

Rio Tinto



Additional Electrode Boiler Project

Basis of Schedule

Project Number

IOC: W051218

SNC: 682228

Document Number

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Additional Electrode Boiler

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Issue Codes: RC = Released for Construction, RD = Released for Design, RF = Released for Fabrication, RI = Released for Information, RP = Released for Purchase, RQ = Released for Quotation, RR = Released for Review and Comments.

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1.0 INTRODUCTION

The purpose of this project is to increase the overall capacity of the Steam Plant to make it possible to process the increased concentrate throughput expected because of the Flotation Plant Capacity Increase Project.

The Basis of Schedule (BoS) outlines the development of the Execution schedule for IOC's Additional Electrical Boiler Project. It also identifies the assumptions, constraints, exclusions, special conditions, development methodologies and structure that is utilized in the preparation of the Execution schedule.

2.0 KEY MILESTONES

Key Milestones	Start	Finish
NTP Issued	05-Dec-22	
Start Detail Engineering	05-Dec-22	
Project Management & Controls	05-Dec-22	23-Feb-26
Start Construction/Demolition 2023	03-Apr-23	
Complete Detail Engineering		09-Feb-24
Start Construction/Demolition 2024	26-Feb-24	
Temporary Water Treatment Skids in Service		09-Apr-24
Start Construction/Demolition 2025	24-Mar-25	
Finish Construction/Installation		30-Sep-25
Commissioning Deaerator and Boiler Completed - Ready for Operation		27-Oct-25
Demolition Start - 2025	11-Nov-25	
PROJECT COMPLETION		29-Jan-26

3.0 PROJECT DESCRIPTION AND SCOPE OF WORK

RT/IOC intend to reduce the carbon footprint at the Labrador City Operations. To this end a 40MW Electrode Boiler is going to be installed to displace the use of Bunker C oil currently used for two oil fired boilers. In addition, the new boiler will augment the current steam generating capacity to support recently implemented projects aimed at increasing production.

The project consists of five (5) separate, non-interacting construction sub-projects:

1. Steam Plant
 - o Replacement of filters and softeners;
 - o Replacement of flash Tank and heat recovery exchanger;
 - o Staged demolition work to remove the existing deaerator, flash tank, heat recovery exchanger, filters and softeners, chemical dosing system, brine system and miscellaneous piping;
2. 46kV transmission line;
3. 46kV switchyard

- Demolition of existing structures to make room for the switchyard;
- 46kV to 13.8kV stepdown transformer with supporting equipment and control room; and
- The 13.8kV cabling from the switchyard to the new E-room;
- 4. New Steam Plant building extension
 - The extension is stick-built;
- 5. E-room
 - E-room is also stick-built;
 - Once the necessary steel work has been erected the extension and E Room can proceed independently of each other.

4.0 EXECUTION STRATEGY

The Steam Boiler project will be executed by the Engineering, Procurement and Construction teams with the following considerations:

- Engineering will provide the following deliverables:
 - SOW documents for contracts awards;
 - SOW documents for procurement quotations and tendering;
 - Construction work packages.
- Multiple contracts will be used for site construction in 2023, 2024 and 2025.
- Transmission line will be a separate contract for materials supply and site installation.
- Roof steel reinforcement and cable tray supports (required for the cabling from the 46kV Switchyard to the extension) will be awarded to a Structural Steel Contractor.
- Procurement will be a joint effort of Rio Tinto Procurement who will be doing the contracting and purchasing award and SNCL who will handle all technical aspects of procurement as well as contract management, expediting, etc.
- The procurement packages are as below:

Sr. No	Engineering Package Number	Procurement Package Number	Package Name
1	EMNA-400	PMNA-400	40MW Boiler
2	EMNC-401	PMNC-401	Deaerator
3	EMSL-400	PMSL-400	Flash Drum
4	EMSL-401	PMSL-401	Heat Recovery Exchanger
5	EMNL-400	PMNL-400	Crane
6	EMNL-401	PMNL-401	Sump Pumps
7	EMNF-404	PMNF-404	Raw Water Treatment
8	EENH-501	PENH-501	Medium Voltage Gas Insulated Switchgear.
9	EENH-502	PENH-502	Low Voltage MCC, VFD and Low Voltage Harmonic Filter Capacitor Bank
10	EENH-503	PENH-503	UPS, DC Battery and charger, panels, etc.
11	EMNH-404	PMNH-404	HVAC
12	EPYJ-500	PPYJ-500	46kV / 13.8kV Stepdown Transformer
13	EPYJ-501	PPYJ-501	Switchyard equipment

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14	EGYG-100	PGYG-100	Temporary Water Treatment Skid
15	EZSL-600	PZSL-600	DCS
16	EZSL-601	PZSL-601	PLC
17	EZSL-602	PZSL-602	PSVs
18	EZSL-603	PZSL-603	On/Off Valves and Control Valves
19	EEYJ-503	PEYJ-503	Modular 46kV SWY E House
20	CCYL-300	PCYL-300	Structural Package for Roof and Wall Reinforcement 2023
21	CDNB-300	PDNB-300	Civil and Concrete 2023
22	CGNL-800	PGNL-800	Extension Steel Contract 2024
23	CGNL-800	PGNL-801	General Construction Contract Mechanical, Electrical and I&E 2024
24	CGYJ-800	PGYJ-800	46kV SWY 2025
25	CPYK-501	PPYK-501	46kV Transmission Line 2024
26	CGSL-400	PGSL-400	Tie-Ins Fabrication and Installation and 18in reroute 2023
27	CLYJ-400	PLYJ-400	Demolition for 46kV SWY 2023

5.0 SCHEDULE DEVELOPMENT PROCESS

The Steam Boiler EPCM Schedule is a Level 3 schedule prepared in Primavera P6 Professional Cloud version R20.12 using the critical path method (CPM) with various levels of detail for different purposes in the project environment.

The schedule will be updated as necessary to include the latest adjustments to activity descriptions, logic, and duration's necessitated, material deliveries, and finalized commitments.

The schedule development process commenced with the identification of scope of work from the contract documents and execution strategy.

The schedule is developed using top-down approach with inputs, feedback and reviews by SNCL project team. Engineering Manager and Discipline Leads contributed to defining the engineering scopes, key dates, deliverables and cross discipline logic. The schedule integrates the engineering, procurement and construction through sequencing along a logical network using Critical Path Method (CPM) and Primavera P6.

The schedule duration has been estimated after consideration of the logical restraints on the engineering, procurement and construction activities. Engineering durations estimated by the engineering deliverables and information on manufacture lead times and delivery durations are from the bids received during the feasibility study. Construction activities duration estimated by SNCL construction team, also integrated with existing facilities and weather condition.

6.0 SCHEDULE ASSUMPTIONS

Following assumptions applies to the schedule:

- Steam Boiler execution schedule is scheduled to start the detail engineering on 05-Dec-2022;
- Construction starts on 03-Apr-2023;
- Permits will be received as required;
- Regulatory constraints will be incorporated into the schedule as required;
- Weather and seasonal conditions have been considered

7.0 WORK BREAKDOWN STRUCTURE

The high-level schedule WBS is as follows :

Layout:None		WBS Name
WBS Code		
-	682228-CUR	682228 Steam Boiler Execution Schedule
+	682228-CUR.MS	Milestones
+	682228-CURShutdown	Shutdowns
+	682228-CUR.ENG	Detail Engineering
+	682228-CUR.PROC	Procurement Packages
+	682228-CUR.CONTR	Contracts
-	682228-CUR.CON2023	Demolition / Construction
+	682228-CUR.CON2023.1	General
+	682228-CUR.CON2023.2	Switchyard Demolitions and Civils - 2023
+	682228-CUR.CON2023.3	Extension Construction - 2023
+	682228-CUR.CON2023.4	Existing Steam Plant - 2024
+	682228-CUR.CON2023.5	Extension Construction - 2024
+	682228-CUR.CON2023.6	Mechanical Equipment Pre-Com and Commissioning
+	682228-CUR.CON2023.7	Flash Tanks and Heat Exchangers
+	682228-CUR.CON2023.8	Extension Electrical Equipment Installation
+	682228-CUR.CON2023.9	Transmission Line
+	682228-CUR.CON2023.10	Switchyard - 46 kV Substation
+	682228-CUR.COMM	Commissioning
+	682228-CUR.3	Demolition

