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IOC/RioTinto Additional Electrode Boiler Project
Cost Estimate High Level Review

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SUBJECT: **COST ESTIMATE REVIEW OF THE ADDITIONAL ELECTRODE BOILER PROJECT**

IOC management have requested that MineStone provides a cold-eye review report regarding the cost estimate prepared and developed by the Engineering firm SNC-Lavalin (SNC) for the Additional Electrode Boiler Project.

As per the SNC documentation, the Project definition reflects feasibility level which supports a Class 3 estimate with an expected accuracy range of within -10% to +15% as defined by the AACE International Recommended Practice 18R-97.

For this mandate, IOC and its engineering firm SNC, provided the following documentation that would be the persecutor for review of the cost estimate, constructability report & project implementation schedule:

- 682228 Steam Boiler Cost Profile_R01 (PDF)
- 682228 Steam Boiler MHs Profile_R01 (PDF)
- W051218-3-MG-MMO Feasibility study report_RevA 20211211 (PDF)
- W051218-3-PU-EST-Estimate Basis_Rev0 (PDF)
- W051218-5-MG-PLN Project Execution Plan PEP_Rev 0 (PDF)
- W051218-5-MG-REG Procurement Packages Register_Rev B (PDF)
- 682228_33GA_EST_IOC_Bolier_Rev0-ISSUED20220106 (Excel)
- 682228W051218_Owner's Team Estimate_Boiler_Project_Rev1 (Excel)
- Cost and MHs Profile_Revised on 19-Jan-22 (Excel)
- 682228_33GA_EST_IOC_Bolier_Rev2-ISSUED20220809 (Excel)
- W051218-5-PU-SCH-ExecutionSchedule_Rev1signed
- W051218-3-PU-SCH Basis for Execution Schd_Rev1signed
- 682228-CUR_2022_08_24c (XER)
- W051218-5-PU-PLN Procurement and Contracting Plan_Rev4

A structured, if not formal, review process is a best practice for the level of detail and diligence used during this estimate review cycle; however, it will vary with the strategic importance, total value, and purpose of the particular estimate sections or parts.

The estimate "review" is qualitative in nature and focused on ensuring that the estimate technically meets requirements and serves as a quality assurance and control function. This quality review will determine if the estimate was:

- Developed using contractually or procedurally required practices, tools and data;
- Whether it covers the entire project scope;
- Whether it is free from errors and omissions (at a macro level; the validation step should reveal any errors or omissions from the specific details);
- Whether it is structured and presented in the expected format;
- Others as deemed applicable.

The estimate "validation/review" is quantitative in nature and focused on ensuring that the estimate meets the project expectations and requirements in regard to its appropriateness, competitiveness, and identifying improvement opportunities.

The cost estimate is benchmarked against or compared to various cost metrics and/or cost targets, including third party published data from the public domain, similar completed projects from our historical data, or past detailed estimates similar in nature.

1 PROJECT SCOPE OF WORK (AS PER SNC DOCUMENTATION)

The project involves the development of the capital cost estimate for the Additional Electrode Boiler Feasibility Study (Project) at IOC's Moss pit, and processing plant in Labrador City, Newfoundland and Labrador, Canada.

Project components were developed within the overall project to meet the design objectives that includes the following:

- Demolition and modifications of existing structures within and adjacent to the new steam plant extension battery limits, including:
    - Removal of existing flash drum, deaerator, chemical dosing pump and tanks and heat exchangers including associated foundations, piping and electrical bulks;
    - Installation of temporary protection shelter for the flue from construction debris to be installed from the Mag Plant to 20 ft downstream of the bridge.
- Installation of the new 40 MW electrode boiler and associated auxiliary equipment including:
    - Piling for the new steam plant extension;
    - New 40 MW electrode boiler;
    - New steam plant extension including electrical room (E-room) located adjacent to the Owner's existing steam plant;
    - New 46 kV switchyard including electrical and control room located south-east of the new steam plant and just south of the parking area;

- New 46 kV overhead transmission line running from the existing SS 606 to the 46 kV switchyard;
- Cable and cable tray runs between the new substation and steam plant extension to be anchored on the side of existing buildings;
- Temporary water treatment skid to maintain water supply to the existing steam plant during construction of the steam plant extension;
- Instrumentation and control systems, including any modifications to existing instruments associated with incorporating the new steam supply into existing controls infrastructure.

