clearance
- Piling
- U/G works
- Foundations installation at site
- Pre-cast of the concrete foundation and its elements off site
- Landscaping
- Roads
- Final clean up

Contractor shall be responsible for the water management during the excavation works while the excavations are still open.

2.1.2 Structural

- Most of the structural scope is associated with the off-site pre-fabrication of the modules, skids, and PARs.
- Scope to include main structures, sub-structures, grating, staircases, vertical access ladders and the likes
- Temporary transportation/shipping steel shall also be included in the structural scope and will be subject to removal after safe erecting at site.
- Temporary shipping steel shall be painted in a different to the main structure colour clearly thus identifying it. If there will be no interface or clashes with any permanent piping or equipment, then the temporary steel can be left in its place to minimize the additional work. Client to verify.

2.1.3 Piping

- Installation of all piping material straight length and prefabricated spools
- Installation of all supporting (including anchoring)
- Execution of Tie-in points according Tie-in list to be developed in due course
- Installation of special piping parts like bellows, spring supports, etc.
- External painting of piping and supporting
- Insulation of piping and equipment
- Installation of all steam tracing, when applicable
- All testing (hydraulic, pneumatic) of piping
- Installation and connection of safety showers
- Rigging and alignment of Mechanical Equipment
- Installation of all Shims and levelling plates for equipment installation
- Perform all required Mechanical Completions actions

2.1.4 Mechanical

- Installation of all static and rotating equipment
- Performing all necessary alignment tasks/checks followed by its functioning testing
- Functional testing
- Preservation if and where required

2.1.5 Electrical

- Installation of the above ground cabling
- Installation of U/G cabling, trays, and conduits
- Installation of the power and control cabling
- Installation of the electrical tracing and all JB's associated with this scope
- Grounding and lightning protection
- Installation of the control stations
- Termination the equipment cabling and its testing
- Connection & testing of Power, Lighting & Control cables UNDERGROUND
- Pre-commissioning works e.g., loop testing
- Installation of the lighting within the plant and around the perimeter (street lighting)

2.1.6 Instrumentation

- Installation and connection of all LV cabling
- Installation and connection of grounding cables, bars, rods, etc.
- Installation and connection of lighting
- Installation and connection of junction boxes (Electrical)
- Installation and connection of Heat Tracing on Instruments
- Installation and connection of RCUs & MCPs
- Installation and connection of power outlets
- Installation and connection of emergency stops & local control boxes
- Installation and testing of all off-line instruments
- Installation testing of all in-line and on-line instruments
- Calibration of instruments Ex: Level Transmitters – Radar.
- Installation of all main- and secondary cable tray
- Installation and connection of all instrument cabling and tubing; FO cable and tubing for underground run
- Installation and connection of air hook-ups
- Installation and connection of air manifolds
- Installation of junction boxes (Instrumentation)
- Installation of name labels on instruments, housings, and junction boxes
- Initiation of inspection by third party
- Pre-commissioning test packages
- Testing

2.2 Permit to Work

The overall construction work will be divided into two sub-work areas, the "ISBL-Green field" and the existing "OSBL- Brown Field" Areas. It is important to mention that the Green-field area (PCC Plot) will be fenced off and an electronic badging system is to be installed, thus securing the site from the unauthorized entry as well as to have an efficient way for a "head" count in the event of an emergency.

2.2.1 Permit for Green Field (ISBL)

Considering that the 'green field' construction area situated in the proximity to the live plant, AEB Operations shall formally release the area before the start of each shift to the Contractor. Release of the area to the Contractor is a highly important safety precaution to ensure that the 'green field' is free of operational AEB risks, and that Contractor has full control of the construction area.

After the 'green field' release, Contractor will have a full access to the work areas under the valid Contractor's work permit(s) in accordance with the HSE procedure in section "Permit to Work". At the end of the working shift once the site is cleared from all involved operatives, Contractor's supervisor (HSE or Other Discipline) shall lock the gate and inform of such to AEB's general foreman (or the designated person in charge).

