Sea Water Piping Upgrade Project

Brownfield project execution challenges

Speaker : Muhammad Bilal Muhammad
Section Head, Plant Project

29th November 2022

Overview

Table of Contents

- ❑ Introduction To Sipchem Sea Water System
- ❑ Project Driver
- ❑ Project Scope & Execution Challenges
- ❑ Project Execution
  - Timeline
  - Challenges
  - Optimization for TAM Window
  - Pre-TAM Scope
  - TAM Scope
- ❑ Project Completion – A Success Story
- ❑ Q & A

Sipchem Sea Water System

Introduction & Schematic

Sipchem utilizes sea water for meeting cooling requirements by indirect heat exchange of Cooled Sea water and Plant Cooling water.

The facility for cooled sea water is being used by three companies

- AL WAHA Petrochemical (Subsidiary of Sipchem)
- Arabian Amines Company (Sipchem's neighboring company)
- Sahara & Ma'aden Petrochemical Company (JV of Sipchem)

Each user has their own set of equipment to exchange heat between cold Sea water and hot cooling water from their plant.

Sipchem Sea Water System

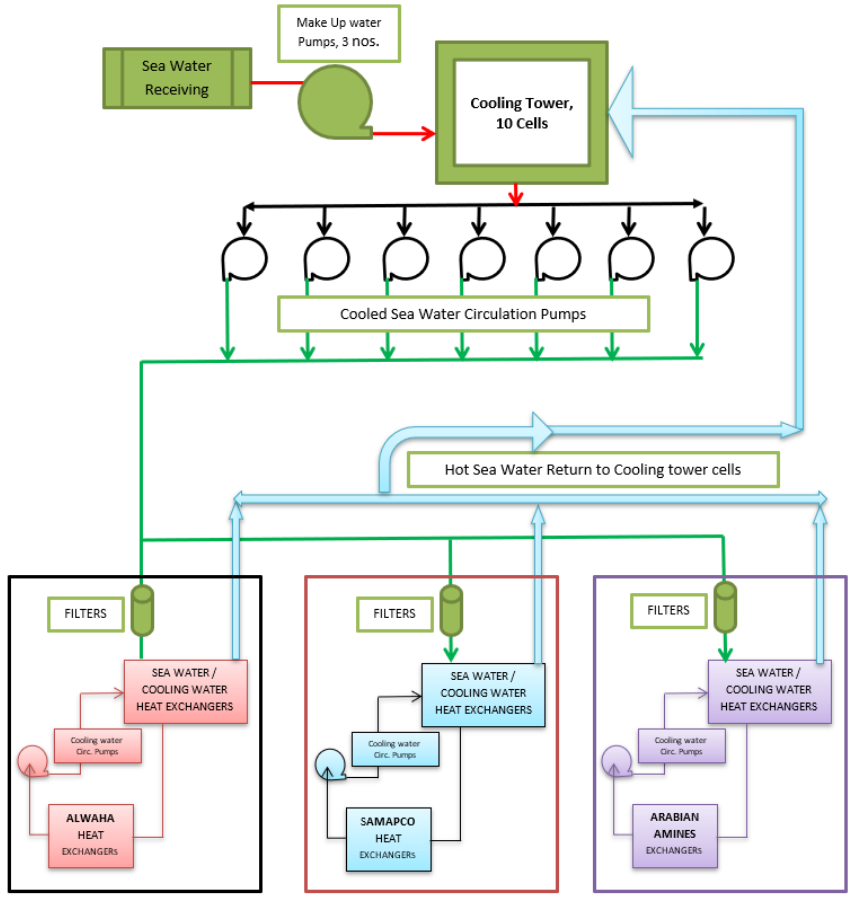
Introduction & Schematic

Sipchem utilizes sea water for meeting cooling requirements by indirect heat exchange of Cooled Sea water and Plant Cooling water.

The facility for cooled sea water is being used by three companies

- Al Waha Petrochemical (Subsidiary of Sipchem).
- Arabian Amines Company (SIPCHEM's neighboring company).
- Sahara & Ma'aden Petrochemical Company (JV of Sipchem).