- Scope Exclusions:
  - Upgrades to on-site bridge, roads and associated infrastructure if required to facilitate construction
  - Demolition or modification of existing conveyor including any associated gallery, bents, and foundations within or near to the switchyard footprint.

2 ESTIMATE REVIEW

SNC has stated they have developed an AACE class 3 estimate for the for the Additional Electrode Boiler Project with an intended accuracy range of within -10% to +15%.

The Class 3 estimates are usually prepared in great detail and should be a bottom-up estimate that includes manhours, base manhours, developed productivity factor, developed crew rate and material costs.

The SNC estimate which is a bottom-up estimate that includes manhours, base manhours, developed productivity factor, developed crew rate and material / equipment costs should have been done in parallel with the contractors' budgetary quote to validate the estimate and have a better confidence in the total budget at completion of the project.

One of the critical items to review would have been the listing of all drawings, sketches, specifications, and other technical deliverables used in preparing the estimate to ensure that it is complete and up-to-date. Unfortunately, we did not have the visibility of these technical documentations and it was only viewed during the presentation of the estimate at the SNC Lavalin premises on the 25th & 26th of August 2022.

The initial screening review prepared is to assess if the scope was quantified completely, ensuring that the estimate is documented correctly (i.e., a comprehensive BOE is prepared and the estimate is consistent with it), and that it adheres to project, contract and/or IOC guidelines. This was followed by a math check (extensions of pricing are correct, summaries add up properly, etc.)

A key point to remember – We are performing an estimate review, which is not a detailed independent cost estimate. However, the following are some quick check estimates that were developed as part of the validation process.

3 BASIS OF ESTIMATE

The basis of estimate prepared by SNC is well-written and describes properly and clearly the estimate being prepared in terms of the project scope, pricing basis, allowances, assumptions, exclusions and any cost risks.

However, we would recommend that the document includes the list of MTO's used, drawings, 3D Model, and other documents with clearly identifying the document code, name, date and revision. This would help with the traceability to the base and origins of the scope, quantities and pricing at later stages.

4 ESTIMATING METHODOLOGY AND PROCEDURES

During our visit to the SNC premises on the 25th and 26th of August 2022, we have met the complete project team and interviewed the lead cost estimator so we would know who prepared the estimate, his level of estimating experience in relation to the scope of the project, and their discipline in regard to quality practices.

We are confident that the estimator has followed established or contracted estimating procedures and guidelines, he also used estimating methods, techniques, and procedures related to the AACE standards which were used in preparing the estimate. Based on the discussions, the SNC team did check and review the estimate before publication.

5 ESTIMATE DOCUMENTATION

The cost estimate is clearly documented, and the estimate summary and detail pages were also properly organized and presented at an appropriate level of detail. Thus, every cost appearing on the estimate summary is traceable to the estimate so-called detail and other estimate backup sheets.

6 ESTIMATE DETAIL

In detail review, we are considering the Pareto principle: i.e., 80 percent of the costs come from 20 percent of the estimate line items. We have examined in detail selected items or categories of items in the estimate that are likely to have the most significant cost effect if estimated incorrectly.

41 Civil Works

- In general material prices are +/- 15% higher than the benchmarked rates (To be validated with actual quotes)
- Productivity factor PF = 1.41 (This all depends on what the "1" is based on. It should be read and calculated as part of the manhours & crew rate) – No comments.
- In general, the labour rate used is a bit high for this type of activities, the reason is there is no major construction equipment required. (High by 10% based on benchmarked rates)

42 Concrete Works

- In general material prices are +/- 10% higher than the benchmarked rates (To be validated with actual quotes)

- Productivity factor PF = 1.43 (This all depends on what the "1" is based on. It should be read and calculated as part of the manhours & crew rate) – No comments.

43 Steel works

- Overall, the material costs are within the range of current market pricings, except for the steel plate price is a bit higher by 5% to 10%.