Exceptionally, the AEB work permit shall be used for following works:

- Excavations deeper than 1.20m
- Entrance into confined spaces
- Hot works within the Confined space

2.2.2 Permit for Brown Field (OSBL)

All works within the 'brown field' will be subject to AEB Permit to work. Also, in that case RAMS and the SPA (formerly known as LMRA) are required.

2.2.3 Working Hours

Construction working hours are based on working weeks of 40 hours per week. The work will be executed during normal 5x8 hours per week. Overtime and work during the weekend, if necessary, should be discussed and approved by AEB operations in advance (at the minimum 48 hours).

- Current working hours are: 7:00-16:15 (TBC)
- AEB safety shop opening hours: 06:00 – 18:00 hrs (TBC)
- AEB Material Delivery: (TBC)

Special working overtime needs to be discussed in advance between Contractor and the AEB project team members.

2.2.4 Construction Management

To provide an adequate support during the execution of the Construction works, Contractor is to set up a site office. Considering the previous experiences of the similar size projects and considering the hybrid construction execution approach, the below provided Organization Chart represents a typical set of the site-based project team.

It is important to mention that representation of Contractor's Construction Team at the selected fabricator premises e.g., fab-yard or, as a minimum, regular visits should be considered. Hence, an additional function should be incorporated into the org-chart at a later stage.

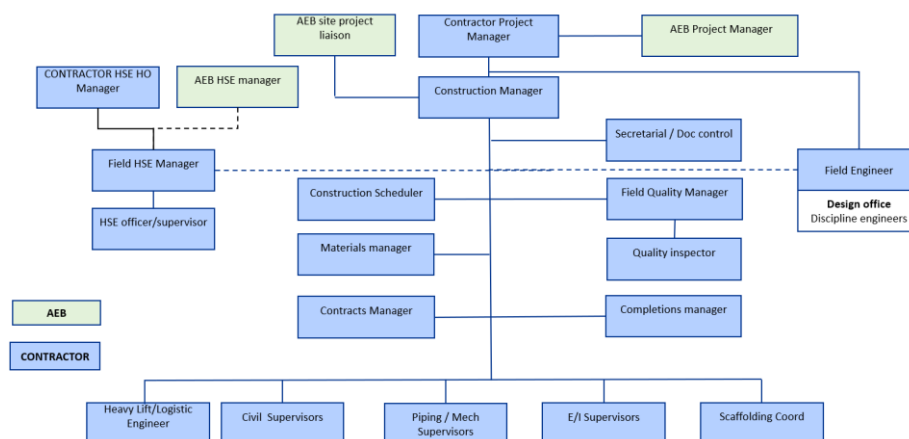


Figure 2-6 Typical line-up of a site-based project team

3 Health Safety & Environment

3.1 Objectives

The objectives of the project safety, health, and environmental program are to:

- Protect the lives and health of all employees of Contractor, AEB and visitors who are involved in AURORA Project.
- Protect the environment,
- Prevent damage to property, materials, supplies and equipment and to avoid process loss / delay as a potential impact caused by such damages.
- Maintain Company's reputation

All involved personnel working on the project are to ensure that activities which are within their range of expertise and responsibility will meet or exceed the project health, safety, and environmental requirements as outlined in the HSE plan and lead to achievement of the project objectives in these areas.

3.2 HSE Philosophy

Contractor shall emphasise and implement HSE aspects during the design, construction, and operation. Safety will be addressed by the following and not limited to:

- Addressing HSE issues during the design phase,
- Ensure that HSE is addressed and followed whilst on company travel and during the site visits
- Implementation and maintenance of an extensive safety program on the construction site.

Contractor standing firm in believing that incidents are preventable through commitment, following the procedures, participation, and cooperation of all involved parties, such commitment outlined below and should not be limited to:

- Taking actions that reduce both the likelihood of an accident as well as the consequences of an accident.
- Compliance to applicable regulations, permit conditions, recognized, and generally accepted good engineering practices.
- Proposing "inherently safer" design solutions where possible (i.e., eliminating hazards rather than controlling them with active safeguards or administrative procedures).
- Issuing clear and concise instructions.
- Providing adequate resources.
- Compliance with the project safety program standards and procedures.

It is a mandatory obligation to report any incidents, no matter how small or "insignificant" it may seem, thus, to learn from it and to ensure that preventable measure and actions are applied in the future.

