

Environmental Management Plan

August 2016

Mongolia: Ulaanbaatar Urban Services and *Ger* Areas Development Investment Program—Tranche 1

Prepared by the Municipality of Ulaanbaatar for Mongolia and the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 15 August 2016)

Currency unit	–	togrog (MNT)
MNT1.00	=	\$0.00046
\$1.00	=	MNT2,163.50

ABBREVIATIONS

ADB	–	Asian Development Bank
ADF	–	Asian Development Fund
AP	–	affected person
C-EMP	–	contractor's environmental management plan
CFBC	–	circulating fluidized bed combustion
CS	–	consulting service
DEIA	–	detailed environmental impact assessment
DSC	–	design supervision consultant
EIA	–	environmental impact assessment
EMP	–	environmental management plan
EMR	–	environmental monitoring report
ESMS	–	environmental and social management system
ESS	–	environmental safeguard specialist
FAM	–	facility administration manual
FGD	–	flue gas desulfurization
HDPE	–	high density polyethylene
HOB	–	heat-only boiler
IEC	–	information, education, and communication
IEE	–	initial environmental examination
LAR	–	land acquisition and resettlement
LARP	–	land acquisition and resettlement plan
M&E	–	monitoring and evaluation
MET	–	Ministry of Environment and Tourism
MFF	–	multitranches financing facility
MUB	–	Municipality of Ulaanbaatar
NGO	–	nongovernment organization
P1-EMP	–	environmental management plan for Project 1
PC	–	public consultation
PIS	–	project implementation support
PM	–	particulate matter
PMO	–	program management office
PPTA	–	project preparatory technical assistance
RRP	–	report and recommendation of the President
SPM	–	suspended particulate matter
SPS	–	Safeguard Policy Statement
SRA	–	Subcenter Development Authority
USUG	–	Ulaanbaatar Water Supply and Sewerage Authority

WEIGHTS AND MEASURES

cm	–	centimeter
dB(A)	–	A-weighted sound pressure level in decibels
ha	–	hectare
kg	–	kilogram
km	–	kilometer
kWh	–	kilowatt-hour
m	–	meter
mm	–	millimeter
m/s	–	meter per second
m ²	–	square meter
m ³	–	cubic meter
mg/l	–	milligram per liter
mg/m ³	–	milligram per cubic meter
mg/Nm ³	–	milligram per standard cubic meter
Nm ³	–	standard cubic meter
°C	–	degree Celsius

NOTE

In this report, "\$" refers to United States dollars.

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I. ENVIRONMENTAL MANAGEMENT PLAN

A. General

1. This updated EMP based on detailed design¹ aims to (i) provide critical facts, significant finding, and recommended actions; (ii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (iii) to describe the monitoring measures and reporting procedures to ensure early detection of conditions that require particular mitigation measures; and (iv) identify responsibility for carrying out the mitigation and monitoring measures.
2. The EMP will guide the environmentally-sound construction of all subprojects of Tranche 1 and ensure efficient lines of communication between MUB, PMO, DSC and contractors. The EMP identifies activities according to following three phases of development: (i) Pre-Construction Activities; (ii) Construction Phase; and (iii) Post Construction/Operational Phase.
3. The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of environmental assessments conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating environmental impacts of the subproject; and (iv) ensure that safety recommendations are complied with.
4. A copy of the EMP must be kept on work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.
5. For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventive actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

B. Design Rationale

6. Necessary re-adjustments in Detailed Design stage to create conformity between EMP and design - this means mitigation through avoidance. Built-in inherent negative impacts can be invited through an unsound design and most negative factors can be avoided (eliminated) through the use of improved and environmentally sound technical design. Usually the engineer, find a compromise somewhere in between to adjust with available finances. As the detailed design of the project is now available, necessary re-adjustments in the EMP have been made in the light of detailed design features and the processing of salient features of IEE/EMP have been brought to the notice of detail design

¹ Design Due Diligence Report for Tranche 1 prepared by DOHWA-Monconsult in February 2016

consultants (CS-1). They have the option to avoid as many adverse factors as possible through design adjustments. Table 1 shows the Salient Features of Various Components of Tranche 1 considering updating design parameters according to detailed layout plan.

