JCM Validation Report Form

A. Summary of validation

A.1. General Information

Title of the project	Introduction of High Efficiency Electrolyzer in Chlor-Alkali Production Plant
Reference number	SA001
Third-party entity (TPE)	(TPE-SA-001) Japan Quality Assurance Organization
Project participant contracting the TPE	Kanematsu Corporation
Date of completion of this report	20/03/2018

A.2 Conclusion of validation

Overall validation opinion	☒ Positive ☐ Negative

A.3. Overview of final validation conclusion

Only when all of the checkboxes are checked, overall validation opinion is positive.

Item	Validation requirements	No CAR or CL remaining
Project design document form	The TPE determines whether the PDD was completed using the latest version of the PDD forms appropriate to the type of project and drafted in line with the Guidelines for Developing the Joint Crediting Mechanism (JCM) Project Design Document, Monitoring Plan and Monitoring Report.	☒
Project description	The description of the proposed JCM project in the PDD is accurate, complete, and provides comprehension of the proposed JCM project.	☒
Application of approved JCM methodology (ies)	The project is eligible for applying applied methodology and that the applied version is valid at the time of submission of the proposed JCM project for validation.	☒
Emission sources and calculation of emission reductions	All relevant GHG emission sources covered in the methodology are addressed for the purpose of calculating project emissions and reference emissions for the proposed JCM project.	☒
	The values for project specific parameters to be fixed *ex ante* listed in the Monitoring Plan Sheet are appropriate, if applicable.	☒
Environmental impact assessment	The project participants conducted an environmental impact assessment, if required by the Kingdom of Saudi Arabia, in line with Saudi Arabian procedures.	☒
Local	The project participants have completed a local stakeholder	☒

Item	Validation requirements	No CAR or CL remaining
stakeholder consultation	consultation process and that due steps were taken to engage stakeholders and solicit comments for the proposed project unless a local stakeholder consultation has been conducted under an environmental impact assessment.	
Monitoring	The description of the Monitoring Plan (Monitoring Plan Sheet and Monitoring Structure Sheet) is based on the approved methodology and/or Guidelines for Developing the Joint Crediting Mechanism (JCM) Project Design Document, Monitoring Plan, and Monitoring Report. The monitoring points for measurement are appropriate, as well as whether the types of equipment to be installed are appropriate if necessary.	☒
Public inputs	All inputs on the PDD of the proposed JCM project submitted in line with the Project Cycle Procedure are taken into due account by the project participants.	☒
Modalities of communications	The corporate identity of all project participants and a focal point, as well as the personal identities, including specimen signatures and employment status, of their authorized signatories are included in the MoC.	☒
	The MoC has been correctly completed and duly authorized.	☒
Avoidance of double registration	The proposed JCM project is not registered under other international climate mitigation mechanisms.	☒
Start of operation	The start of the operating date of the proposed JCM project does not predate January 1, 2013.	☒

Authorised signatory:	Mr. ☒ Ms. ☐
Last name: Asada	First name: Sumio
Title: Senior Executive	
Specimen signature: [redacted]	Date: 20/03/2018

B. Validation team and other experts

	Name	Company	Function*	Scheme competence*	Technical competence*	On-site visit
Mr. ☒ Ms. ☐	Koichiro Tanabe	JQA	Team Leader	☒	Authorized	☐
Mr. ☒ Ms. ☐	Irhan Febijanto	External individual	Team Member	☒	Authorized	☒
Mr. ☒ Ms. ☐	Tadashi Yoshida	External individual	Internal Reviewer	☒	Authorized	☐

Please specify the following for each item.

* *Function: Indicate the role of the personnel in the validation activity such as team leader, team member, technical expert, or internal reviewer.*

* *Scheme competence: Check the boxes if the personnel have sufficient knowledge on the JCM.*

* *Technical competence: Indicate if the personnel have sufficient technical competence related to the project under validation.*

C. Means of validation, findings, and conclusion based on reporting requirements

C.1. Project design document form

<Means of validation>

A series of the JCM approved forms, including Project Design Document (hereinafter referred to as "PDD") form, was checked and confirmed as complete against the JCM Guidelines for developing Project Design Document and Monitoring Report, JCM_SA_GL_PDD_MR_ver02.0 (hereinafter referred to as "JCM Guidelines").