Potential problem areas should also be reported in HSE Alerts, with the objective of avoiding future incidents. In addition, near misses shall also be reported. Lessons learnt

through analysis of incident investigations will be performed to provide input for future activities.

3.2.1 HSE Plan

For the HSE requirements on this project refer to the Safety Engineering Plan & File doc. no. 416041-47990/G.06/005. Contractor to revisit and develop.

3.2.2 Construction Safety Risks

The following safety risks during construction require special attention:

- Brown field scope activities (work within the live plant)
- Working at height
- Working with or near a potentially polluted soil
- Critical / complex lifts
- Confined spaces
- Exceptional hot work
- Multiple contractors working in one area
- Specialist contractors
- Multiple small lifts
- Adverse weather conditions

3.2.3 Fire & Gas Warning System

Gas detection systems shall be installed when and where required. Such requirement shall be stipulated in the working permit. AEB will provide Contractors with gas detection equipment (TBC).

When an alarm is given the work shall be stopped, equipment turned off, and the plot shall be cleared.

3.2.4 Existing Hazardous Contamination

It was mentioned by AEB that there is a likelihood of potential ground contamination. Ground pollution examination shall be considered and carefully analyzed for the purpose of establishing the appropriate safeguards before "breaking" the ground and handling of the disposable excavated contaminated ground.

3.2.5 Safety Limitations & Work Permit System

The work areas shall be fenced off where possible to indicate that construction works are being performed and special warning signs to be placed when and where is required. Contractors must consider that the AEB facility is in regular operation and therefore the permit to work system shall apply (brown field areas).

AEB Operations might stop or limit the construction activity(s) due to safety hazards should such deemed necessary.

Should the entry into confined space(s) deemed necessary, "Manhole Watches" will be required and will be supplied by AEB operations (TBC). The HSE plan provides a clear description of the term "Confined Space" and the safety measure to be considered and follow. A permission "voor besloten ruimtes" will require a separate permit.

3.2.6 Interaction with Other AEB Works

During the execution of the construction activities, it is foreseen that other AEB project(s) and/or maintenance activities might take place. AEB is to notify and to coordinate in a timely manner of such interfaces.

Contractor shall be involved in those type of coordination meetings to pro-actively plan the work for safe and efficient execution.

3.2.7 Operational Assistance

It is foreseen that in some instances, AEB Operations might require some support e.g., mechanical or piping specialist assistance etc.

If such help will be deemed required, AEB Operations will inform Contractor in a timely manner to plan and facilitate the manpower. It is important to notice that the main scope of the work is a priority. If assistance will be requested then it will be considered as secondary priority and will be dealt with accordingly.

4 Temporary Construction Facilities

4.1 Offices & Temporary Facilities

The assumption is made that no suitable temporary construction area is available within close vicinity to support the execution of the Project simultaneously (BROWN field and GREENFIELD Scopes of work). Taking such constrain into consideration it is has been envisaged that from the practical and cost-effective approach the overall scope has been split -up in to two phases:

- PHASE I - Brownfield (Modifications within live plant and the Cooling Water Scope)
- PHASE II - Green Field (PCC Capture Plant)

To support the execution of the Brown Field works (PHASE I), the current Car Park area and later PCC capture plant plot (Fig. 3-1) shall be used for the purpose of the establishing adequate temporary facilities. During this phase the laydown area and temp facility area will be allocated within the AEB premises. The Project Temporary Facilities shall include the following:

- Office Space for AEB and CONTRACTOR Project indirect office space inc. meeting rooms and kitchen area(s)
- Sub-Contractor's In-direct office space
- Changing facilities for direct labour
- Canteen area
- Shower facilities
- Toilet

It is currently estimated that total number of direct labours for this phase ONLY will reach approx. 50-70 men at peak. Rough estimation based on the piping spools prefabrication and pre-modularization strategy.



Figure 4-1 Designated Temporary Facilities Area

It is assumed that AEB will negotiate the rental of the laydown area within the TMA Logistics Premises for the purpose of the temporary storage/staging of the major equipment and the modules as they will arrive prior to its installation for the PHASE II PCC plant scope.