8.0 ENGINEERING SCHEDULE

Engineering provides the scope of work to support the award of the construction contracts and IFI/IFQ equipment packages for tendering. The contractors/vendors data will be incorporated into the detail engineering for issuing construction work packages.

The deliverables review processes will follow the standard revision steps:

- PA – Issued for internal review;
- PB – Issued for client review;

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- IFC/Rev. 00 – Issued for construction.

The key engineering milestones are shown here:

Engineering Deliverables	Date
Civil Engineering Completed	20-Apr-23
Process Engineering Completed	26-Jul-23
Conduct HAZOP/LOPA	02-Aug-23
Piling Engineering Completed	02-Aug-23
Electrical Engineering Completed	29-Aug-23
Architectural Engineering Completed	29-Aug-23
Steel Engineering Completed	06-Sep-23
Piping Engineering Completed	13-Sep-23
Concrete Engineering Completed	12-Oct-23
I&C Engineering Completed	16-Oct-23
Layout Engineering Completed	26-Oct-23
Mechanical Engineering Completed	09-Feb-24

9.0 PROCUREMENT SCHEDULE

The procurement activities are planned according to the following steps:

- Prepare and Issue RFP
- Tender Period
- Technical Bid Evaluation
- Commercial Bid Evaluation & Client Approval
- PO Issued
- Obtain Vendor Data and Approved
- Manufacturing
- Delivery at Site

The duration for each step follows SNCL standard durations. The lead times are based on quotation from vendors or the best practices.

The equipment/material deliveries are planned as below:

Equipment Deliveries	Date
Receive Temporary Water Treatment Skid at Site	27-Jun-23
Receive PLC at Site	18-Dec-23
Receive PSVs at Site	18-Dec-23
Receive On/Off Valves and Control Valves at Site	18-Dec-23
Receive DCS at Site	20-Dec-23

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Receive Saturation Tanks SUEZ at Site	21-Feb-24
Receive HVAC at Site	18-Mar-24
Receive Water Treatment SUEZ at Site	18-Apr-24
Receive Boiler at Site	01-May-24
Receive Deaerator at Site	12-Jun-24
All Vendor Data Received	08-Aug-24
Receive Flash Tank at Site	13-Sep-24
Receive Heat Exchanger at Site	13-Sep-24
Receive Chemical Tanks & Pumps SUEZ at Site	02-Dec-24
All Equipment Packages Bids Received	13-Dec-24
All Construction Packages Bids Received	13-Dec-24
All Equipment Packages Awarded	13-Dec-24
Receive UPS, DC Battery, Panels at Site	18-Dec-24
Receive LV MCC, VFD, Harmonic Filter, Cap Bank at Site	20-Dec-24
All Construction Packages Awarded	24-Jan-25
Receive 46kV / 13.8kV Stepdown Transformer at Site	20-Jun-25
Receive Modular Control Room at Site	03-Jun-25
Receive Switchyard Equipment at Site	04-Jun-25
Receive Medium Voltage GIS at Site	05-Jun-25

10.0 CONSTRUCTION SCHEDULE

The construction schedule is based on the scope of work and construction sequence. The activity durations are estimated by SNCL project construction team.

The weather conditions are a significant consideration in the construction schedule. As such, major construction activities are scheduled in spring/summer/fall time.