A valid form of the JCM PDD of JCM_SA_F_PDD_ver02.0 is used for the PDD version 01.0 dated 19/12/2017 (as the first edition) and for the PDD version 02.0 dated 05/03/2018 (as the second edition). The validation was conducted on the first edition and the result was reflected on the second edition of PDD appropriately.

<Findings>

No issues were identified to the requirement.

<Conclusion based on reporting requirements>

The validation team confirms that the PDD is completed using the valid form of the JCM PDD form and drafted in accordance with the JCM Guidelines for developing PDD.

C.2. Project description

<Means of validation>

The purpose of the proposed JCM project is to reduce CO_2 emission emitted by the regional grid system through a replacement of four units of the existing elements of ion exchange membrane (hereinafter referred to as "IEM") brine electrolyzer with the latest model. The latest model has a more optimum performance design, in particular, optimization of elements' inner structures and electrode shape, reduction of resistance (lowering the voltage) of various components, and prevention of the mechanical damage for IEM, Thus, these performances achieve lower power consumption and contribute to energy saving.

The proposed JCM project is implemented by Jubail Chemical Industries Company (hereinafter referred to as "JANA") from Kingdom of Saudi Arabia and Kanematsu Corporation (hereinafter referred to as "Kanematsu") from Japan. The High efficiency electrolyzer (type: nx-BiTAC868) is installed by Kanematsu in the factory of JANA, which is located in Jubail Industrial City-31961, Kingdom of Saudi Arabia. The total production capacity of four units of the electrolyzers newly installed is 50,000 ton-NaOH/year. The latest model of IEM can be operated stably at a lower voltage, and thus it can reduce its electricity consumption by about 7%. The annual emission reductions of 3,289 tCO_2 is expected through the installation of the IEM brine electrolyzer, and the emission reduction achieved for 5 years (2017-2022) is 16,445 t-CO_2 totally.

The validation team conducted one-day on-site assessment for this proposed JCM project on 23/01/2018, after its document review, and had a follow-up interview with the project participants. The location information of the proposed JCM project and the other description stated in Section A (Project description) of the PDD were cross-checked through the physical inspection. As for the duration of the proposed JCM project, it is confirmed that the starting date of project operation is 25/01/2017, which is the starting date of monitoring activities for data collection. The expected operational lifetime of the proposed JCM project is five years, which is determined based on the durable year list stipulated in the Regulation of the Japanese Finance Ministry No.15/1965 concerning the equipment lifetime.

The proposed JCM Project was partially supported by the Ministry of Environment, Japan through the financing programme for JCM model projects, which provided financial support of less than half of the initial investment for the projects in order to facilitate GHG emission reduction project in Kingdom of Saudi Arabia and to acquire JCM credits. Regarding the technology transfer, the electrolyzer manufacturer

(Thyssenkrupp Uhde Chlorine Engineers (Japan) Ltd.) conducted operation and maintenance trainings for the installation of the electrolyzer, which were held on 20/12/2016 and 21/12/2016, and JANA's employees participated in the training opportunities.

The validation team assessed the first version of PDD and the supporting documents to validate that the proposed JCM project was in accordance with the JCM requirements. The team also conducted the on-site assessment to confirm the accuracy and completeness of the project description through interview with project participants. The details of the persons interviewed, and documents reviewed are provided in the Section E of this report.

<Findings>

No issues were identified to the requirement.

<Conclusion based on reporting requirements>

It is confirmed that the project description of the PDD is reasonable and appropriate.

C.3. Application of approved methodology(ies)

<Means of validation>

The project applied the approved methodology of JCM_SA_AM001_ver01.0 "Introduction of High Efficiency Electrolyzer in Chlor-Alkali Production Plant". The methodology is approved by the Joint Committee on 18/10/2017 and valid at the time of the validation.

