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नमामि गंगे

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1C1O Prayagraj
Monitoring Tool for Jal Nigam

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GOPA Infra

in consortium with

FICHTNER
WATER & TRANSPORTATION

Consulting Services on Rehabilitation Measures on behalf of the National Mission on Clean Ganga

"Support to Ganga Rejuvenation"
Phase II
Uttarakhand and Uttar Pradesh

India

Indo-German Development Cooperation
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Table of Contents

1 Monitoring System

To oversee Concessionaire during all relevant phases of the Concession Agreement (in design and planning, in testing and commissioning as well as in operation and maintenance of works.

2 Recommended Tools for Monitoring

2.1 Tool 1: Monitoring in Design/Planning Phase

Item	Sub tool	Description	Responsible	Partici-pation	Date / Sequence	Comments / Remarks
T1.1	Monitoring 1	Implementation of comprehensive codi-fication systems for the different type of documents (letters, submittals, com-menting on submittals, response to comments) as well as of procedures for the paper flow (exchange of documents as well as scale of distribution) and registration (Submittal List).	C	C, PE, JN	immediately after award of contract	The immediate implementation of such clear and comprehensive codification systems and proce-dures will essential for the successful and effi-cient management of the document flow taking into account the expected huge amount of docu-ments caused by the complexity of the project with very limited sequences for check and com-menting on submittals by PE.
T1.2	Monitoring 2	Implementation of comprehensive codi-fication (designation, classification and numbering) systems for treatment units, equipment, motors/drives, valves, pipes, fittings, sensors, meters and other I&C devices as well as their inter-linking.	C	C, PE, JN		The immediate implementation of such detailed and comprehensive codification systems will be a crucial precondition for the successful completion in time of the huge design and planning works for the complex system as well as for effective check-ing and commenting on by PE within the envisaged very limited timeframe.
T1.3	Monitoring 3	Implementation of comprehensive codi-fication (designation, classification and numbering) systems for drawings (dia-grams, profiles, layouts, sections and plans).	C	C, PE, JN		
	Monitoring 4	Design Workshops	C	C, PE, JN		The designs of the complex system will be exten-sive and the timeframe for checking and com-menting on is very limited. Therefore we recom-

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						mend to organise stepwise pointed workshops for presentation and pre-clarification of main design components.
T1.4	Workshop 1	Presentation and discussion of option analysis related to the selection of the most preferred type of biological treatment process.			after 2 weeks	State of the art process, acc. to good engineering practise, proven process with adequate number of references with same or similar capacity in same or similar climatic zones.
T1.5	Workshop 2	Presentation and discussion of proposed measures to improve the energy efficiency of the selected type of biological treatment process.			after 4 weeks	Especially the aeration system (blowers, valves and diffusers) and mixing systems of the Activated Sludge Tanks (main consumer of energy) has to be of energy efficient and reliable type.
T1.6	Workshop 3	Presentation and discussion of option analysis related to the selection of the most preferred type of technology for disinfection of treated wastewater			after 6 weeks	Currently chlorine is used for disinfection of the treated wastewater. Because chlorine gas is toxic (health and safety risk) as well as some by-products created in the process of chlorine disinfection increase the risk of cancer (health risk) the technology should be changed.
T1.7	Workshop 4	Presentation and discussion of option analysis related to the selection of the most preferred equipment type for mechanical thickening and dewatering of sludge.			after 8 weeks	The selected type of equipment for thickening/dewatering as well as for polymer preparation and dosing should be proven by own experiences of the Concessionaire and take into consideration the polymers available in the Indian market.
T1.8	Workshop 5	Presentation and discussion of option analysis related to the selection of the most preferred type for anaerobic digestion of sludge.			after 10 weeks	The Concessionaire has to take into consideration the Performance Criteria: 'Less than 2,000,000 MPN Fecal Coliforms per g TS'.
T1.9	Workshop 6	Presentation and discussion of option analysis related to the selection of the most preferred type for energetic utilisation of biogas.			after 12 weeks	Proven technologies for implementation i.e. CHP-units and microturbines should be assessed based on realistic figures of biogas generation.
T1.10	Workshop 7	Presentation and discussion of flexibility for least-cost expansion acc. to potential change/increase of effluent requirements.			after 14 weeks	For fast, effective and sustainable improvement of the current status of the water quality in Indian rivers, especially in Ganga river it is urgently required to implement advanced biological treatment including the removal of nitrogen and phosphorus in addition to the removal of BOD and SS