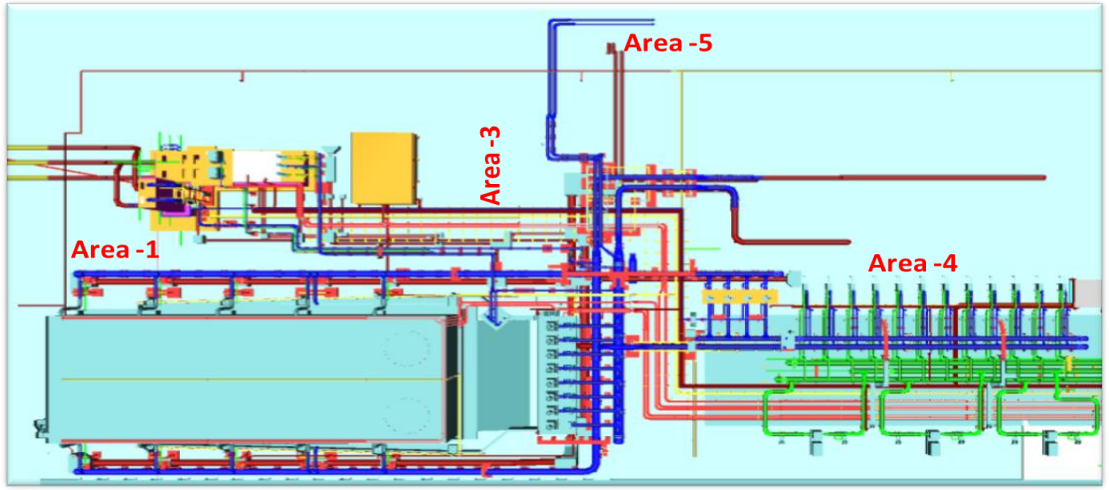
Each user has their own set of equipment to exchange heat between cold Sea water and hot cooling water from their plant.



Sipchem Sea Water System

System Characteristics & Layout

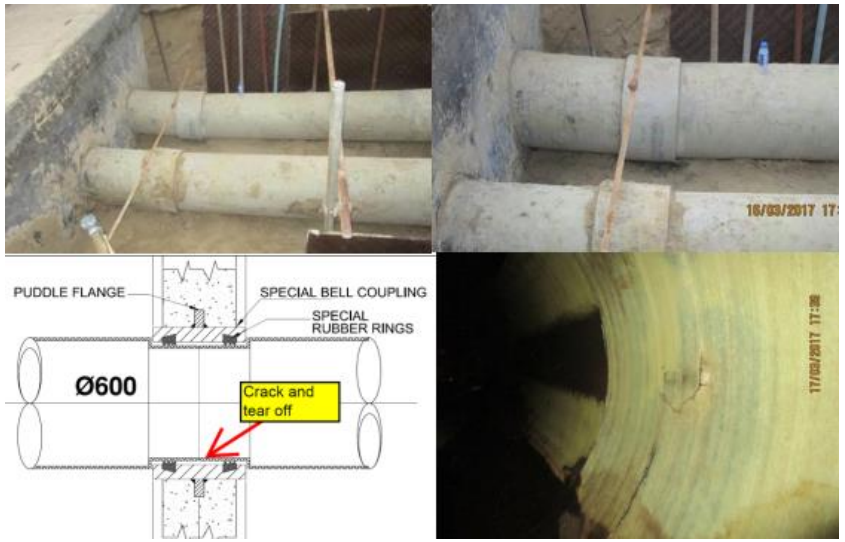
- Piping Material - Glass Reinforced Plastic (GRP).
- Design/Operating Pressure: 8/4 Bar.
- Piping diameter range 24”- 88”.
- Underground piping at 5 Meter depth.
- UG Piping Joints - “Coupling Type”.
- Thrust blocks at joints and elbows.
- Sea Water Circulation rate - 6000 to 18000 M3/Hr.