The validation team assessed that the selected methodology was applicable to the proposed JCM project. The applicability of the proposed JCM project was checked against two eligibility criteria stipulated in the approved methodology. The steps taken for validating it and the conclusion are summarized as below.

Criterion 1: Project electrolyzer employs an ion-exchange membrane technology in electrolyzers in the manufacturing process of chlor-alkali and the electrolyzer is the bipolar type.

Project information in the PDD: The project installs the bipolar type ion exchange membrane (IEM) brine electrolyzers system in chlorine and caustic soda production process in Jubail Industrial City.

Assessment and conclusion: It is confirmed through review of the relevant documents

provided by Kanematsu and interview with the PPs during the on-site assessment that the installed membranes are F-8080 type IEM and the installed electrolyzer is a modern bipolar type of nx-BITAC. The installation of these types of IEM and electrolyzer meets the criterion 1. Therefore, the validation team concludes that the Criterion 1 is satisfied.

Criterion 2: Specific electricity consumption (SEC) for project electrolyzer i under the standard conditions, 32% NaOH and 90 degrees Celsius is less than threshold SEC values set in the table below under the standard conditions, 32% NaOH and 90 degrees Celsius;

CD (Current density) [kA/m^2]	*Threshold SEC value of the electrolyzer [kWh(DC)/t-NaOH]*
4.0 ≦ CD < 4.5	*2,045*
4.5 ≦ CD < 5.0	*2,088*
5.0 ≦ CD < 5.5	*2,131*
5.5 ≦ CD < 6.0	*2,174*
6.0 ≦ CD < 6.5	*2,217*

Project information in the PDD: The project SEC derived from the specification of the project electrolyzer is 1990 [kWh(DC)/t-NaOH] when CD is between 4.5 and 5.0 and is less than the threshold SEC value of 2,088 [kWh(DC)/t-NaOH].

Assessment and conclusion: It is confirmed through review of the Performance Guarantee Acceptance Certificate of the Electrolyzer (nx-BiTAC868) provided by Kanematsu and the comprehensive interview with PPs during the on-site assessment that average of current density of the electrolyzers is 4.89 [kA/m^2] having a range of CD (Current Density) with 4.5 [kA/m^2] ≤ CD <5 [kA/m^2] and DC power consumption of the electrolyzer is 1,990 [kWh(DC)/t-NaOH]. The value is lower than the threshold SEC value of 2,088 [kWh(DC)/t-NaOH]. Therefore, the validation team concludes that the Criterion 2 is satisfied.

<Findings>

No issues were identified to the requirement.

<Conclusion based on reporting requirements>

The validation team confirms that the project applies the valid version of the approved methodology and the applicability is demonstrated to the eligibility criteria of the methodology as appropriate.

C.4. Emission sources and calculation of emission reductions

<Means of validation>

The proposed project aims to reduce electricity consumption of electrolyzers by replacing the existing element of ion exchange membrane brine electrolyzer with the latest model. The replacement is proposed by Kanematsu using the technology provided by Thyssenkrupp Uhde Chlorine Engineers (Japan) Ltd. A reduction of electricity consumption of the electrolyzers contributes to reduce GHG emissions emitted from the regional grid system.

Reference Emission during the period *p* (RE_p) is calculated ex-ante by multiplying the electricity consumption of references electrolyzer *i*, during the period *p* ($EC_{RE,I,p,}$) by CO_2 emission factor for consumed electricity (EF_{elec}). The calculation equation is as below.

The CO_2 emission factor for grid electricity (EF_{elec}) is 0.654 tCO_2/MWh adopted from the most recent value of the combined margin emission factor, which is published by Clean Development Mechanism - Designated National Authority, Ministry of Petroleum and Mineral Resources, the Kingdom of Saudi Arabia. This emission factor (0.654 tCO_2/MWh) is cross-checked by the List of Grid Emission Factors issued by IGES.

$$RE_P = \sum_i^n EC_{RE,i,p} \times EF_{elec} \quad \text{.....(1)}$$

Where,

RE_p	:	Reference Emission during the period *p*
$EC_{RE,I,p}$	:	Electricity consumption of references electrolyzer *i*, during the period, *p*
EF_{elec}.	:	CO_2 emission factor for consumed electricity,