Item	Sub tool	Description	Responsible	Partici-pation	Date / Sequence	Comments / Remarks
						(refer to proposal of National Green Tribunal).
T1.11	Workshop 8	Presentation and discussion of designs for house connections, sewer system, pumping stations and nallahs as well as harmonisation of planning for sewer system with planning for STPs.			after 16 weeks	The harmonisation of planning of both system components is essential for reliable and efficient O&M as well as will be basis for establishment of realistic load scenarios along the CA period.
T1.12	Monitoring 5	Monitoring of flexibility of capacity of SCADA system for potential expansion and modification of the plant in case new effluent requirements have to be respected.			after 14 weeks	The SCADA system should have at least the re-serve capacity for signal exchange and control of the potential expansion and modification measures as well as the implementation of addi-tional operation pictures.
T1.13	Monitoring 6	Monitoring of preparation of implemen-tation of additional software tools/programs including lectur-ing/training of related operators			after 14 weeks	Potential additional software tools could be: - software tool for modelling and dynamic simula-tion of STPs (SIMBA, BioWin, GPS-X) - software tool for scheduled and preventive maintenance.

C – Concessionaire, JN – Jal Nigam, PE – Project Engineer

Proposal of National Green Tribunal:

Parameter	Symbol	Unit	NGT proposal
Biochemical Oxygen Demand	BOD	mg/L	10
C, hemical Oxygen Demand	COD	mg/L	50
Total Suspended Solids	TSS	mg/L	20
Total Nitrogen	TN	mg/L	10
Ammonia Nitrogen	NH_4-N	mg/L	None
Total Phosphorus	TP	mg/L	1
Fecal Coliforms	FC	MPN/100mL	100/230**

Item T1.10 is not applicable for CA Allahabad because the sewer system is not fully included.

As instrument for counter-check sophisticated and proven technologies as well as equipment components we have prepared an Overview of German/European Suppliers/Manufacturers which provide such technologies and equipment components a well as are willing to support by design, preparation of offers and technical consultation.

NMCG: Third party experts to assist PE and JN in evaluation of sensitive design issues (technologies not so common in India so far)

Support C in training their operators for O&M of technologies not so common in India so far

Potential suppliers of software tools for modelling and dynamic simulation of STPs:

Software Tool	SIMBA	BioWin	GPS-X
Supplier	ifak technology + service GmbH Ludwig-Erhard-Allee 10 76131 Karlsruhe Germany	EnviroSim Associates Ltd. McMaster Innovation Park 175 Longwood Road South, Suite 114A Hamilton, Ontario L8P 0A1 Canada	Hydromantis Environmental Software Solutions, Inc. 407 King Street West Hamilton, Ontario L8P 1B5 Canada