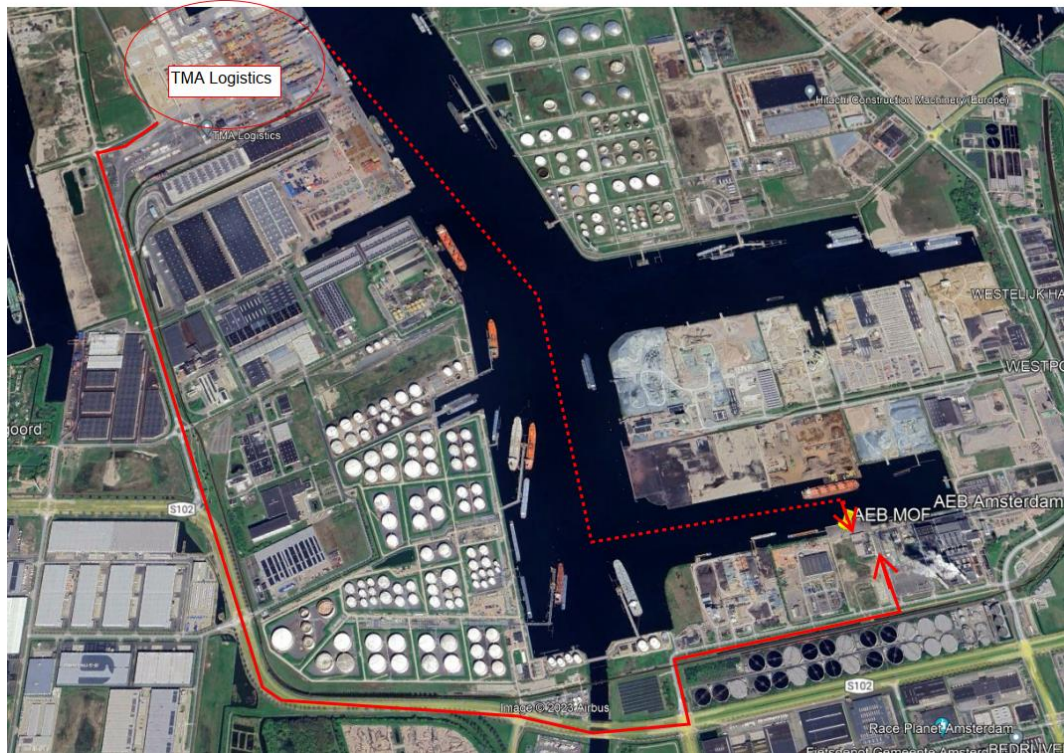


Figure 4-2 Modules Staging Area (TMA Logistics)

4.1.1 Consumables & Utilities

Temporary Facilities Utility Connection(s)

The temporary facilities will require the below utilities which are to be established and connected:

- Power
- Internet Connection
- Drinking Water
- Sewer Connection
- Waste collection (different types for recycling segregation and regular replacement)

AEB is to provide tie-in points for the power and water supply; Contractor is to ensure the connections are carried out in the safe manner.

- Connections points / tie-ins will be supplied by Contractor/AEB. Construction Contractor(s) to carry out the actual connections to the facilities.
- Construction Contractors to connect and install the required internet distribution network to the consumers.

Contractor shall be responsible providing their own Internet / LAN connections, required office furniture inc. computers, copy machines and any other required electronic supply

Utilities within Construction Area

Contractor to install the required distribution network to his consumers such as working air; power to welding machines etc. Contractor should be fully self-supporting i.e., welding diesels, air compressors to be included in the scope of supply of the Contractor.

All equipment like generators, compressors etc. must be low noise types.

All utilities e.g., diesel, petrol, compressed air, and the likes shall be supplied by the Contractor excluding hydro-test and demin water which will be supplied by AEB. Disposal of hydro-test water is permitted in the sewer system after permit has been granted.

Sufficient lighting will be provided by CONTRACTOR for the contractor areas, construction roads and the general lighting within the construction site. Contractors are responsible to provide sufficient lighting at their work locations.