The $EC_{RE,I,p}$ is obtained by multiplying electricity consumption of the project electrolyzer ($EC_{PJ,i,p}$) by the ratio of Specific electricity consumption of the reference electrolyzer ($SEC_{RE,i,p}$) and Specific electricity consumption of the project electrolyzer ($SEC_{PJ,i}$). Thus, the equation (1) can be written as equation (2).

$$EC_{RE,i,p} = \sum_i^n EC_{PJ,i} \times \frac{SEC_{RE,i,p}}{SEC_{PJ,i}} \times EF_{elec} \quad \text{.....(2)}$$

Where,

$EC_{PJ,i,p}$: Electricity consumption of the project electrolyzer

$SEC_{RE,i,p}$: Specific electricity consumption of the reference electrolyzer,

$SEC_{PJ,i}$: Specific electricity consumption of the project electrolyzer

The threshold value of $SEC_{RE,i,p}$ for current density between 4.5 [kA/m^2] ⩽ CD <5 [kA/m^2] is 2,088 [kWh/t-NaOH]. The electrolyzers in the proposed JCM project have the average of current density of 4.89 [kA/m^2]. The value of $SEC_{PJ,i}$ is determined by the manufacturer guarantee value.

Project emissions during the period *p* (PE_p) is calculated by equation (3).

$$PE_P = \sum_i^n EC_{PJ,i,p} \times EF_{elec} \quad \text{.....(3)}$$

Where:

$EC_{PJ,i,p}$: Electricity consumption of the project electrolyzer *i*, during the period *p*

$EC_{PJ,i,p}$ is calculated by multiplying the rated power consumption of electrolyzer by the total capacity of them. The rated power consumption of electrolyzer is estimated based on the previous data provided by the manufacturer.

The emission reductions (ER_p) is calculated by equation (4).

$$ER_p = RE_p - PE_p \quad \text{.....(4)}$$

The total emission reduction for 5 years operation during 25/01/2017 until 24/01/2022 is 16,445 tCO_2e.

It is confirmed through the review of the relevant documents and the on-site assessment that all CO_2 emission source specified by the applied methodology are identified, and the reference emissions, project emissions and emission reductions in the PDD and Monitoring Plan Sheet are correctly calculated, in accordance with the methodology JCM_SA_AM001_ver01.0. It is also confirmed through interview with PP that there is no backup power generation system, therefore there is no fossil fuel used for generating electricity in this plant. In Kingdom of Saudi Arabia, the supply of the grid electricity is stable and hence, there is no power outage or instability of electricity supply during a year.

In the Monitoring Plan Sheet, the cells for the parameters of $FC_{PJ,p}$, EG_p, EF_{elec}, η, NCV_{fuel} and EF_{fuel} are blank. Therefore, the validation team raised CL04, and this CL was resolved in the "Findings" below.

<Findings>

CL04

The blank cells in Monitoring Plan Sheet are requested to fill in to avoid the different meaning.

Resolution by the PPs

The blank cell in MPS and MRS is filled in with "-".

<Conclusion based on reporting requirements>

The validation team has reached the conclusion that the selected emission sources and GHG types are justified for the JCM project. The validation team has assessed values for project-specific parameters to be fixed ex ante in the MPS and intermediate processes to estimate the values. As a result, these are considered reasonable in the context of the proposed JCM project. The issue raised by the team has been fully clarified.

C.5. Environmental impact assessment

<Means of validation>

According to Kingdom of Saudi Arabia regulation stipulated in Royal Commission Environmental Regulations 2015, Volume I, Regulation Standards, Environmental Impact Assessment (hereinafter referred to as "EIA") is not required, except a newly installed project or a project for manufacturing a new product. The proposed JCM project replaced the existing four units of electrolyzer (BiTAC model) and membrane with the latest model (nx-BiTAC model), and therefore it is not classified in either category. It is also confirmed through interview with the PPs that the factory has been authorized by the government and has received the Environmental Permit for operation in 2015, based on the environmental information report issued by JANA. Since the proposed JCM project contains only renewal of facilities, it does not change the environmental impact. Therefore, it is not necessary to renew the EIA because of the proposal of JCM project.