Project Driver

History of Failures

- Frequent failures of underground joints at different locations.
- Leak observed at the coupling joints specifically at/or near the thrust block.
- Impact on plant production to all three users, as repair procedure for identifying underground leaks and implementing corrective action consumed a lot of time.
- Sample typical failure is shown in picture.



Project Driver

Root Cause Analysis

Findings of the RCA were;

- Huge flow rate causes big thrust and shocks to piping system particularly during startups and sudden power failures.
- Repair procedure utilized to arrest these leaks are internal/external lamination, which has resulted in making this piping network more rigid and suspectable to further leaks.
- The coupling joint O-rings can accept 1° to 2° of articulation of the joint. More than this deflection, joint can start leaking when subjected to mis-alignment .
- Recent soil analysis revealed that;
    - UG piping was laid on loose soil, which didn't provide uniform support to whole length. Once leakage starts, either minor or major, it again causes disturbances to soil support which aggravates the situation.
    - Underground water table is quite high which causes differential settlements of loose soil. This causes additional strain on GRP piping which already has lower mechanical strength compared to Metal piping.

Recommendation of RCA was;

- Upgradation of sea water piping system with new above ground design and implementation ASAP.

Project Scope & Execution Challenges

Scope of Work

- New Piping system design with Surge & Stress Analysis (~ 2,500 Meter Piping).
- Support structure design for above ground piping.
- Associated Civil/Instrument/Electrical works.
- Demolishing of existing piping network.

Execution Challenges

- Upgrade required long plant outage, which is not economical option as Sea water network is shared.
- Alternative piping route for above ground piping and its integration with existing equipment.
- Engagement of competent EPC contractor.
- Segregation of Pre-TAM & TAM Scope.
- Alignment with Sipchem planned timeline for TAM and completion of Pre-TAM Scope.
- Interface & Risk Management while field execution in Pre-TAM & TAM.

Project Execution - Timeline

Past Milestones

- Project started on September 2018, with initial plan to complete in March 2019 TAM.
- Due to business requirement TAM had to be preponed to November 2018.
- Risk assessment was done and then this project was deferred to next TAM opportunity in 2022 with status of 70% completion progress.
- EPC Contractor with its Sub-Contractors de-mobilized in March 2019.

TAM 2022 Execution Plan

- EPC Contractor re-engaged in June 2021.
- Contractor & Sub-Contractor mobilization scheduled for November 2021.
- Pre-Tam Activity Scheduled for 3 Months from 15-November-2022 till 15th February 2022.
- TAM Activities Schedule for 22 Days, scheduled from 15th February 2022.

Project Execution – Challenges

EPC Contractor & Sub-Contractor Management

- Project timeline while integrated to planned TAM 2022 mandated EPC Contractor & Its Sub Contractors availability.
- Ensuring resource availability as Project scope required huge number of skilled manpower for lamination activities.
- Covid-19 impact on contractor's procurement activities and resource sourcing.
- On-field availability of multiple sub-contractors as per project execution plan.

Pre-TAM Scope Field Execution

- As alternative route for new piping system, pre-TAM scope was massive including civil works for new foundation, support structure works, Pipe laying, Lamination, hydrotesting etc.
- Ensuring readiness for TAM Scope.

Project Execution – Challenges

Optimization of TAM Window

- With scheduled 22 Days for TAM scope, Sea Water Upgrade project was on critical path. While other TAM activities were near critical path.
- Keeping in view of SIPCHEM business requirement, TAM team optimized their activities to maximum of 15 days.
- SIPCHEM Management mandated project team to review optimization of TAM timeline for this project, from 22 days to 15 Days.