- Overall, the installation manhours per activity and by unit looks at least high by 15%. To be checked and validated by contractor rates.

- Productivity factor PF = 1.73 (This all depends on what the "1" is based on. It should be read and calculated as part of the manhours & crew rate) – No comments.

- May be not a huge impact on cost but touch-up painting - Allowance on total steel tonnage are very low compared to benchmarked unit rates (Low by 25% - 35%)

44 Architectural works

- Overall, the material costs and installation rates are within the range of current market prices and benchmarked versus other similar projects within the area,

- Productivity factor PF = 1.78 (This all depends on what the "1" is based on. It should be read and calculated as part of the manhours & crew rate) – No comments.

- The following allowances items looks very low as only 44k & 62K total respectively. The job might look easy, but this is supposed to be much more complex in reality. We recommend a review of this price and adjust accordingly.

  SNC Item Description: *"TRAY RUN FROM SWITCH YARD TO EXTENSION -- Architectural allowance for modifications/rework from openings on existing building (about 40 openings on wall and 5 openings on roofing each opening average about 2ft x 2ft) (for cable support on the wall and roof)"*

  SNC Item Description: *"FLUME PROTECTION ALLOWANCE"*

4B Building Services

- Although the unit rates look fine in many instances but for the building services and HVAC total cost of 200K looks too low for the benchmarked data from similar project or buildings in terms of size and nature. We recommend another review of the quantities and allowances.

- Is there any utilities such as seal water, Plant & Instrument Air, hose reels etc.. These seems to be missing from the estimate. We recommend that this area has to be much more elaborated.

4D Demolition works

- It has always been benchmarked that this kind of work is much more complex or difficult than it looks or being realized. Although a detailed scope has been identified for the demolition work but the realization of this kind of work is to be revised and approved to provide plan and timeline.

- Demolition quotes received from Pennecon, Ontario company & P&G is being measured as a pre-feasibility study, therefore; would require additional development.

- It has to be noted that this estimate is based on a chosen option that is not freezed and could change further during later stages of development.

45 Mechanical works

- The major equipment pricing has been obtained from the potential vendors and only installation has been estimated in-house. The ratio of installation versus cost of equipment is very similar to most of the benchmarked projects from similar nature and size.

- The insulation price for the Flash Tank - Insulation (3'' thick) is very low and could be revised for better realistic pricing.

46 Piping works

- The piping is considered as 1km of multiple small diameter sizes and the cost is 75% for installation and 25% for material. For these kinds of projects usually it would be safer to have a higher design growth and wastage factors.

- When we checked the material spec, average size and diameter, the installation hours are low by at least 10% and we recommend that the material pricing be checked with the current market pricing by contacting multiple vendors and suppliers for investigating the cost of fabricated steel.

47 Electrical works

- Some cable prices are too low for instance the following. We recommend contacting some vendors and get some informal quotes:
  - ex 3C12 @ 2.88$/m reg price 8$/m
  - ex 3C12 @ 3.8$/m reg price 12$/m
  - ex 4C10 @ 4.8$/m reg price 20$/m

- Cable trays prices are somehow low specially if they also include the supports and grounding (Low by at least 15%)

- Some installation manhours are high such as cable trays, some power cables, and transformers. These are high by 5% to 10% and no actions is recommended.

- It is assumed that all of the equipment prices are based on the vendor quotes recently obtained. We have not seen any quotes but we have been told that all quotations are recent and cover the scope and spec.

48 Instrumentation, control and telecom works

- We recommend contacting vendors and suppliers for the PLC and DCS system. The prices are low needs to be verified against some quotes
- We are assuming that the instruments are supplied by vendor on skid and not delivered separately, if so we suggest to remove the installation hours.
- All cable prices are a bit low by at least 25%. Recommended to contact vendor & suppliers for updating the prices.
- Some of the instrument prices are missing. Could be they are included in some equipment pricing. A note would be sufficient:
  - LEVEL SWITCH - Tag# 5427-LSH-0025
  - LEVEL SWITCH - Tag# 5427-LSL-0025
  - LEVEL SWITCH - Tag# 5427-LSH-4000
  - LEVEL SWITCH - Tag# 5427-LSL-4000
  - Push Button - Tag# 5427-HS-4000
- Telecommunication cost is only an allowance but it is within range of benchmarked project.