Through the document review, the validation team raised CL01 for clarification. This clarification request was resolved in the "Findings" below.

<Findings>

CL01

The PDD states that an EIA is not applicable (N/A) in Section D. However, it is not in line with the JCM Guidelines.

Resolution by the PPs

The answer of EIA in Section D was changed from "N/A" to “NO”, and thus this CL is closed.

<Conclusion based on reporting requirements>

The validation team has concluded that the planning of the proposed JCM project is in accordance with the EIA regulation in Kingdom of Saudi Arabia. (The answer of EIA in Section D is in line with the JCM Guidelines).

C.6. Local stakeholder consultation

<Means of validation>

The PPs conducted a local stakeholder consultation on 31/10/2017 at meeting room of JANA, located in Jubail Industrial City-31961, the Kingdom of Saudi Arabia. It was explained by the PPs that, since no local residents living near around the factory, all participants of the stakeholder consultation were employees of JANA.

The local stakeholders provided positive comments for the proposed JCM project. There is no negative issue that requires action to be taken by the PPs which raised through the consultation. It is confirmed through the review of the relevant documents and the interview with the PPs during the on-site assessment that the stakeholder consultation process was appropriately conducted to collect stakeholder’s opinion. The summary of the comments received in the consultation and due account of all comments taken by the PPs are fully described in PDD. However, the stakeholder implementation process was described incompletely in PDD, thus the validation team raised CL03. This was resolved in “Findings”.

<Findings>

CL03

The description of local stakeholder implementation process was not written completely in line with JCM Guidelines.

Resolution of CL03 by the PPs

The PPs added a description in the PDD, related to the results of invitation for the

local stakeholder consultation. It was confirmed through interview with the PPs that they tried to invite government officials of the Kingdom of Saudi Arabia at the invitation stage, however as a result, the participants in the stakeholder meeting were only the employees of JANA. The validation team considered it reasonable, and thus this CL is closed.

<Conclusion based on reporting requirements>

The validation team has concluded that the implementation of the local stakeholder consultation of the proposed JCM project is adequate. The additional explanation related to the local stakeholder implementation is appropriate and in line with JCM Guidelines.

C.7. Monitoring

<Means of validation>

In this proposed JCM project, the PPs have defined a single parameter "power consumption of project electrolyzer during the period *p*", $EC_{PJ,i,p}$, to be monitored ex-post in accordance with the approved methodology. It is calculated by multiplying the amount of electric current and electric voltage of electrolyzers. The model of the project electrolyzers is nx-BiTAC, which consists of two units (RE120 and RE121) installed in two production lines (A and B). Each electrolyzer has 68 cells, where the electric current and the electric voltage of each cell is monitored by ammeter and voltmeter respectively, and the data is collected automatically through Cell Voltage Monitoring System (hereinafter referred to as "CVMS"). Two units of CVMS have been installed to monitor two pairs of electrolyzers in every second. The collected data is recorded by Distributed Control System (hereinafter referred to as "DCS") and by Emergency Control System (hereinafter referred to as "ESD"). A backup of data is automatically conducted for every three months. The electric voltage and electric current for each cell in each electrolyzer recorded by DCS is downloaded in an Excel spreadsheet. By multiplying of the total electric voltage of all cell in the electrolyzer with the electric current of the electrolyzer, the power consumption of the electrolyzer is calculated and recorded on a monthly basis.

It was confirmed that the latest calibration for CVMS was carried out on 03/01/2018, by an independent calibration service provider, Alazzaz Co. Ltd., who has been accredited by the International Accreditation Service. The subsequent calibration is scheduled on 02/01/2019.