2.2 Tool 2: Monitoring in Testing and Commissioning Phase

Item	Sub tool	Description	Responsible	Partici-pation	Date/ Sequence	Comments / Remarks
T2.1	Monitoring 1	Update of the related documents Process Description, Equipment Specification, P&I-diagrams, Control Philosophy, Single Line diagrams, Signal Flow diagrams, ATEX-zones plan and drawings as basis for all checks and tests.	C	C, PE, JN	Submission 2 weeks before first check/test	Update is required to implement all changes and modifications established during detailing of design, construction of structures and assembly of equipment.
T2.2	Monitoring 2	Implementation of a comprehensive time schedule and of clear procedures and preparation of related documents (forms for check protocols, test records) and an Overview Matrix showing the progress of checks and tests during commissioning.	C	C, PE, JN	in good time before first check/test	Procedures and forms must be clarified and agreed in adequate time before the Concessionaire invites for the first check/test. The invitation to witness checks/tests has to be submitted in adequate time before the intended date of the check/ test.
T2.3	Monitoring 3a	Participation in selected checks/tests of sensitive equipment at Place of Manufacturing.	C	C, PE, JN	acc. to the Time Schedule	Screens as well as screenings and grit removal equipment; large scraper bridges; aeration blowers, big pumps (i.e. inlet pumps, recirculation pumps, return sludge pumps, digester circulation pumps); digester mixing system; CHP-units; thickening and dewatering equipment.
T2.4	Monitoring 3b	Participation in selected Performance Tests of big pumps at Place of Manufacturing.	C	C, PE, JN		Big pumps should be tested along the full Performance Curve at the test bench of the manufacturer (i.e. KSB).
T2.5	Monitoring 4	Participation in selected Functional Tests of sensitive equipment on site.	C	C, PE, JN		refer to above under item T2.1 mentioned equipment
T2.6	Monitoring 5	Participation in selected Performance Tests of sensitive equipment on site i.e. Performance Test of Aeration System.	C	C, PE, JN		The load will not be sufficient to test at least one line of AST acc. to the design load. Therefore the performance of the Aeration System should be tested by a Standard Oxygen Transfer Test.
T2.7	Monitoring 6	Participation in selected Signal Tests of sensitive Local Control Units of Package Units and in central SCADA.	C	C, PE, JN		A cleaned List of failures and alarms is required to allow efficient monitoring of failed equipment components (check of availability).
T2.8	Monitoring 7	Monitoring of the progress of checks and tests based on the Time Schedule	C	C, PE, JN	weekly	Concessionaire has to explain reasons for time delays and potential related compensation

Item	Sub tool	Description	Responsible	Partici-pation	Date/ Sequence	Comments / Remarks
		and the Overview Matrix (refer to item T2.2)				measures.
T2.9	Monitoring 8	Monitoring of professional qualification and experience of the staff members especially of the newly hired ones.	C	C, PE, JN	whenever necessary	To identify the needs for deeper lecturing and training as well as for modification of the Plan for lecturing and training accordingly in case necessary to enable all operators for efficient and reliable O&M of the works.
T2.10	Monitoring 9	Monitoring of lecturing and training of operators for efficient and reliable O&M of the works especially for O&M of new and sensitive technologies and equipment (i.e. CHP- units).	C	C, PE, JN	acc. to the Conception for Lecturing & Training of Operators	Lecturing and training of operators has to be carried out to an extent adequate that the operators can operate and maintain such equipment efficiently and reliable. In case of reasonable doubts we recommend to enter into a temporary Service Contract with the Supplier/Manufacturer for 1 or 2 years for bridging till the operators could earn enough experience for proper O&M.
T2.11	Monitoring 10	Monitoring of the preparation of correction graphs/curves for evaluation of the consumption of consumables (especially electrical energy).	C	C, PE, JN	in good time before the performance test of works	For a reliable evaluation of the Power Consumption under excess flow conditions and low load conditions correction graphs/curves will be required which present realistic consumption values for above mentioned flows and concentrations/loads (differing considerably from the design values).
T2.12	Monitoring 11	Monitoring of the availability of STP's equipment by regular checks of the Log Book and the Failure/Alarm List generated in SCADA system.	C	C, PE, JN	weekly	The checks and the as close as possible clarification of the duration of fails of equipment components are very important because this is usually not verifiable recorded in SCADA. Related remarks in the Log Book (date/time of completion of repair and of reset of alarm in SCADA are essential for later verification.
T2.13	Monitoring 12	Monitoring of the preparation of O&M manual including all required certificates proofing compliance to ATEX and qualified calibration of related equipment components as well as Safety Data Sheets for used chemicals.	C	C, PE, JN	when necessary	The O&M manual incl. the mentioned Safety Data Sheets is the essential basis for the successful lecturing and training of the operators (refer to item T2.10).