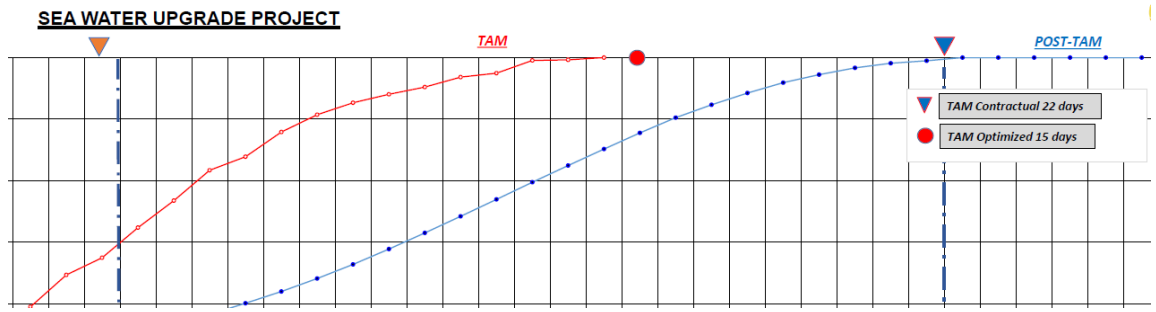
Project Execution – Optimization of TAM Window

Brainstorming & Activity Sequencing

- Operations team supported the idea to early handover partial scope prior to TAM, as cooling tower 4 cells can be isolated one by one, while plant is in operation.
- EPC Contractor reviewed and confirmed readiness to accommodate this additional scope in Pre-TAM.
- Following activities shifted to Pre-TAM and completed in January 2022;
  - 4 Cooling Tower cells (out of 10) associated piping.
  - 4 Pipelines replacement on the associated Exchangers.
  - Back wash 10” Pipeline replacement.

Optimized TAM Schedule

- TAM window optimized to 15 days & Portion of S-Curve after the activity is pasted below.



Project Execution – Pre TAM Scope

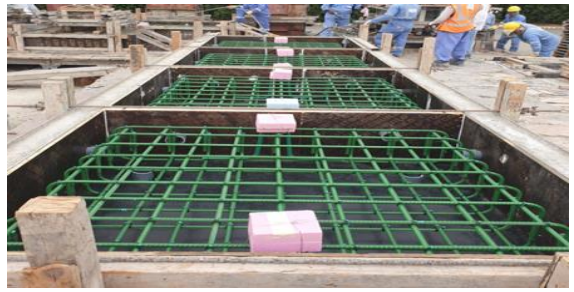
Expediting Activities

- Optimization of Lamination activities;
  - 227 out of 323 Joints completed in Pre-TAM, with 96 Remaining for TAM scope.
  - Impact reduced the piping erection activities of approximately 4 days.
- Replacement of all existing corroded bolts on Tie-in points before TAM. This reduced the dismantling time from 60 hours to 36 hours (3 shifts).
- Flange connection have been executed and torquing verified in advance. This reduced the piping erection activities of approximately 48 hours (2 shifts).
- All new instruments calibrated in Pre-TAM. This avoid any stand-by time due to instrument availability.

Project Execution – Pre TAM Scope

Expediting Activities

- Design of balance foundation modified as pre-cast and executed in field. This avoided any impact on piping erection activities.
- All remaining spools for lamination were measured, cut and beveled before TAM. This reduced the piping erection activities of approximately 2 days.
- All required material, bolts, gaskets, spools, etc. were placed near erection site prior to start of TAM. Avoiding any material movement during TAM.



Project Execution – TAM Scope

Interface Management

- Multiple interfaces working in the same area and required extended coordination with Operations, Maintenance, Security and Contractors.
- Cranes movement and mobilization was challenging as it required extensive involvement with TAM team working in same area.
- Old underground pipelines Concrete pouring activity presented unique challenge of high numbers of vehicle movement from in/out of plant.

Project Completion

A Success Story

- Timely & Safe completion of Pre-TAM & TAM Scope for massive scope of work for Piping/Civil/E&I Works.
- Project Execution with 200,000+ Safe Manhours.
- Complete Sipchem Sea Water network for three affiliates upgraded to new design, with minimum impact on plant operating time.
- Project execution schedule adjusted for TAM preponement in 2018 and aligned with TAM 2022 execution timeline.
- TAM Scope Schedule optimized to 15 days from 22 days original plan.
- Extensive interface management between Project team, Operations, TAM & Security Team.
- Contractor & Sub-Contractor management for resource availability and execution, covering COVID-19 period as well.

Q & A

Open Discussion

THANK YOU

here, there EXCELLENCE everywhere