The roles and responsibility of the personnel are described in the Monitoring Structure Sheet in accordance with the requirements of the applied methodology. The monitoring structure consist of:

- General Manager (Kanematsu), checking the monitoring data and electricity generation reported, calculating GHG emission reductions based on the monitoring data. Also responsible for project planning, implementation, and reporting for JCM procedure.
- Director (JANA), checking the reporting of power consumption.
- Operation Administrator (JANA), taking and checking the data of power consumption through DCS, preparing the reporting of power consumption, and archiving data. Reporting the power consumption to Director (JANA) and General Manager (Kanematsu)

<Findings>

No issues were identified to the requirement.

<Conclusion based on reporting requirements>

The validation team has concluded that Monitoring Plan of the proposed JCM project complies with the requirements of the methodology and JCM Guidelines, and the PPs have ability to implement the described Monitoring Plan, including Monitoring Structure Sheet.

C.8. Modalities of Communication

<Means of validation>

The MoC was submitted to the validation team for review in the latest form as of the time of validation, JCM_SA_F_MoC_ver. 01.0, in which a person of Kanematsu is nominated as the focal point. The MoC was signed by the authorized representatives of all the PPs with the contact details.

The validation team has assessed the personal identities including specimen signatures and employment status of the authorized signatories directly through the interview with PPs during the on-site assessment. Primary authorized signatory of Kanematsu is Mr. MAKOTO Yokoshi as Manager, Industrial Machinery & Plant Section, Plant & Ships Department, and alternate authorized signatory is Mr. NORIO Asami as Assistant Manager, Industrial Machinery & Plant Section, Plant & Ships Department. Primary authorized signatory of Jubail Chemical Industries Company is Mr. SEENIVASAN Veerachamy as Technical Services Director, and alternate

authorized signatory is Mr. TARIQ Farooq as Senior Process Engineer.

It is confirmed that all corporate and personal details including specimen signatures and the information in the MoC, dated 30/01/2018, are valid and accurate as requested in the JCM Guidelines for Validation and Verification.

<Findings>

No issues were identified to the requirement.

<Conclusion based on reporting requirements>

The validation team has concluded that the MoC complies with all relevant forms and requirements.

C.9. Avoidance of double registration

<Means of validation>

It is declared in the MoC that the proposed JCM project is not registered under any other international climate mitigation mechanism other than the JCM. For cross-check, the validation team confirmed through checking publicly available information of Clean Development Mechanism (CDM), Verified Carbon Standard (VCS), etc. that the proposed JCM project has not been registered under other international climate mitigation mechanisms in terms of the name of entities, applied technology, scale, and the location. Therefore, it is concluded that the proposed JCM project dose not result in double registration/double counting of GHG emission reductions.

<Findings>

No issue was raised to the requirement.

<Conclusion based on reporting requirements>

The validation team concluded that the proposed JCM project was not registered under the other international climate mitigation mechanisms at the stage of validation.

C.10. Start of operation

<Means of validation>

The starting date of the proposed JCM project is set as 25/01/2017 in the PDD. It is confirmed through the review of relevant documents, and the interview with the PPs during the on-site assessment, that it is the starting date for monitoring activity.

<Findings>

No issue was raised to the requirement.

<Conclusion based on reporting requirements>

The validation team concludes that the start of the operating date of the proposed JCM project has been defined appropriately.

C.11. Other issues

<Means of validation>

There was a lack of information related to the date of revision history of PDD. Therefore, the validation team raised CL02. This clarification request was resolved in the "Findings" below.

<Findings>

CL02

There is a lack of PDD revision history date.

Resolution of CL02 by the PPs

The date of PDD revision history is filled in with 19/12/2017 for PDD version 01.0, and 05/03/2018 for PDD version 02.0. The validation team confirms that the revision history of PDD has been revised appropriately, and thus this CL is closed.

<Conclusion based on reporting requirements>

The validation team confirms that no other issues remain.