Table 1: Salient Features of Various Components of Tranche 1²

Subproject	Description of Components	
	Bayankhoshuu Subcentre	Selbe Centre
Construction of water and sewerage pipeline network	Water Supply Network HDPE & Steel Pipe D150~250: 5.376km Combined trench for water and heating pipe:3.86km Manhole D1500, H-3.5 22ea; Flowmeter 3	Water Supply Network HDPE & steel Pipe D150~250: 6.056km Trench for water and heating pipe:3.94km Manhole D1500, H-3.5 25ea, Flowmeter 3
	Internal sewerage pipe work HDPE Pipe D150~300: 9,928m Manhole D1000- 6, D1500-282 Protection Pipe D350~D500: 1,298.5m	Internal sewerage pipe work HDPE Pipe D150~300: 9,802m Manhole D1000- 12, D1500-265 Protection Pipe D350~D500: 39m
Construction of sewage Network extension	4116 meters D450 & 500 ductile iron gravity sewer pipe 2250 meters D600 ductile iron gravity sewer pipe	2183 meters D400 ductile iron gravity sewer pipe
Water Reservoir	Reservoir 1000ton, Pump station 1ea, Pipe D125-300:3.141km, manhole D1500, 5ea	Reservoir 1000ton, Pump station 1ea, Pipe D300:276m
Road	Carriageway – 5.5 m; Total length- 6.591 km including 1m pedestrian way for each road Width 9.5 m; Length- 350 m Width- 14 m; Length- 5.34 km Width- 20m- 0.9 km Street light- every 40 m Rehabilitation of existing road after trenches—2.07 km Landscaping -4.5 ha included in pedestrian ways	Carriageway – 12.0 m; width- 14 m, length- 5.5 km Rehabilitation of existing road after trenches—0.97 km Landscaping -4.5 ha included in pedestrian ways
Drainage and Flood Protection	Culvert D1.5m-115m, D1.5mx2 -105m Flood Protection (Ravine Slope) 2,448m	Flood Protection (Embankment) 2,300m Culvert -3,000m Foot bridges 8, Culvert 211m Three bridges- 24.15 m, 30.15 m and 60.25 m span
Heating Plant	16.8 MW CFBC Type Boiler (3 Boilers); Boiler capacity- 15Gcal/h Heating Pipe network- 3.86 km; steel pipe +insulation DN-125-400 Manhole-39, Substation-6	25.2 MW CFBC Type Boiler (3 Boilers) Boiler capacity- 15Gcal/h Heating Pipe network- 3.94 km; steel pipe +insulation DN-125-400 Manhole- 40, Substation- 5
Social and economic infrastructure	Kindergarten (2232 m ² of floor area of class rooms, administration and services; playground -500 m ² Business Incubator and Vocational Training Centre- 1800 m ² open/green area- 500 m ²	Kindergarten (2,232 m ² of floor area of class rooms, administration and services; playground-500 m ² Business Incubator and Vocational Training Centre- 2,090 m ² open/green area – 500 m ²

² Source: Design due diligence for Tranche 1; prepared by DOHWA-Monconsult LLC, February 2016

C. Overview of Impacts of Project

7. This section summarizes impacts as given in Initial Environmental Examination (IEE) Report³ and as reviewed by the Consultant⁴ during detailed engineering design of this project. Analysis of impacts are for “without mitigation measures” scenario. There is no significant adverse impact anticipated due to the project and all impacts could be mitigated. Suggested measures will not only mitigate or reduce the impacts to acceptable level but will improve the existing environmental condition as well.

8. The Project identified a range of positive impacts and benefits and adverse issues/concerns/impacts from the investment. Benefits include convenient access to houses and properties, and safe/potable water supply, wastewater management services, heating, and socio-economic infrastructure. These will lead to positive impacts, such as improved hygiene and sanitation, reduced health risks and incidence of diseases, reduced dust suspension, reduced soil and groundwater contamination, reduced greenhouse gas emission, reduced nasty odor especially during non-winter months, and an improved business and working environment.

9. The major adverse impacts during construction will be dust, noise which will arise from earthworks, transport/ loading/unloading of aggregate materials and wastes, movement/operation of construction vehicles/equipment, dry exposed areas, open stockpiles of aggregate materials and wastes, crushing/grinding/mixing/drilling/screening/ potential blasting, among others. The levels will be salient during the peak of construction period.

10. The opening/re-opening/dismantling of active and closed pit latrines within the construction alignments will cause foul odor to emanate. The workers handling the site clearing will be most at risk. Other potential sources of foul odor during construction would be poor sanitation practices of construction workers, poor management of solid wastes, the use of high VOC-emitting processes and specialty applications. Inner roads and lanes of main roads will be closed. The existing traffic congestion, particularly during peak hours, will be worsened. Travel time would become longer.

Impacts of the Heating with CFBC Boiler

11. The required land size for the construction of the Bayankhosuu heating plant (3 x 5Gcal/h) is about 9880 m² (1 ha) and the required land size for the construction of the Selbe heating plant (2 x 9Gcal/h + 1 x 5 Gcal/h) is about 10,916 m² (1.1 ha). The required land sizes are included the coal storage building, district heating facilities, control room, parking area and access road etc.

12. All materials and construction will be in compliance with the latest ASME Boiler Construction Code with regard to materials, thickness of tubes and plates, tests of materials, design of parts, pressure tests, type and size of auxiliary equipment, and other requirements.

13. The CS1 have had investigation of the technical/economic feasibility for construction of a coal fired heating plants examining certain types of boilers with different types of operation modes and focused on Circulating Fluidized Bed Combustion (CFBC)

³ Prepared during feasibility study in October 2013 by the TA Consultant

⁴ The “Consultant” means Project Management Support Services Consultant- CS2; egis International

system with low load operation in addition to base load operation. Low load operation is defined as continuous operation at 40% of boiler maximum continuous rating (BMCR), or less.