Other works (Indirects)

- Temporary Facilities, operations & maintenance, onsite services, Vendor Representatives during construction, EPCM services, camp & catering, freight & duties, spares, contractor commissioning and first fills all are within project benchmarked percentages from direct or equipment costs.
- Escalation remains an allowance of 8 million and we do not have any comments on that. In normal standards we do recommend to be calculated based on a project cashflow with indices well identified per year.

7 ALLOWANCES

The basis for the common estimating allowances such as material take-off allowances, overbuy allowances, design allowances for engineered bulk materials, congestion allowances, swell factor, etc., were properly described, developed and the associated cost is considered included in the estimate.

Also noted that design growth has been established properly by the SNC estimating group in conjunction with the specific engineering disciplines during internal MTO reviews.

We would highly recommend that the design growth factors are only reflected by discipline and not per item. This will help identify the budget for design growth and be traced for the upcoming stages without being affected by the contingency. The design growth will be reduced by every stage the estimate is advanced until engineering is fully completed.

8 CONSTRUCTIBILITY REVIEW

Execution strategies were investigated by SNC team for the construction of the project in order to optimize efficiency, minimize schedule and maximize safety. Our understanding is that the execution will be subdivided by major scopes of work, primarily demolition, steam plant extension and the switchyard. Distinct construction periods were also identified which include an enabling and a main construction segment based on stick-built construction.

As stated by SNC that contractors will be expected to self-perform the work, and to provide all equipment including scaffolding and cranes up to 90 tons in capacity. Cranes greater than 90 tons (heavy lift cranes) will be provided by the Project.

It is to be noted that we still have no clear plan on how the installation of the steam plant extension whether by heavy cranes or other methods. This is still pending, and we highly recommend to be resolved before the budget is approved.

The crane sizes for installing the steam extension building budget is close to one million CAD which we would believe it is too low. (2 weeks for 400 Tons crane & 4 months for 250 Ton Crane)

9 SCHEDULE REVIEW

Schedule development is the process of translating the project scope into activities, contractual milestones, logical relationships, durations, resource availabilities, time constraints, and other schedule basis information into the project schedule model.

We are confident that the schedule presented is effective and integrate with project technical documents, scope of work, contracts and other project attributes that will have an impact on the project schedule.

In general it is in good shape but there are still some minor comments which we recommend being taken into consideration as per the following:

- Calendar (28 - 5x8 w holidays): This calendar is missing the statutory Holidays in Quebec for the years 2023, 2024 and 2025.
- Calendar (28 - 5x8 w holidays): This calendar is missing two main vacations per year (The holiday days between Xmas and New Year's Day; the construction holiday days as per the "Commission de la Construction du Québec".
- The Demo/Construction packages coding should have the letter "C" and not the letter "P" where the letter "P" will be always reserved for Procurement packages. (Just for consistency)
- Define critical activities with total float to be less than or equal to 5d.
- The Critical bars should always have a red colour. (Best practices)

We would also recommend the following self-explanatory comments regarding the schedule presented by SNC:

- Schedule Calendar: the project has several calendars which are created but suggested only one calendar to be used in the main schedule. Kindly note that the schedule must be made according to the execution strategy and constructability review.

- Kindly validate the activities that does not have predecessors and successors (It is not much but always an important cross check). This can have an impact on the critical path or near critical path.