11.0 NETWORK LOGIC

Network logic was developed with the input from discipline leads. Efforts were made to use FS logic as much as possible. There are still some uses of SS and FF relationships with lag time to reflect more realistic work logic. No constraints were used for contractual deadlines.

No negative links (lead or negative lag) were used in the schedule logic to comply with the Scheduling Best Practice Guidelines. A lead or negative lag indicates that a successor activity can start before its predecessor activity is complete.

12.0 CALENDAR

A 5 x 8 hrs/day (w/ holidays) calendar is assigned to engineering and procurement activities. It is based on 8 hrs/day Mon–Fri (standard five days per week) considering official Canadian holidays.

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13.0 ACTIVITY ID AND ACTIVITY CODES

To facilitate sort capability with layout presentation within P6, the following activity codes were established in P6:

- Area
- Phases
- Discipline
- IOC EWP package
- IOC procurement package
- Document number

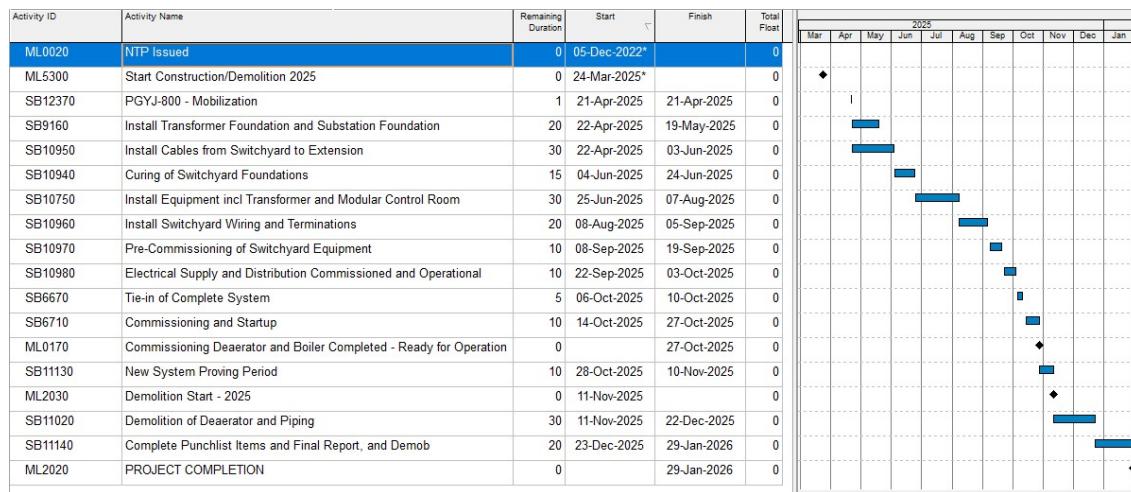
The Activity Codes will be further detailed during the development of the schedule.

14.0 RESOURCE LOADING

The direct hour from the Class 3 estimate will be loaded onto the schedule at a later date.

15.0 CRITICAL PATH

The critical path to Project Completion runs from the mobilization of the contractor after the thaw in April 2025, through installation of foundations, which allows for installation of the electrical equipment, leading to achieving permanent power:



This is a reasonable critical path, with no lags along it and only Finish-to-Start relationships.