4.1.2 Waste Disposal

Waste containers will be installed close to the construction area, the final location to be determined at later stage. Waste shall be segregated per type, e.g., wood, steel, paper etc. It is Contractor's responsibility for correct segregation, disposal and timely replacement once filled up.

4.1.3 Car Parking

Car parking is established at the designated area located outside the AEB's Contractor Gate entrance.

4.1.4 Construction Roads

Within the PCC main construction plot, a one-way traffic system shall be implemented to maintain safe and smooth traffic movements.

4.1.5 Transport Route Materials and Equipment Supplies

AEB's Material Delivery Gate/Entrance point shall be used for the deliveries of the equipment and material delivered by road and NOT to exceed allowable weight and height.

Any delivery of the oversized equipment or material(s) shall be discussed and approved by the project prior to the delivery being sanctioned. Transportation and Logistic Plan has outlined the alternative routes for such deliveries.

4.1.6 Personnel, Transportation, and Registration

Contractors shall arrange transportation for their own personnel and any potential sub-contractors working directly for them to/from the temporary facility area to the designated work location(s) i.e., minibuses, bicycles.

4.1.7 Project Warehouse

It is assumed that 50% of the existing Warehouse will be available to support the project. However, if the warehouse would not be available or deemed not suitable e.g., not practical for long term storage, inadequate size etc., then the Contractor shall consider to establish an alternative Warehouse at the TMA Logistics premises.



Figure 4-3 Existing Warehouse location

4.1.8 Smoking Area

Smoking is not permitted at site nor anywhere within the AEB facilities. Smoking free policy applies to AURORA Project

4.1.9 Transport Route Materials and Equipment Supplies

All material and equipment will be delivered at:

- Australiëhavenweg 21, 1045 BA Amsterdam, The Netherlands.

4.1.10 Emergency Escapes for Emergency Services

The existing emergency escapes routes and procedure already established within the AEB premises will be utilized; no special additional arrangements will be necessary required.

4.1.11 Position of Heavy Equipment

As a part of the Construction execution Strategy, the PCC Plant shall be considered as pre-modularised to the best of its practical ability. Hence, the use of the heavy lifting machinery is foreseen during the installation of the modules and major equipment.

The actual position and size of the crane(s) shall be determined at the later stage once the weight of the modules/skids and PARs are finalised.

For heavy lifts a separate lifting plan will be made, which will outline the exact location and the crane capacity inc. all necessary rigging details and arrangements.

Temporary closure of roads must be discussed with all relevant parties and the requirements shall be discussed and implemented in close cooperation with AEB's traffic management department.

4.1.12 Intermediate Storage of Hand Tools, Equipment, etc.

The distance between the Contractor Facilities and the Construction Site requires an intermediate storage facility (steel containers) close to or at the Construction Site. Contractors shall provide fit for purpose storage facilities as part of their scope. Location(s) are to be discussed and agreed upon at the later stage.

4.1.13 Intermediate Location Temporary Toilet Facilities

It is a necessary requirement to provide a mobile toilet unit fitted up with hand washing basin(s) at site location. e.g. Dixies and/or a bigger WC unit at the later stage (once the manpower will gradually start increasing).

5 Quality

Quality Performance is the direct responsibility of everyone working on the project. It is the intention that the Project Team Members refer to the Construction QA/QC Plan during the preparation and the execution phases of the project.

Contractor, subcontractor(s), vendors etc. are to implement and adhere to Contractor's Quality Management Systems and to ensure that their provided services do meet the acceptance criteria.

- QMS : Must be announced by Contractor's QA/QC
- QA : Must be announced by Contractor's QA/QC

Specifics and an in-depth overview of the Contractor's QA/QC management practices shall be outlined in the Project Specific Quality Management Plan.

6 Construction Execution Sequence

6.1 Construction Work Area Breakdown Review

For the more efficient and cost-effective execution of the Project, a CWA/AWP philosophy has been applied. Such philosophy involves the method of "breaking up" the project into a multiple smaller size area.

The AWP approach is designed to have a close control during the engineering phase, MTO quantification, procurement and later during the actual construction management and execution phases.