14. The boiler design will have control of coal fuel, limestone and inert material feed into the boiler, including conveyors, air blowers, and all electrical and mechanic equipment is required to ensure automatic feed control at all loads.
15. The boiler and coal equipment will be located indoors. All parts of the equipment requiring protection from the weather, moisture, and temperature extremes will be made of weatherproof construction or be provided with watertight shields or enclosures.
16. The impact of the proposed heating station is studied in two distinct phases:
 - i. During the construction phase which may be regarded as temporary or short term; and
 - ii. During the operation phase which would have long-term effects.
17. The critical areas of environmental concern for which the impacts and their predictions are taken into consideration are listed below:
 - i. Air Quality
 - ii. Noise
 - iii. Land and Soil
 - iv. Water Quality
 - v. Hydrology and Drainage
 - vi. Terrestrial Ecology
 - vii. Socio-economic aspect
18. The impacts can be further categorized as positive impacts and negative impacts depending upon their nature, potential and magnitude. Table 2 presents the matrix showing the impacts during the construction and operation stage of the HOB sub-project.

Table 2. Matrix showing the Impacts of the HOB

No.	Impacts	Negative Impact		Positive Impact	
		Short Term	Long Term	Short Term	Long Term
A	Construction Phase				
i	Pressure on local infrastructure	√			
ii	Contamination of Soil	√			
iii	Impact on water quality	√			
iv	Impact on air quality including dust generation	√			
v	Impact on flora & fauna		√		
vi	Noise pollution	√			
vii	Traffic congestion and loss of access	√			
viii	Staking and disposal of construction material	√			
viii	Public health and safety	√			
ix	Social impact				√
B	Operational Phase				
i	Increase in air and noise levels		√		
ii	Disposal of solid waste and landscape waste		√		
iii	Induced development	√			√
iv	Employment generation				√
v	Quality of life				√
vi	Positive boost to the local economy				√
vii	Public health & Safety				√

19. Construction activities normally spread over pre-construction, preparatory construction, machinery installation and commissioning stages and end with the induction of manpower and start-up.
20. Pre-construction phase basically involves completion of all legal formalities with respect to the No Objection Certificates from the various statutory bodies, surveys/ studies required, acquisition of land, settlement of all issues related to compensation, if any, finalization of contract for procurement of machinery/ equipment, recruitment and hiring of requisite skilled, semi-skilled manpower and labor, provision of space and other facilities like water supply, disposal of wastewater and solid waste etc. on temporary basis for the contracted labor to be employed and provision for storage of machinery and materials to be used for construction.
21. Preparatory construction phase mainly consists of transportation of machinery, equipment and materials to the site for construction, demolition of existing structure, clearing and levelling of land, construction of foundations, buildings and approach roads.
22. Machinery installation and commissioning involve activities like fabrication work, cutting, welding and construction of buildings and other facilities, laying of cables and pipelines etc. It involves testing of plant for any type of leakages and designed capacity.
23. During operation, main potential environmental impacts relate to the operation of the heating system, and other activities to a lesser extent. Potential adverse impacts during operation of the Heat-Only Boilers (HOBs) include (i) pollutants emission from the HOBs, (ii) noise from the HOBs, (iii) wastewater, and (iv) solid waste of ash and slag. The operation of the HOBs in Selbe and Bayankhoshuu Subcentres will emit particulate matters (PM), SO₂ and NO_x, the concentrations of which will be influenced by the quality of coal burned, the flue gas volume and the type and performance of the flue gas treatment equipment, traffic, and health and safety hazards. During operation, air emissions, solid wastes—ash, slag and FGD residue—and wastewater from running the heating systems are the salient impacts.
24. Detailed explanation and basic assessment of the FGD system is attached as an Annex 2.

II. MITIGATION MEASURES, MONITORING, REPORTING AND IMPLEMENTATION

A. Mitigation Measures

25. A wide range of mitigation/protection measures are used to address various identified environmental impacts. These mitigation/protection/compensation measures are derived based on the guiding principles shown in Figure 1. The guiding principles consists of six possibilities, three (viz. avoidance, modification and control/mitigation) for project activity and three (viz. protection, relocation/compensation, and enhancement) for environmental component. The most effective combination of all these strategies (in terms of its applicability and cost-effectiveness) are found and then incorporated in the EMP.

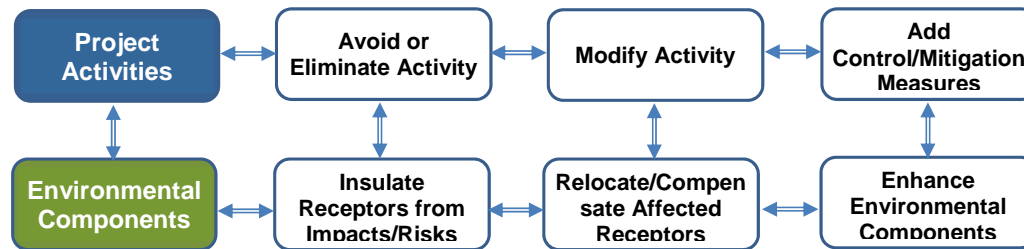


Figure 1; Guiding Principles for Derivation of Mitigation measures

26. For each mitigation measure to be taken its location, timeframe, implementation and overseeing/supervising responsibilities are listed in the EMP matrix.

27. **Table 3** lists the potential environmental issues and impacts during preconstruction, construction and operation phases of Tranche 1, as identified by the DEIAs and the IEE as well as corresponding mitigation measures designed to minimize the impacts after addressing all the relevant environment issues identified during detailed design.

28. The Mitigation Plan points out that most measures are the usual good engineering practices. The effectiveness of the measures will be evaluated based on the results of the environmental monitoring and inspection to determine whether they be continued or improvements should be made. Improvements need to be confirmed through stipulated environmental management procedures.