682228-CUR.ENG Detail Engineering		380	380		18-Apr-22	26-Oct-23	552
682228-CUR.ENG.2 General		380	380		18-Apr-22	26-Oct-23	552
LOE-ENG	Engineering by Subtracting with PCN0006	0	0	0%	18-Apr-22	18-Apr-22	932
WBS-PMPS	Project Management & Services	380	380	0%	18-Apr-22	26-Oct-23	552
682228-CUR.CON2023 Demolition / Construction		566	566		06-Jun-23	19-Sep-25	0
682228-CUR.CON2023.1 General		248	248		13-Mar-24	18-Mar-25	113
WBS-Cost-Enabling	Enabling Works - WBS Summary	248	248	0%	13-Mar-24	18-Mar-25	113
WBS-Cost-Civil	Civil and Concrete - WBS Summary	248	248	0%	13-Mar-24	18-Mar-25	113
WBS-Cost-SMPEI	SMPEI - WBS Summary	248	248	0%	13-Mar-24	18-Mar-25	113
WBS-CM-30M	Construction Manager (30Months)- WBS Summary	248	248	0%	13-Mar-24	18-Mar-25	113
WBS-CM-2023/24	Construction Management - WBS Summary	248	248	0%	13-Mar-24	18-Mar-25	113
682228-CUR.CON2023.3 Extension Construction - 2023		88	88		06-Jun-23	11-Oct-23	316
WBS-Extension	STEAM PLANT BUILDING EXTENSION - WBS Summary	88	88	0%	06-Jun-23	11-Oct-23	316
682228-CUR.CON2023.5 Extension Construction - 2024		110	110		30-Aug-24	18-Feb-25	113
682228-CUR.CON2023.5.3 Installation of Equipment, Piping, E&I		110	110		30-Aug-24	18-Feb-25	113
WBS-EH	E-House - WBS Summary	110	110	0%	30-Aug-24	18-Feb-25	113
682228-CUR.CON2023.10 Switchyard - 46 kV Substation		105	105		22-Apr-25	19-Sep-25	0
WBS-SY-22	Swichyard Area 2022 - WBS Summary	105	105	0%	22-Apr-25	19-Sep-25	0
WBS-SY-23	46kV Substation - WBS Summary	105	105	0%	22-Apr-25	19-Sep-25	0

- Hours should be reviewed and made sure that total estimated hours balance with the cost estimate thus all activities are assigned with the right resource. For instance, in the snap shot below activity SB6660 has 10,539 hours but the activity SB12352 does not have any hours. This will affect any planned value that will be used on the project.

Activity ID	Activity Name	Remaining Duration	Start	Finish	Calendar	Budgeted Labor Units
Transmission Line		85d	2024-04-26	2024-08-27	682228 - 5x8 w Holidays	10539h
SB6660	Installation of Line, Poles, Conductors, Surge Arrestors etc.	84d	2024-04-29	2024-08-27	682228 - 5x8 w Holidays	10539h
SB12352	Transmission Line Installation	85d	2024-04-26	2024-08-27	682228 - 5x8 w Holidays	0h

- The schedule can be optimized by reviewing the duration of commissioning and demolition activities and punch items.
  The activity SB11140: Complete Punchlist Items and Final Report, and Demobilization has twenty (20) days of duration which we believe it is necessary to question the duration
  It is to be noted that normally the punch list can be done at the same time as the commissioning.

- We recommend checking and to validate if the following activities could be done in overlap or in parallel

Commissioning		35d	2025-09-22	2025-11-10
SB10980	Electrical Supply and Distribution Commissioned and Operational	10d	2025-09-22	2025-10-03
SB6670	Tie-in of Complete System	5d	2025-10-06	2025-10-10
SB6710	Commissioning and Startup	10d	2025-10-14	2025-10-27
SB11130	New System Proving Period	10d	2025-10-28	2025-11-10

- Note that the procurement of the transformer is on the near critical path with only two (2) days as total float. Validation is required for those activities as such:
  - Delivery time, a seven (7) days calendar could be assigned based on the fabrication country
  - Manufacturing time should also be validated

  So, a two (2) days delay in any of the below activities could impact the end date of the project especially with the difficulties of shipping in the current market situation.