The following Construction Work Area breakdown is proposed:

- 1) PCC Capture Plant
- 2) PCC Conditioning Unit
- 3) PCC Liquefaction Plant
- 4) Flue Gas Stack Tie-in
- 5) Primary Cooling Water Intake, Supply and Return
- 6) LP Steam Supply and LP Condensate Return
- 7) Industry Water & Potable Water Supply
- 8) Flue Gas Condensate Treatment Plant
- 9) Demin Water Unit (DWU) and Supply
- 10) Fire Water, Wastewater, Surface water
- 11) Rainwater Collection and Discharge
- 12) Heat Integration
- 13) IA System
- 14) Electrical Power Supply
- 15) DCS and IPS Integration
- 16) Chemicals & Consumables

6.2 Construction Sequence

On a high-level, the sequence of the planned construction activities is per the following:

- 1) PHASE I (Off -Site)
 - a) Prefabrication of the Modules and PAR's
 - b) Piping Spools pre-fabrication
- 2) PHASE I (On -Site)
 - a) Establishing of the On-Site Temp Facilities to support PHASE I (main PCC Plot)
 - b) Execution of the Brown field Tie- ins and Modifications (Items 1 – 14, Fig.)
 - c) Demobilization of the PHASE I Temp. Facilities
 - d) Ground Contamination/Pollution survey
 - e) Site preparation PCC Plot (Greenfield Scope)
 - f) Piling
 - g) U/G Civil and electrical works

- 3) PHASE II
 - a) Installation of Modules and PAR's
 - b) Installation of major equipment, skids.
 - c) Integration and field hook up to the installed modules/skids
 - d) OSBL tie-ins

During the construction execution of the project the works will be executed on basis of normal sequencing construction progress. This means that construction is following a logical special building sequence to prevent blockages and considerable reworks.

When the progress reached a stage of approximate 60%, the work approach will shift from this bulk progress to system completion, this to meet the planned hand over sequence and to meet the project milestones.

The start on the above ground facilities will follow finishing the preparation works for temporary construction roads, building of temporary facilities and utilities and underground civil activities such as drainage, fire water, earthing, electrical cable installations and other possible excavation works.

6.3 Site Preparation

6.3.1 Pre-Digging

The project will take care for pre digging conform the requirements for new construction works locations as handed over by Contractor's engineering.

Pre digging for verification the presence of underground obstacles in the new plot area's is required well in advance the start of the construction activities.

6.3.2 Removal of above and underground obstacles

Contractor shall investigate and take care that all above and underground existing obstacles as present on the new construction plot will be removed prior the start of the construction activities.

Re-location of existing obstacles, if required, will be executed, and coordinated by Contractor.

6.3.3 Presence of Soil Pollution

Soil pollution is probably present in minor quantities at the new facility in the form of hydrocarbons. The pollution on the plot is probably minor and it has a preference not to remove these materials from the site.

The Ground Investigation survey has been carried out by AEB, and the report will be shared with Contractor. Contractor to revisit and confirm.

Provided that pollution will not exceed the allowable thresholds, it is still important to follow safety rules and procedures in case the small traces of redundant hydrocarbons can still be found. In this case the subcontractor (s) will immediately stop all related works and inform CONTRACTOR and AEB with the findings.

6.3.4 Piling

Piling is foreseen for all new foundations. A schedule shall be developed in close co-operation with the piling contractor to minimize the impact for AEB Operations of the adjacent AEB live facility. Such approach will also important and maximize the efficiency of the piling contractor.

6.3.5 Foundations

Excavation works for foundations will be executed in a controlled manner this to avoid any further large open areas which create unsafe situations, risks of falling and flooding in case of heavy rainfall.

Prior arrival of the equipment, a dimensional check of the foundations with anchor bolting is essential this to avoid double handling of equipment erection. At all excavated locations there is hindrance from groundwater.

Small size foundations, water drainage and/or oil drainage concrete channels shall be pre-casted to ease the construction work in-situ.

6.3.6 Underground Sewers, Drainage

The installation of the required underground fire water systems and drainage systems will be executed before the foundations installation in the same area. This is to avoid large open trenches and blocking the access.