Table 3: Environmental Mitigation Plan

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
A. PRIOR TO CONSTRUCTION PHASE						
ROW Acquisition, Obtaining Approval and Community Preparation	Resettlement issue (8 LARP would be required ⁵)	<ul style="list-style-type: none"> Provide compensation in accordance with resettlement action plans (RAPs) Engage NGOs for implementation of RAP 	All affected community	RAP development budget PIS(CS2) and Resettlement cost	DSC(CS1), PIS(CS 2)	PMO
		<ul style="list-style-type: none"> At least 30 days before awarding of contract for civil works, losses shall have been fully compensated for. 	All affected community	Included in resettlement cost	PMO	
	DEIA requirement and approvals	<ul style="list-style-type: none"> Conduct/prepare EIA Report and obtain approval from MET 	Not applicable	Included PMO's annual budget		
	Potential communicable/transmittable diseases brought with entry of workers & overall health/safety hazards during construction & potential grievances	<ul style="list-style-type: none"> Intensive IEC campaign on communicable/ transmittable disease; e.g. SARS, STD, HIV/AIDS, tuberculosis etc., that may be brought with entry of workers, on health safety hazards during construction & on the grievance redress mechanism Ensure that the bidding entity has covered medical checking of workers 	All affected community	Included PMO's annual budget	PMO with , Community Awareness Consultant (CS3), DPH, khoros	PIS (CS2)
	Conflict, complaint issues from local residents and affected people	<ul style="list-style-type: none"> Organize introductory meeting, public events on planned construction Get to know the local residents on GRM and construction details Conduct survey on locals expectance in terms of environmental consequences of the construction Organize public discussions to get complaints from affected people 	All affected community	Included Design cost		
	Special requirements for Heating with CFBC Boiler	<ul style="list-style-type: none"> Due to specifics of proposing technology, the construction company needs to have detailed EIA approved by the MET and obliged to follow it during construction and operation stages. Additionally, the detailed EIA should address following issues: <ul style="list-style-type: none"> Compliance with the existing ambient air quality standards will be achieved by implementation of measures outlined in EMP. This needs to be coupled with the 	Project site	Included in the proposed budget of bidding entity	Construction company	PMO, MET

⁵ (i) LARP for Heating, Kindergarten and Business Incubator each for Selbe and Bayankhoshuu; (ii) LARP for road and other engineering infrastructure (phase-1) each for Selbe and Bayankhoshuu; (iii) LARP for road and other engineering infrastructure (phase-2) each for Selbe and Bayankhoshuu; (iv) LARP for water reservoir each for Selbe and Bayankhoshuu

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<p>continuous monitoring of air pollutants within and around the project site as well as in adjoining areas.</p> <ul style="list-style-type: none"> o To assess the impact of air emissions from various continuous point sources, air dispersion modelling study have to be conducted during the DEIA o The sufficiency of the land for proposed heating stations should be assessed in detail during the detailed EIA o Additionally, the cumulative impacts of the proposed HS should be assessed during the detailed design and DEIA. 				
Procurement & Prior to Mobilization of Contractors	Environmental management readiness	<ul style="list-style-type: none"> • Updating of the EMP prior to tendering and construction as necessary and including EMP requirements in tender and contract documents; • Developing a plan to implement the GRM; • Contracting of PIS and Licensed Institute by PMO for project specific environmental quality monitoring, developing detailed monitoring plan for construction and operation periods in accordance to the monitoring plan; • 	Not Applicable	Included PMO's annual budget	PMO	MUB
	Failure to obtain necessary consents, permits, no objection certificate NOCs, etc can result to design revisions and/or delay of works.	<ul style="list-style-type: none"> • Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works. • Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc. • Include in detailed design drawings and documents all conditions and provisions if necessary 	Not Applicable	Included PMO's annual budget	PMO	PIS (CS2)
	Disruption to traffic flow and sensitive receptors due to temporary area due to need of additional space/area intended for construction use	<ul style="list-style-type: none"> • Determine locations prior to award of construction contracts 	Not Applicable	Included Design cost	DSC (CS1)	PMO, PIS (CS2)/
		<ul style="list-style-type: none"> • Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. 	Not Applicable	Included Design cost	DSC(CS1)	PMO, PIS (CS2)
		<ul style="list-style-type: none"> • Prior to construction, prepare a site EMP (CEMP) which shall fully respond to the requirements set in the project EMP, and shall include a number of sub-plans, including the following: <ul style="list-style-type: none"> o Soil erosion protection plan o Borrow and spoil management plan o Water protection plan o Health and safety risk management plan o Spill management plan, o Waste management plan o Service interruption plan 	Within construction alignment	Included in Contractor's bid	Contractor	PMO, PIS (CS2)
B. CONSTRUCTION PHASE						