Activity ID	Activity Name	Remaining Duration	Start	Finish	Total Float	Calendar
Procurement Packages		625d	2022-12-05	2025-06-20	2d	682228 - 5x8 w Holidays
PPYJ-500 46kV / 13.8kV Stepdown Transformer		625d	2022-12-05	2025-06-20	2d	682228 - 5x8 w Holidays
DE12070	PEYJ-500 46kV / 13.8kV Stepdown Transformer - Specification - 00	10d	2022-12-05	2022-12-16	2d	682228 - 5x8 w Holidays
DE12080	PEYJ-500 46kV / 13.8kV Stepdown Transformer - Data Sheets - 00	10d	2022-12-05	2022-12-16	2d	682228 - 5x8 w Holidays
DE11940	PEYJ-500 46kV / 13.8kV Stepdown Transformer - SOW RFI - 00	5d	2022-12-19	2023-01-03	2d	682228 - 5x8 w Holidays
SB6940	PEYJ-500 46kV / 13.8kV Stepdown Transformer - Prepare and Issue I	10d	2023-01-04	2023-01-17	2d	682228 - 5x8 w Holidays
SB6950	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Issue IFQ	5d	2023-01-18	2023-01-24	2d	682228 - 5x8 w Holidays
SB6960	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Tender Period	20d	2023-01-25	2023-02-22	2d	682228 - 5x8 w Holidays
SB6920	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Technical Bid Evalu	10d	2023-02-23	2023-03-08	2d	682228 - 5x8 w Holidays
SB6930	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Commercial Bid Eva	10d	2023-02-23	2023-03-08	2d	682228 - 5x8 w Holidays
SB6970	PEYJ-500 46kV / 13.8kV Stepdown Transformer- PO Issued	10d	2023-03-09	2023-03-22	2d	682228 - 5x8 w Holidays
SB7010	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Obtain Vendor Data	65d	2023-03-23	2023-06-23	2d	682228 - 5x8 w Holidays
SB11480	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Review and Approv	24d	2023-06-26	2023-07-28	2d	682228 - 5x8 w Holidays
SB6990	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Manufacturing (12m	436d	2023-07-31	2025-05-08	2d	682228 - 5x8 w Holidays
SB7000	PEYJ-500 46kV / 13.8kV Stepdown Transformer- Delivery at Site	30d	2025-05-09	2025-06-20	2d	682228 - 5x8 w Holidays
LOE-PEYJ-5	46kV / 13.8kV Stepdown Transformer - LOE	555d	2023-03-23	2025-06-20	2d	682228 - 5x8 w Holidays

10 CONTINGENCY RECOMMENDATION

Our understanding is that contingency is a cost element of the estimate used to cover the uncertainty and variability associated with a cost estimate, and unforeseeable elements of cost within the defined project scope.

Contingency also covers inadequacies in complete project scope definition, estimating methods, and estimating data. Contingency specifically excludes changes in project scope, and unforeseen major events such as earthquakes, prolonged labor strikes, etc.

The amount of contingency included in the cost estimate prepared and developed by SNC is identified at 14.7% of the direct and indirect costs (Excluding escalation) calculated using a probabilistic model with Monte Carlo simulation at the P80 output level.

The percent is derived from the total CAPEX/Demolition excluding the escalation amount as follows:

Percent % contingency = contingency 11,532,000 CAD divided by the project total = 78,468,000 CAD

Minestone suggests using a higher contingency to cover for the uncertainties in cost elements and including a growth cost item for the unexpected constructability obstructions reference accessibility of construction equipment for the installing the steam building extension.

11 CONCLUSION & RECOMMENDATIONS

As a conclusion and based on the information provided from the client and its engineering firm (SNC), and after taking into consideration all the recommendations provided above, MineStone d0 consider the cost estimate developed by SNC is suitable for a class III estimate as per the AACE guidelines and would meet as a minimum the industry standards of a feasibility study report.

However, it should be noted that MineStone opinion considers the study and budget not ready for the IOC/RioTinto AFE budget approval as many sections of the project still needs to be either verified or validated as per the following most critical items:

- General contractor should be contacted to verify the unit rates and challenge the constructability plan of the project;
- Demolition scope should be expanded and better identified with a solid plan specially for brownfield area. Cost should be revalidated with potential demolition contractors;
- Location of the plant must be fixed. This could have impact on the demolition section and utilities tie ins including the overhead electrical line, soil and water specification;
- Soil investigation must be completed for the project specifically for this project location;
- Constructability plan for installation of the new steam building extension should be verified and approved by the team members and a contractor that is approving the process;
- The risk register exists but still excluded from the budget estimate. It would be practical to identify the critical activities and apply a risk budget.

End of Document