16.0 SCHEDULE RISK ANALYSIS AND SCHEDULE CONTINGENCY

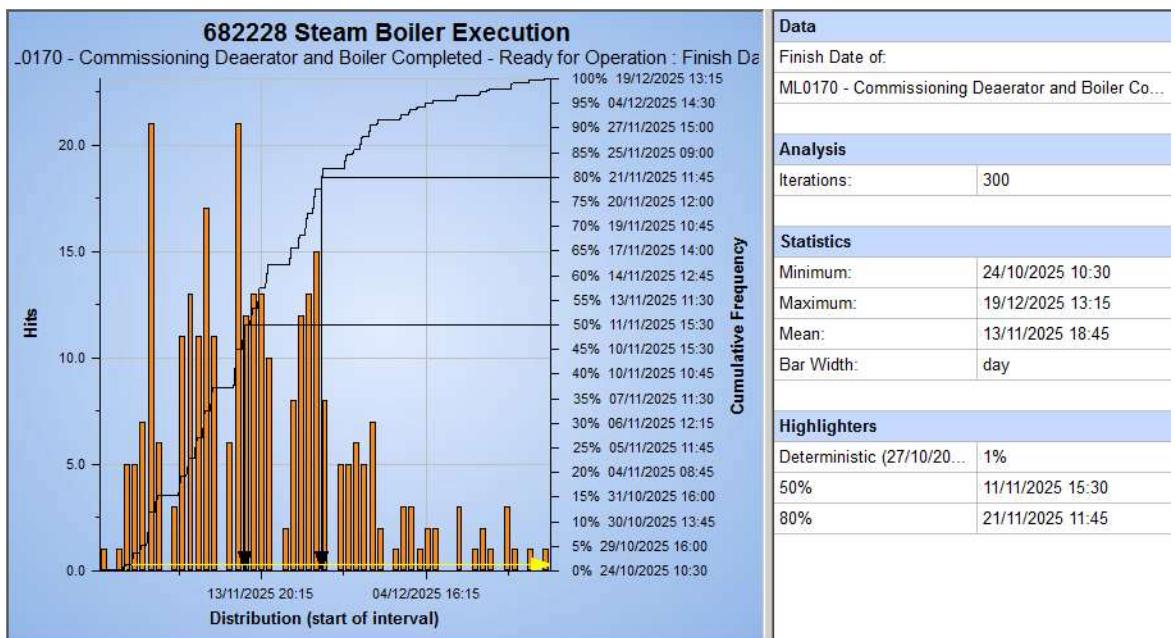
A Monte Carlo analysis was performed using the following duration uncertainty template, which was established by the project stakeholders:

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Templated Quick Risk								
Field	Value	Tasks	Distributi...	Min	Likely	Max	Correlati...	Description
682228 SRA Codes	= 1ENGEN	155	Triangle	90%	100%	115%	75%	Engineering - General
682228 SRA Codes	= 2ENGCON	89	Triangle	95%	100%	120%	75%	Engineering - Conc/Steel
682228 SRA Codes	= 3ENGELE	30	Triangle	95%	100%	125%	75%	Engineering - Electrical
682228 SRA Codes	= 4PROC	226	Triangle	85%	100%	110%	75%	Procurement
682228 SRA Codes	= 5FABMEC	9	Triangle	100%	100%	115%	75%	Manufacturing/Fab - Mechanical
682228 SRA Codes	= 6FABELE	10	Triangle	100%	100%	105%	75%	Manufacturing/Fab - Electrical
682228 SRA Codes	= 7SHIP	20	Triangle	100%	100%	125%	75%	Shipping
682228 SRA Codes	= 8SHIP2	0	Triangle	100%	100%	135%	75%	Shipping - Potential Overseas
682228 SRA Codes	= 9SURV	1	Triangle	95%	100%	105%	75%	Survey Works
682228 SRA Codes	= 10GEO	2	Triangle	95%	100%	120%	75%	Geotech Works
682228 SRA Codes	= 11CTV	12	Triangle	95%	100%	115%	75%	Civil Installation
682228 SRA Codes	= 12SA	14	Triangle	95%	100%	125%	75%	Concrete/Steel/Arch/Trays/Cabling/Instru. Installation
682228 SRA Codes	= 13MPEI	29	Triangle	95%	100%	120%	75%	Mechanical/Piping/Elec Installation
682228 SRA Codes	= 14TIE	4	Triangle	100%	100%	100%	75%	Piping Installation - Tie-ins
682228 SRA Codes	= 15COMM	12	Triangle	95%	100%	110%	75%	Pre-Commissioning/Commissioning

Here is the resulting histogram showing P-scores for the 'Ready for Operation' event:



This shows that our target date of October 27, 2025 is a P1, meaning low likelihood of achieving. We see that the P50 date is about 2 weeks later on November 11, 2025, and a P85 on November 25, 2025.