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
Soil Resources	Earthwork, soil erosion, soil contamination	<ul style="list-style-type: none"> • Implement soil erosion protection plan; • Minimize the area of soil clearance where close to close to human receptors; • Maintaining slope stability at cut faces by implementing erosion protection measures; • Control silt runoff from construction sites; • Cover soil stockpiles; • Properly stabilize slopes and re-vegetate disturbed surfaces. • Implement emergency preparedness and response plan (Spill Management Plan); • The top soil from the productive land area shall be preserved and reused for plantation purposes. It shall also be used as top cover of embankment slope of internal and peripheral roads for growing vegetation to protect soil erosion. It will be ensured that all excavated earth is utilized within site for levelling and road embankment purposes. • Store chemicals/hazardous products and waste on impermeable surfaces in secure, covered areas with clear labelling of containers and with a tray or bund to contain leaks • Regularly remove all construction wastes from sites to approved waste disposal sites; • Provide spill clean-up measures and equipment at each construction site; • Conduct training in emergency spill response procedures; • Implement borrow and spoil management plan, specifying location of borrow pits, quarries and spoil disposal sites; • Ensure that borrow areas are located away from residential areas, water bodies and valuable pasture/grazing land; • After use, grade borrow and spoil areas to ensure drainage and visual uniformity; • Borrow pit restoration must follow the completion of works in full compliance with all applicable standards and specifications • Fuel and lubricants shall be stored at the predefined storage location. • The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. • Construction vehicles and equipment shall be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. • All efforts shall be made to minimise the waste generation. Unavoidable waste shall be stored at the designated place prior to disposal. • To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized Waste Oil Recycler. 	All construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS 2)

Item	Potential Environmental Concerns/Impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<ul style="list-style-type: none"> To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route. Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided during construction phase. Non-bituminous wastes should be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed of in an identified dumping site approved by the MET. 				
Ambient Air	Fugitive dust generated by construction activities, gaseous air pollution (SO ₂ , CO, NO _x) from construction machinery	<ul style="list-style-type: none"> Stockpiles management: Manage stockpiles to reduce dust emissions. Locate stockpiles downwind of sensitive receptors. Spray stockpiles with water before material is moved. If a stockpile is within 300m of human receptors, additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing. Construction site management: Irrigation of construction sites and material handling routes where fugitive dust is generated, especially during strong windy days. Transport of materials: Trucks carrying earth, sand, stone or loose materials must be covered with tarpaulins or other suitable cover. Construction vehicles and machinery must be maintained to a high standard to minimize emissions (note that local standards do not exist for vehicle emissions). Manufacturing plants: Site any plants for the production of concrete or pavement covering such as asphalt at least 300 m from the nearest dwelling and locate downwind. 	All construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS 2)
Noise Level	Noise generated from construction activities	<ul style="list-style-type: none"> Source control. Maintain all exhaust systems in good working order and undertake regular equipment maintenance; Locate sites for concrete-mixing and similar activities at least 300 m away from noise sensitive areas; Operate between 8 am – 6 pm only and reach an agreement with nearby businesses and residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances; Provide advance warning to the community, including businesses and residents on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance; Vehicles transporting construction materials or wastes will comply with posted speed limits at all times and will be limited to low speeds in construction sites; 	All construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<ul style="list-style-type: none"> Vehicles transporting construction materials or wastes will not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and hospitals; Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the GRM will be disseminated; Ensure noise monitoring is undertaken near sensitive receptors, 				
Surface and ground water	Water Contamination, improper use of water	<ul style="list-style-type: none"> Implement the approved soil erosion management plan (as specified in soil mitigation measures section above) during construction; Implement contingency plans to control oil spills and other hazardous substances (Spill Management Plan) as part of the CEMP. Special attention will be paid for the Selbe site as Selbe River is next to the existing facility; Provide adequate construction site temporary sanitary facilities with holding tanks for construction workers. Discharge toilets to the existing wastewater treatment facilities Provide temporary drainage provision during construction to ensure that any storm water running off construction areas will be controlled; Enclosed drainage around chemical storage areas, maintenance shop and vehicle cleaning areas on construction sites and storage will be on hard standing; Meet construction water demand using water from permitted sources outside Subcentres; delivered to sites by water trucks & stored on site in tanks. Ensure potable water is stored clean & safe. 	All Construction sites and field offices & workers accommodations	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)
	Flooding	<ul style="list-style-type: none"> All works undertaken on construction site must be timed to avoid the typical summer rainfall floods; Rainfall forecasts must be monitored and work halted in the event that there is a flood risk. 	All Construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)
Solid Waste	Waste management and resource use	<ul style="list-style-type: none"> Implement the Waste management plan Minimize earth works during construction by optimizing the use of borrow pits and quarries; Reuse material from site demolition as much as possible if existing wastewater treatment facilities will be demolished; Demolition site will be properly cleaned up and demolition waste need to be collected and stored before disposal; Provide appropriate waste storage containers for worker's construction wastes; install enclosed storage points of solid and liquid wastes away from sensitive receptors, regularly haul to approved disposal facilities; Only contractors approved by the local authorities shall be used to remove all wastes from construction sites; 	All Construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<ul style="list-style-type: none"> It's strictly prohibited to burn any waste at any construction site. Waste must be collected and properly disposed 				
Fuels and Hazardous goods	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Prepare spill control procedures and submit the plan for PMO approval Train the relevant construction personnel in handling of fuels and spill control procedures Store dangerous goods in banded areas on a top of a sealed plastic sheet away from watercourses. Make available MSDS for chemicals and dangerous goods on-site. Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. Store hazardous materials above flood plain level Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials 	All Construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)
Physical Cultural Resources	Damage to temple or partial during religious rites and ceremonies	<ul style="list-style-type: none"> Construction activities must be immediately suspended if any temple are encountered; The local temple authorities must be promptly informed and consulted; and Construction activities shall resume only after thorough investigation and with the permission of the local temple authorities 	Bayankhoshuu site	Included in construction contract	Contractors	Local temple authorities
Socioeconomic resources	Community health and safety risks	<ul style="list-style-type: none"> Temporary traffic management, road safety awareness: During any works which involve crossing roads and affecting traffic movements, road users and pedestrians shall be made aware of changes to traffic flows through clear signage in advance of construction and during construction at the site; Construction site safety: Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. 	All sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<ul style="list-style-type: none"> Heavy machinery shall not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites shall be made secure, discouraging access by the public through fencing or security personnel, whenever appropriate. 				
	Occupational Health and Safety	<ul style="list-style-type: none"> Implement Health and Safety Management Plan (HSMP): This includes recording and reporting any occupational health and safety incidents, and reviewing the distribution and use of appropriate PPE. HSMP shall include the following provisions: <ul style="list-style-type: none"> Training. Provide adequate training to all workers, temporary or permanent workers, on occupational health and safety risks at construction sites, proper working procedures, proper use of PPEs, handling and disposal of hazardous wastes, incident reporting requirements; Clean water. Provide a clean and sufficient supply of fresh water, for construction and for all camps. Sewage and wastewater. Provide adequate sanitation facilities at all work sites. Solid waste. Provide garbage receptacles at construction sites, which will be periodically cleared and disinfected. Liquid chemical waste. Provide receptacles in suitably bounded areas for the storage of liquid chemical waste prior to disposal. Include clear warnings with health risks. Personal protection. Provide PPE, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations for workers. Emergency Preparedness and Response. An emergency response plan to take actions on accidents and emergencies, including public health emergencies associated with hazardous material spills and similar events will be prepared. Records Management. Store and maintain easily retrievable records protected against loss or damage should be established. It will include documenting and reporting occupational accidents, diseases, and incidents. Safety communication. Ensure that safety, rescue and health matters are given a high degree of publicity to all persons regularly or occasionally at active construction sites. Posters in Mongolian for the contractors drawing attention to relevant health regulations will be made or obtained from the appropriate sources and will be displayed prominently at construction sites. 	All sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)
Cumulative and indirect Impacts	Cumulative construction impacts	<ul style="list-style-type: none"> coordination with other projects in the area of influence in terms of construction schedule, possible access road and borrow/disposal sites and spoil sharing; enforcement of good construction management to minimize dust, noise and waste generation; education of construction workers to minimize social disturbance and cultural conflict; 	Construction sites	Included in construction contract	Contractors	PMO/ DSC(CS1)/ PIS(CS2)