D. Information on public inputs

D.1. Summary of public inputs

In line with the JCM Project Circle Procedure, the PDD was made publicly available through the JCM website for 30 days to invite public comments, in line with the requirement of the JCM the Project Cycle Procedure. This call for public comments was open from 30 Jan 18 - 28 Feb 18 (24:00 GMT). The specific JCM website of the proposed JCM project is as below, and no comment was received.

https://www.jcm.go.jp/sa-jp/information/252

D.2. Summary of how inputs received have been taken into account by the project participants

Not applicable

E. List of interviewees and documents received

E.1. List of interviewees

1. Kanematsu Corporation
   - Norio Asami, Assistant Manager, Industrial Machinery & Plant Sec./Global Environmental Business Team, Plant and Ships Dept.
2. Jubail Chemical Industries Company (JANA)
   - V. Seenivasan, Technical Services Director (TSD) Director
   - Tariq Farooq, Senior Process Engineer
   - Mohamed Saleem, Senior Superintendent-Mechanical
   - J. Harikrishna Kumar, Senior Superintendent
   - Abdul Wajib, Instrument Supervisor-DCS, CVMS & Instrument
   - G. Anwar Habys, Instrument Engineer
   - M. Ali Akbar, Senior Superintendent Laboratory
   - Munawar Shah, Senior Operation Superintendent
3. Environmental Resources Management (ERM) Japan Ltd.
   - Tsuyoshi Nakao, Team Leader of Sustainable Management Team

E.2. List of documents received

1. Project Design Document, for publication (JCM_SA_F_PDD_ver02.0.DOCX)
2. Monitoring Plan Sheet and Monitoring Structure Sheet, for publication (JCM_SA_AM001_ver01.0.XLSX)
3. Modalities of communication statement, for publication (JCM_SA_F_MoC_ver01.0 .pdf)
4. JCM Approved Methodology SA_AM001 (JCM_SA_AM001_ver01.0.pdf)
5. Monitoring Plan Sheet of JCM Approved Methodology SA_AM001 (JCM_SA_AM001_ver01.0.xlsx)
6. JCM Glossary of Terms (JCM_SA_Glossary_ver01.0)
7. JCM Project Cycle Procedure (JCM_SA_PCP_ver02.0.pdf)
8. JCM Modalities of Communication Statement Form (JCM_SA_F_MoC_ver01.0)
9. JCM Guidelines for Developing Project Design Document and Monitoring Report (JCM_SA_GL_PDD_MR_ver02.0.pdf)
10. JCM Project Design Document Form (JCM_SA_F_PDD_ver02.0.docx)

11. JCM Guidelines for Validation and Verification (JCM_SA_GL_VV_ver01.0.pdf)
12. JCM Validation Report Form (JCM_SA_F_Val_Rep_ver01.0.docx)
13. Company profile of Kanematsu Corporation
14. Company profile of Jubail Chemical Industries Company (JANA)
15. Acceptance Certificate for bi-polar electrolyzers indicates the performance test runs completed in January 25, 2017, which the day is determined as the starting operation day
16. The durable year list stipulated in the Regulation of the Japanese Finance Ministry No.15/1965 concerning the equipment lifetime, which used for determining the operation life of the proposed JCM project.
17. The documents related to OJT implementation evidences, which indicated by the Article 7 in the sales contract for bi-polar electrolyzer unit between Kanematsu Corporation and Thyssenkrup Uhde Chlorine Engineers, and the attendance list of OJT.
18. Technical Appendix for Cell Room Package, which shows the technical specification of electrolyzers.
19. Certificate of Performance Guarantee Acceptance which indicates the guaranteed DC Power Consumption of 1990 [DCkWh/MT-NaOH8100%] during 5 days of performance guarantee test period (20-25 January 2017)
20. List of the main equipment replaced in the proposed JCM project No.20
21. Excel sheet rev2.1 used for showing CO_2 reduction estimated calculation
22. Kingdom of Saudi Arabia Royal Commission for Jubail and Yanbu, Royal Commission Environmental Regulation 2015, Volume I, Regulation and Standards, which indicates the EIA is not required in the proposed JCM project
23. Environmental Information Report which indicates several revisions have been done in the previous years and the Environmental Permit to Operate
24. Minute of Meeting for Local Stakeholder Consultation (LSC) including the agenda and the list participant list
25. Presentation materials for the local stakeholder consultation provided by Kanematsu Corporation, JANA CO. Ltd., and ERM Japan.
26. An overview of MRV including the document for DCS/CVMS monitoring data, the explanation about Power Consumption Unit Calculation Method and the general specification of CVMS.
27. Calibration Certificates for Monitoring point No.1 (Data Acquisition Unit of MX-100 model, Documenting Process Calibrator 754 model, Beamex MC5P model, four units of CVMS connecter to each electrolyzer, density meter, four unit of temperature transmitter for each electrolyzer, magnetic flowmeter), Specification

of Densimeter and Temperature Transmitter, including Preventive Maintenance Report DCS & ESD System