This is 4 weeks of contingency to get to the P85 date, which is a conservative amount of buffer on a critical path that is 10-months long.

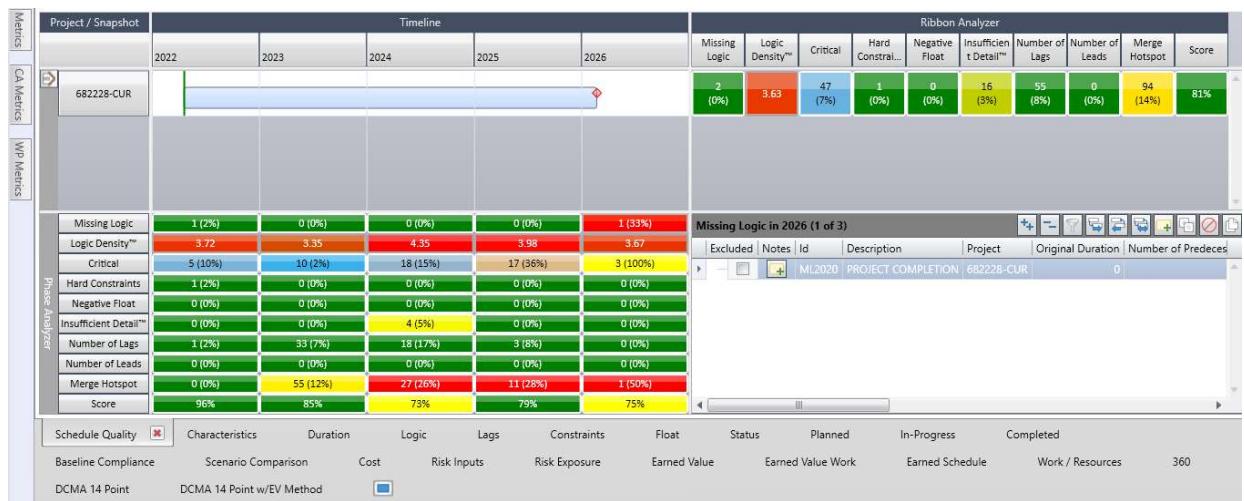
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Activity ID	Description	CURRENT Internal Target	P-Score of Target Date	P50 Date	P85 Date	P100 Date
ML0170	Commissioning Deaerator and Boiler Completed - Ready for Operation	27-Oct-2025	P1	11-Nov-2025	25-Nov-2025	19-Dec-2025

17.0 SCHEDULE QUALITY

The schedule quality report is as follows (produced using Acumen Fuse):



We see that there are some issues to review regarding Logic Density and Merge Hotspot but generally the quality rating is positive.

The following schedule quality report was generated:

Report Summary	
Task view	All tasks
Constraints	6
Open-ended tasks (Does not include ignored links)	22
Out of sequence updates ("broken logic")	0
Lags longer than 0 units	90
Negative lags ("leads")	0
Positive lags on Finish-to-Start links	12
Start-to-Finish links	2
Lags between tasks with different calendars	0
Links to / from summary tasks	0
Duration uncertainty distribution shape 2	215
Total number of items found	347

The constraints are mostly soft constraints:

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<u>Bookmark</u>	<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Constraint Type</u>	<u>Constraint Date</u>
<input checked="" type="checkbox"/>	ML0160	Start Construction/Demolition 2023	Start milestone	Start on or after	03-04-23 00:00
<input checked="" type="checkbox"/>	ML0020	NTP Issued	Start milestone	Start on	05-12-22 00:00
<input checked="" type="checkbox"/>	A2040	Shutdown - September 2023	Normal	Start on or after	11-09-23 00:00
<input checked="" type="checkbox"/>	A2060	Shutdown - June 2023	Normal	Start on or after	12-06-23 00:00
<input checked="" type="checkbox"/>	ML5290	Start Construction/Demolition 2024	Start milestone	Start on or after	26-02-24 00:00
<input checked="" type="checkbox"/>	ML5300	Start Construction/Demolition 2025	Start milestone	Start on or after	24-03-25 00:00