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
		<ul style="list-style-type: none"> proper management of each construction site and timely restoration/strengthening affected areas upon completion of each construction project. 				
	Temporary traffic disturbance	<ul style="list-style-type: none"> Contractors will consult with relevant local authorities on the timing of the road excavation, including departments responsible for transport and traffic police; Use of appropriate traffic signals if alternate line traffic is required to maintain access along the road. 	Construction sites	-	Contractors	Khoroo representative /local authorities
C. OPERATION PHASE						
Heating Plant	Air emission(PM, SO ₂ , NO _x)	<ul style="list-style-type: none"> Dust suppression/extraction facilities will be provided to mitigate the dust generated at coal conveying area, transfer points and coal stockyard. Enclosed galleries will be provided to arrest the coal dust generated at all the conveyor points. The coal dust from coal transfer points would be restricted to 5 mg/Nm³ 	Coal handling area		MUB Heating Authority	MET
		<ul style="list-style-type: none"> 100% Dry fly ash extraction, storage and disposal facilities are proposed for utilization of 100% fly ash in dry form. Closed trucks & containers would be allowed to avoid fugitive emissions. To reduce the dust nuisance while loading the ash into the open trucks from fly ash silos, the fly ash would be conditioned with water spray. 	Ash handling area			
		<ul style="list-style-type: none"> To control the particulate matter in the flue gas, an electrostatic precipitator with an efficiency of 99.89% is proposed 	Generation of fugitive particulate matter			
	Noise	<ul style="list-style-type: none"> Properly designed plant and machinery (i.e. by providing inbuilt mechanisms like silencers, mufflers, and enclosures for noise generating parts) and shock absorbing pads in the foundation of vibrating equipment will be provided. In the high noise intensity working areas/zones ear muffs or ear plugs or any other suitable personal protective equipment would be provided to the workmen. Provision of isolation for major noise generating equipment. Regular noise level monitoring would be carried out for taking corrective action, wherever required 	Boiler feed pump, Turbine, Generator			
	Ash, slag, FGD residue	<ul style="list-style-type: none"> Apply dust suppression when handling coal and ash Prompt disposal of ash to interested re-users. But operator must ensure ash in safe before disposing to re-users. Consult experts or conduct a lab analysis 				
Water Supply and	Pipe design and maintenance	<ul style="list-style-type: none"> Adequate layering and packing of earth around the tertiary pipe in order to protect it from cold weather. The depth of the material to be advised by a cold weather 			USUG	MET