The principle of the U/G works is to excavate and to install the lowest services first moving "upwards" towards the top of the ground elevation. Thus, to ensure and to avoid repetitive excavations and to disturb the already installed U/G services/elements

6.3.7 Paving and Gravel Finishing

Straight after the backfill activities are finished in a specific area, the start for application gravel should commence for creating a safe, clean working area and resulting in the basis for supporting structures on the paving.

All underground works shall be finished including the testing; painting, wrapping and all necessary checks shall be completed and verified by Contractor before the backfilling can start.

6.4 Steel Structures and Pipe Racks installation

6.4.1 Prefabrication

All steel structures will be prefabricated and painted to the maximum extent at the pre-fabrication facilities. The preassemblies e.g., Modules, PARs and any other steel structures shall be prefabricated to its maximum extent followed by offsite testing with the intention to carry out only hook-up and a minor site installation scope at site

6.4.2 Steel Works

The installation of the Structural Steel can be carried out in two separate scopes/methods: the Module /PAR steel and the "Stick build" steel areas.

6.4.3 PAR Steel

The prefabrication, and assembly of the PAR steel is part of the PAR contractor scope of work. The PARs should be trail fitted, painted, PFP or insulation where applicable and all pipework hydrotested at the modular fabrication facility. All remaining/remedial works at SITE should be limited to final closing welds, field welds painting, PFP, insulation and touch ups in localized areas.

All cable trays should be installed on the pipe racks with only the final jointing rack between PARs outstanding. This will facilitate cable pulls installation without the need for substantial scaffolding erection (Access towers only). Grating within the PAR's and between cable trays shall also be installed to minimize scaffolding requirements.

6.4.4 Stick Build Steel

It is foreseen that not all the structures/piping will be pre-assembled and therefore will require installation at site. It is in the current construction execution philosophy to minimize the site erection activities to a minimum extent.

6.4.5 Platforms / Cage Ladders / Pre-dressing

Modules /Skids and the PARs shall be pre- dressed up to its maximum extent with the view to avoid the potential additional work to be carried out at site. This to include all access platforms, Staircases, gratings, and the likes to be installed at the pre-fabrication facilities.

6.5 Piping

6.5.1 PAR Piping

The prefabrication and installation of the lines is done at the PAR contractor's shop. Piping shall be installed, tested, cleaned, traced, and insulated, including all supports.

6.5.2 Stick-build Piping

In the process area and the connecting rack area the piping shall be installed as a "stick-build", rack loading will start once sufficient steel is erected, piping installation in the process unit will start once there is sufficient nozzle availability.

Stick build erection of the piping within "brown -field areas including the placement of the piping on the top of the existing structure shall be carried out as a "stick – build".

6.6 E&I Works

6.6.1 Lighting Installation

At the new Unit and where newly installed equipment is erected also new lighting will be installed. This will be orientation lights connected to buildings or structures and light poles. Emergency lighting is only foreseen inside building and on the outside of the buildings.

6.6.2 Grounding Installation

Structure foundation reinforcement is connected to the new ring/mesh grounding station. New ring/mesh grounding system shall be connected to the existing plant ground grid.

6.6.3 Heat Tracing Installation

Many of the process lines have electrical tracing applied. The heat tracing cabling will be installed underground up to the junction box from separate heat trace cabinets. From there the heat tracing cable will follow the pipeline, equipment, or instruments. As from the moment piping has been tested and painted heat tracing works can start. It is eminent that the test systems in the piping discipline and the heat tracing systems can be grouped together i.e., that it is known which heat trace systems apply to which piping test system enabling correct releasing of systems to the next disciplines. Also, special care and measurements are required for ascertaining that insulation screws will not penetrate and cause the damage to the heat tracing cabling.

LV Cabling to the consumers will be partly in a concrete trench where a combined trench is used for instrument cabling and electrical cabling. In this trench one site will be for installing multiple electrical cable trays and the other site will be for multiple instrument cables. The above ground cabling will be following as much as possible the piping routing and is conventional cable trays and cabling.

Contractor's Civil shall prepare road crossing's pipes where the cables can be pulled trough.

6.6.4 Cabling

The main principle is to install multicore cables inside the units to the junction boxes close by the instruments. From the junction boxes single core cables will be pulled in overhead

cable trays to the instruments. The multicore cables will be installed underground in trenches. Further the cabling will run above ground in conventional cable trays following the piping routing in east west direction. Installation of these works will be performed by the E&I contractor.