The Start-to-Finish Links are due to link Start milestone to a Finish milestone and so cannot be avoided:

Start-to-Finish links

From Task				To Task				
<u>Bookmark</u>	<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Bookmark</u>	<u>ID</u>	<u>Description</u>	<u>Type</u>	
<input checked="" type="checkbox"/>	ML2030	Demolition Start - 2025	Start milestone	<input checked="" type="checkbox"/>	ML2020	PROJECT COMPLETION	Finish milestone	
<input checked="" type="checkbox"/>	ML5290	Start Construction/Demolition 2024	Start milestone	<input type="checkbox"/>	SB12380	PGNL-801 - Mobilization	Normal	

The open ends are mostly on WBS Summary or LOEs:

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682228 Steam Boiler Execution2.plan-ScheduleCheckReport					
<u>Bookmark</u>	<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Remaining Duration</u>	<u>Detail</u>
<input checked="" type="checkbox"/>	SB7620	PGNL-800 - Steel Delivery at Site	Normal	150	Finish has no successors
<input checked="" type="checkbox"/>	ML0020	NTP Issued	Start milestone	0	No predecessors
<input checked="" type="checkbox"/>	ML2020	PROJECT COMPLETION	Finish milestone	0	No successors
<input checked="" type="checkbox"/>	DE2760	Extension and e-Room - Steel - MTO	Normal	10	Start has no predecessors
<input checked="" type="checkbox"/>	DE2800	46 KV Switchyard - Steel MTO	Normal	10	Start has no predecessors
<input checked="" type="checkbox"/>	SB9950	PPYK-501 Transmission Line - Technical Bid Evaluation	Normal	10	Finish has no successors
<input checked="" type="checkbox"/>	DE1510	Data Sheets - Raw Water Treatment - 01	Normal	15	Finish has no successors
<input checked="" type="checkbox"/>	SB10890	Curing - Piling and Grade Beam	Normal	22	Finish has no successors
<input checked="" type="checkbox"/>	SB10990	Install Temporary Power Supply	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE3760	MTOs - Piping	Normal	15	Start has no predecessors
<input checked="" type="checkbox"/>	SB11230	PDNB-300 - Prepare and Issue RFI	Normal	10	Start has no predecessors
<input checked="" type="checkbox"/>	DE4010	SOW RFI - PDNB-300 - 00	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4100	Specification - PLYJ-400 - 00	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4130	SOW RFI - PLYJ-400 - 00	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	SB11440	PGSL-400 - Technical Bid Evaluation	Normal	10	Finish has no successors
<input checked="" type="checkbox"/>	SB11410	PGSL-400 - Prepare and Issue RFI	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	SB11420	PGSL-400 - Prepare and Issue IFQ	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4290	SOW RFI - PGSL-400 - PA	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4310	Data Sheets - PGSL-400 - PB	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4330	SOW RFI - PGSL-400 - PB	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	DE4370	SOW RFI - PGSL-400 - 00	Normal	5	Start has no predecessors
<input checked="" type="checkbox"/>	SB11530	PGYJ-800 - Technical Bid Evaluation	Normal	10	Finish has no successors

18.0 SCHEDULE CHALLENGES

The following items could impact the schedule:

- Weather conditions;
- Working in existing facilities;
- Coordinating work around plant shutdowns;

19.0 SYSTEMS AND TOOLS

Planning and scheduling team will use Primavera P6 as the standard planning and scheduling tool used for development and maintenance of Project schedules. Other software packages (i.e., MS Project, Excel, Visio, NavisWorks Timeliner and PowerPoint) may be used to develop simplified schedules to produce illustrative roadmaps.

DOCUMENT END