Item	Potential Environmental Concerns/impacts	Recommended Mitigation Measures	Location	Estimated Cost (USD)	Responsibility	
					Implementation	Supervision
Sewerage Network		<ul style="list-style-type: none"> engineering specialist; Maintenance and repair of stock proof fencing either side of the tertiary pipe in order to protect it from trampling by grazing stock, thus maintaining its integrity; USUG to regularly inspect all pipes and to implement repairs if required 				
	Leak detection and repairs	<ul style="list-style-type: none"> Conduct pipe repairs the soonest time possible to avoid disruption of service and disturbance to users/sensitive receptors. 				
Sewer Collector	Contamination of groundwater and surface water sources and creation of stagnant pools of wastewater due to overflows and leakage	<ul style="list-style-type: none"> Minimize detection and repair timing through efficient methods Ensure proper operation and maintenance shall be done for the system and all the appetences should comply with standards 				
	Impacts due to overflow of sewers	<ul style="list-style-type: none"> Ensure power supply during sewage pumping so that sewers do not overflow Ensure the self-cleaning velocity of the sewerage network 				
Road	Air pollution and noise due to increase in traffic	<ul style="list-style-type: none"> Ensure standard emissions from vehicles Regular monitoring of the noise levels on the road during operational phase will help in keeping track of the noise levels over a period of time Ensure proper maintenance of the roads during operational phase, especially during monsoons. One of the main reason for the high SPM levels in the ambient air is poor condition of road network 			MUB Road Authority	MET
	Road safety and traffic management	<ul style="list-style-type: none"> Maintain traffic signs, guard and protection rails at strategic locations; traffic management turn over to local authorities 				
Occupational health and safety	Health and safety exposures of workers	<ul style="list-style-type: none"> Develop and implement OHS program include job hazard analysis, risk analysis and ranking, safety procedures, training plans, safety incident reporting and record keeping, etc.; wear safety shoes or boots with non-slip soles; wear PPE and chemical resistant clothing to avoid exposure of skin or eyes to corrosive and/or polluted solids, liquids, gases or vapors; post safety instructions in each workshop regarding the storage, transport, handling or pouring of chemicals; wear safety goggles in all cases where the eyes may be exposed to dust, flying objectives, or splashes of harmful liquids; 				

B. Monitoring Plan

29. Monitoring of environmental components and mitigation measures during construction and operation stages are key component of the EMP. The objectives of the monitoring are to (i) monitor changes in the environment during various stages of the project life cycle with respect to baseline conditions; and (ii) manage environmental issues arising from construction works through close monitoring the environmental compliances. A monitoring mechanism is developed for each identified impact and it includes:

- Location of the monitoring (near the Project activity, sensitive receptors or within the Project influence area)
- Means of monitoring, i.e. parameters of monitoring and methods of monitoring (visual inspection, consultations, interviews, surveys, field measurements, or sampling and analysis)
- Frequency of monitoring (daily, weekly, monthly, seasonally, annually or during implementation of a particular activity)

30. The monitoring program will also include regular monitoring of construction activities for their compliance with the environmental requirements as per relevant standards, specifications and EMMP; The purpose of such monitoring is to assess the performance of the undertaken mitigation measures and to immediately formulate additional mitigation measures and/or modify the existing ones aimed at meeting the environmental compliance as appropriate during construction. Environmental monitoring program is presented in Table 4.

31. The environmental parameters that may be qualitatively and quantitatively measured and compared are selected as 'explicit indicators' and recommended for monitoring during project implementation and O/M stages. These monitoring indicators will be continuously monitored (Table -4) to ensure compliance with the Mongolian National Standards as well as IFC –EHS guidelines and comparison with the baseline conditions established during design stage.

Table 4: Environmental Impact Monitoring (Construction and Operation Phase)

	Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Estimated Cost (USD)	Responsibility	
						Implement	Compliance Monitoring
	A. PRIOR TO CONSTRUCTION PHASE During procurement prior to awarding of contract for civil works						
1.	Ambient air quality SO₂, NO₂, CO, PM₁₀, PM₂₅ <i>Review results against GOM standard MNS 4585:2016</i> <i>Results as baseline data before mobilization</i>	10 Bayankhoshuu in 10 in Selbe	Analytical methods outlined in MNS 0017-2-3-16:1998	Once before construction	800.00 800.00	Licensed Institute for PMO	PMO/PIS Envi Sp/ADB*
2.	Ambient noise levels <i>Review results against GOM standard MNS 4585:2016</i> <i>Results as baseline data before mobilization</i>	10 Bayankhoshuu in 10 in Selbe	Analytical methods outlined in MNS OIMLR 102:2001	Once before construction	800.00 800.00		
3.	Groundwater quality pH, DO, EC, BOD, Hardness, NH₄, NO₂, NO₃, P, mineral, Fe, SO₄, F, Cr⁶⁺, E-coli, coliform <i>Review results against MNS 900:2005 & WHO Guidelines for Drinking-water Quality</i> <i>Results as baseline data before mobilization.</i>	5 Bayankhoshuu in 5 in Selbe	Analytical methods outlined in MNS (ISO) 5667-11:2000	Once before construction	400.00 400.00		
4.	Surface water quality pH, DO, EC, BOD, Hardness, NH₄, NO₂, NO₃, P, mineral, Fe, SO₄, F, Cr⁶⁺, E-coli, coliform <i>Review results against MNS 4586-1998</i> <i>Results as baseline data before mobilization.</i>	5 Bayankhoshuu Creek 5 Chingeltei Creek 5 Selbe River 5 Khailaast Creek (if appropriate, if they have waters)	Analytical methods outlined in MNS 4047:1988	Once before construction	400.00 400.00 400.00 400.00		