Item	Sub tool	Description	Responsible	Partici-pation	Date/ Sequence	Comments / Remarks
T2.14	Monitoring 13	Monitoring of the execution of the Snag/Punch List	C	C, PE, JN	monthly	Usually during all checks and tests arises a long list of technical defects to be rectified. The listed measures have to be executed continuously according to their priority. Before the Final Walk Through (FWT) to prove the completion of the works at least all snags with priority must be implemented.

2.3 Tool 3: Monitoring in Operation & Maintenance Phase

Item	Sub tool	Description	Responsible	Participation	Date / Sequence	Comments / Remarks
T3.1	Monitoring 1	Monitoring of the regular updating/revision of the technical basic documents O&M manual, P&I-diagrams, Control Philosophy and As-built drawings.	C	C, PE, JN	yearly	Update/revision is required because all technical changes as well as modification and optimisation measures implemented during the past year should be inserted into the documents to adapt them to the latest state. This is the essential precondition for the proper regular lecturing and training of the operators (refer to item T3.5).
T3.2	Monitoring 2	Monitoring of the regular updating of correction graphs/curves for evaluation of the consumption of consumables (especially electrical energy).	C	C, PE, JN	yearly	Update /upgrade of the correction graphs/curves based on the operational data of the past year as well as taking into consideration the established modifications in the sewer system and sewer management for accordingly adjusted evaluation of the Power Consumption.
T3.3	Monitoring 3	Monitoring of consumption of relevant consumables (especially electrical energy) and related cost by using the updated correction curves as well as invoices for counter-check.	C	C, PE, JN	monthly	Regular monitoring is essential for continuously strict control of cost.
T3.4	Monitoring 4	Monitoring of the availability of STP's equipment by regular checks of the Log Book and the Failure/Alarm List generated in SCADA system.	C	C, PE, JN	monthly	Regular monitoring is essential because Availability is one of Key Performance Indicators.
T3.5	Monitoring 5	Monitoring of regular lecturing and training of operators for energy saving / cost efficient O&M of the works especially of the aeration system as well as in case new sensitive treatment units or equipment components will be implemented (i.e. CHP units)	C	C, PE, JN	monthly	The regular lecturing and training of operators will be used to also to explain the technical changes as well as modification and optimisation measures based on the updated/revised technical basic documents (refer to item T3.1).
T3.6	Monitoring 6	Monitoring of optimisation of polymer consumption based on coordinated supplier (supplier of thickening/ de-	C	C, PE, JN	when necessary	Degreasing cost for polymer consumption should be possible.

		watering equipment and supplier of polymer) supported tests of potential new polymers on site if required.				
T3.7	Monitoring 7	Monitoring of execution of service contracts for the first one or two years after implementation of new sensitive treatment units or equipment components will be implemented (i.e. CHP units)	C	C, PE, JN	when necessary	Temporary Service Contract with the Supplier/Manufacturer for 1 or 2 years for bridging till the operators have earned enough experience for proper O&M.
T3.8	Monitoring 8	Monitoring of regular service, maintenance and re-calibration of meters, sensors and analysers by qualified service partners (in case required)	C	C, PE, JN	monthly	Basis to record reliable data for efficient operation and further optimisation of processes.
T3.9	Monitoring 9	Monitoring of change from reactive and failure related maintenance to scheduled and preventive maintenance	C	C, PE, JN	monthly	The change of type of maintenance will be established stepwise based on the application of the related software tool. Degreasing cost of spare parts and lubricants (i.e. for CHP-units) will be an indicator for efficient and reliable O&M as well as for successful change from reactive maintenance to preventive maintenance.

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