28. Baseline Determination for the Electricity Grid in the Kingdom of Saudi Arabia, grid emission factor (GEF) according to CDM regulations
29. Attendance list of participants in the on-site assessment
30. Transformer Specification, Technical Guarantee of Rectifier and Technical Information of Rectifier Equipment.
31. Questions & Answer 180123 (Kanematsu Reply-the latest version)
32. Piping and Instrumentation Diagram Chloro-Alkali Plant, Catholyte Circulation, which shows Install Location of Density Meter, Install Locations of the two units of Thermometer Transmitter, and Install Locations of the two units of Thermometer Transmitter.
33. DC Consumption data in 2017 recorded by BiTAC OPERATION DATA
34. List of Grid Emission Factors issued by IGES
35. PDD for registration (JCM_SA_F_PDD_ver02.0_Electrolyzer(Kanematsu 171201)_MOE(1218rev)Clean.docx)
36. MPS for registration (JCM_SA_AM001_IonExchange_DraftFinal171201_rev1.1(Kanematsu 171201).xlsx)

Annex Certificates or curricula vitae of TPE's validation team members, technical experts and internal technical reviewers

Statement of competence JQA

Name: Mr. Koichiro Tanabe

Qualified and authorized by Japan Quality Assurance Organization.

Function	Date of qualification
Validator	-
Verifier	2014/12/22
Team leader	2014/12/22

Technical area within sectoral scopes	Date of qualification
TA 1.1. Thermal energy generation	2014/12/22
TA 1.2. Renewables	2014/12/22
TA 3.1. Energy demand	2014/12/22
TA 4.1. Cement and lime production	-
TA 4.6. Other manufacturing industries	2014/12/22
TA 5.1. Chemical industry	2014/12/22
TA 10.1. Fugitive emissions from oil and gas	2014/12/22
TA 13.1. Solid waste and wastewater	2014/12/22
TA 14.1. Afforestation and reforestation	-

Statement of competence JQA

Name: Dr. Irhan Febijanto

Qualified and authorized by Japan Quality Assurance Organization.

Function	Date of qualification
Validator (JCM project only)	2017/8/21
Verifier (JCM project only)	2017/8/21
Team leader	-

Technical area within sectoral scopes	Date of qualification
TA 1.1. Thermal energy generation	2014/12/22
TA 1.2. Renewables	-
TA 3.1. Energy demand	2014/12/22
TA 4.1. Cement and lime production	-
TA 4.6. Other manufacturing industries	-
TA 5.1. Chemical industry	-
TA 10.1. Fugitive emissions from oil and gas	-
TA 13.1. Solid waste and wastewater	-
TA 14.1. Afforestation and reforestation	-

Statement of competence JQA

Name: Dr. Tadashi Yoshida

Qualified and authorized by Japan Quality Assurance Organization.

Function	Date of qualification
Validator	2014/12/22
Verifier	2014/12/22
Team leader	2014/12/22

Technical area within sectoral scopes	Date of qualification
TA 1.1. Thermal energy generation	2014/12/22
TA 1.2. Renewables	2014/12/22
TA 3.1. Energy demand	2014/12/22
TA 4.1. Cement and lime production	2015/11/12
TA 4.6. Other manufacturing industries	2014/12/22
TA 5.1. Chemical industry	2014/12/22
TA 10.1. Fugitive emissions from oil and gas	2014/12/22
TA 13.1. Solid waste and wastewater	2014/12/22
TA 14.1. Afforestation and reforestation	-