6.6.5 Modules, Skids and Pre-assembled Racks (PAR)

It is assumed that Modules, Skids and PAR's will be prefabricated off site and delivered to project site by water utilizing the local offloading facility.

The design of the modules and skids shall be based on the philosophy to fit-it within the available 'transportation envelope' and no to exceed maximum road width of up to 20 meters (assuming that 20 meter in width will be the maximum available space after the fence relocation at the North -West Corner of Oostzeeweg Road.

It is important to mention that transportation "window" shall be verified to reflect the potential late changes, newly erected structure(s), or other potential obstacles inc. street lightings and safety signage.

6.7 Transport and Lifting of the PAR's

It is the scope of the CONTRACTOR to transport, install and hook-up the Modules and PARs. In an early phase CONTRACTOR, Modules Pre-Fabricator Contractor and AEB will work together to develop the safest and efficient method of the PAR's installation. Transport and lifting methods will have influence on the steel design and therefore must take place in an early phase. Steel for some PARs is subjected to "tandem" lifts and assigned as critical, meaning the "tail lifting" crane will be required. For the critical lifts the crane study shall be evaluated by a CONTRACTOR's Subject Matter Expert.

6.8 Painting

Painting will be subcontracted by the piping contractor for piping and supporting, by the steel subcontractor for the steel works and by the E&I contractor for the E&I works.

Painting up to and including the final paint layer application is foreseen to execute in the piping / pipe supports prefab shops and equipment supplier shops, this due to the controlled conditions for paint application at the prefab shop.

On all pipe spools the prefab welds should be taped off for visible inspection during leak and pressure testing. (Primer is allowed, to be verified by AEB)

All pipe supports will be completely painted.

Touch up painting on the construction site is required on the taped off piping field and shop welds locations after hydro testing including the touch-up occurred due to construction installation damages. A procedure must be developed in close cooperation

with the paint supplier to assure that the paint system will be upheld also at the spots where the initial paint systems are damaged.

Care shall be taken to apply the correct paint system on site and the required controlled conditions.

On process piping above ground and underground systems different paint systems will have to be applied. This will be indicated on the isometrics. The piping subcontractor will have to coordinate the physical separation of systems during pre-fabrication and installation and touch up painting activities

6.9 Insulation

Pre-fabrication of insulation sheeting for piping systems and equipment is required to the maximum extend at supplier's shop, this to minimize field hours and congestion and maximize the quality of the work.

It is assumed that the insulation to the equipment, piping within the skids and modules will be carried out at the fab yard. Only the balance of the insulation which could not be 100% completed at the fab yard(s) shall be transfer to the site installation scope.

7 Mechanical Completion & System Handover

7.1 Mechanical

In this phase no specific discussions have been held on the Mechanical Completion, Pre-Commissioning, Hot/Cold Commissioning, Start-Up requirements and sequencing.

Definition of MC, Pre-Commissioning, Hot / Cold Commissioning, Performance Test, Trial runs and Stable Operation need to be defined in the next phase of the project.

Basis of current schedule and estimate is that pre-commissioning is included in the MC estimate and schedule. Durations and estimate of commissioning and start-up are benchmarks.

Organization of commissioning and responsibilities between AEB and Contractor are also an important decision to be made during the next phase of the project.

Early next phase of the project the start-up sequence needs to be determined so construction, procurement and engineering can focus on the right priorities.

Note: Critical Requirements Below

- Confirm Completions/Commission System Pre-Project Start up
- System – Sub-System MC1 Handover Strategy
- Duration of initial Pre-com, (Hot and Cold) Commissioning and Start-up
- Handover system
- Organization of Commissioning
- Start-Up Sequence
- Performance Tests
- Trial run and stable operations
- Process insulation (according CINI standards)
- Winterizing
- Noise insulation

IMPORTANT: Do not delete this section break



Appendix A

Preliminary Desktop Study Logistics & Route



Appendix B

SMPT Description



Appendix C

General Arrangement



Appendix D

SARENS Reference