5.	Community health & safety conditions <ul style="list-style-type: none"> Incidence of diseases associated with respiratory, nervous circulatory & digestive systems, skin, cancer, communicable/transmittable diseases incidence of accidents (vehicular, fire, etc) & crime <i>Information as baseline data before mobilization.</i>	Concerned khorooos	Information from & close coordination with khoroo health centers & Department of Health (district level), with khoroo government	Once before construction	4'000		
Sub-Total (Prior to Constructor! for baseline data)					9'600.00		
B. CONSTRUCTION PHASE							
6.	Ambient air quality SO₂, NO₂, CO, PM₁₀, PM₂₅ <i>Review results against GOM standard MNS 4585:2016</i> <i>Results as baseline data before mobilization</i>	10 in Bayankhoshuu 10 in Selbe	Analytical methods outlined in MNS 0017-2-3-16:1998	Quarterly	1600.00 1600.00	Licensed Institute for PMO	PMO/ PIS Envi Sp/ADB*
7.	Ambient noise levels <i>Review results against GOM standard MNS 4585:2007</i> <i>Results as baseline data before mobilization</i>	10 in Bayankhoshuu 10 in Selbe	Analytical methods outlined in MNS OIMLR 102:2001	Quarterly	1600.00 1600.00		
8.	Groundwater quality pH, DO, EC, BOD, Hardness, NH₄, NO₂, NO₃, P, mineral, Fe, SO₄, F, Cr⁶⁺, E-coli, coliform <i>Review results against MNS 0900:2005 & WHO Guidelines for Drinking-water Quality</i>	5 in Bayankhoshuu 5 in Selbe	Analytical methods outlined in MNS (ISO) 5667-11:2000	Quarterly	800.00 800.00		
9.	Surface water quality	5 Bayankhoshuu Creek	Analytical methods outlined in MNS 4047:1988	Quarterly	800.00 800.00		

	pH, DO, EC, BOD, Hardness, NH₄, NO₂, NO₃, P, mineral, Fe, SO₄, F, Cr⁶⁺, E-coli, coliform Review results against MNS 4586-1998 Results as baseline data before mobilization.	5 Chingeltei Creek 5 Selbe River 5 Khailaast Creek (f appropriate, if they have waters)			800.00 800.00		
10.	Community health & safety conditions <ul style="list-style-type: none"> Incidence of diseases associated with respiratory, nervous circulatory & digestive systems, skin, cancer, communicable/transmittable diseases incidence of accidents (vehicular, fire, etc) & crime 	Concerned khorooos		Quarterly	2000		
			Information from & close coordination with khoroo health centers & Department of Health (district level), with khoroo government				
11.	Workers' health & safety <ul style="list-style-type: none"> Incidences of illness due to work Incidences of work-related accident, injuries/deaths to emergencies, crime involving workers 	Construction sites	Records of Safety Engineer	Quarterly	2000		
12.	Construction and demolition waste <ul style="list-style-type: none"> Presence/absence of illegal dumping Environment safeguards at dumping site(s) 	Construction sites, waste disposal site	Visual inspections	Quarterly	2000		
Sub-Total (Construction)		USD			16'600.00		
TOTAL (Prior to Construction and During Construction)		USD			26'200.00		
C. OPERATION PHASE							
13.	Ambient air quality SO₂, NO₂, CO, PM₁₀, PM₂₅	10 in Bayankhoshuu	Analytical methods outlined in MNs MNS 0017-2-3-16:1998	Once quarterly	1600.00 1600.00	Licensed Laboratory	PMO/

	<i>Review results against GOM standard MNS 4585:2016</i>	10 in Selbe				for Operator	PIS Sp/ADB* Envi
14.	Ambient noise levels Review results against GOM standard MNS 4585:2007	10 Bayankhoshuu in Selbe	Analytical methods outlined in MNS OIMLR 102:2001	Once quarterly	1600.00 1600.00		
15.	HOB stack emissions SO₂, NO₂, CO, PM₁₀, PM₂₅ <i>Review results against GOM standard MNS 6298:2011, MNS5043:2016, MNS5216:2016 and EHS Guidelines</i>	5 Bayankhoshuu in Selbe	Analytical methods outlined in MNS OIMLR 102:2001	Monthly during heating season (6 times per year)	800.00 800.00		
TOTAL Annually (During Operation)					USD	8000.00	

*ADB will monitor compliance with EMP in the framework of review mission and review of annual EMP monitoring and progress reports

C. Implementation Arrangements

Institutional Setup and Environmental Responsibilities

32. The key players in the implementation of the EMP are the Municipality of Ulaanbaatar (MUB), Subcentres Redevelopment Authority (SRA), Ulaanbaatar Water and Sewerage Authority (USUG), Project Steering Committee (PSC), the Program Management Office (PMO), MET and the ADB.

33. The **MUB** will be the **executing agency** and an **implementing agency** for the Program. With regard to the Program's environmental management and its safeguards compliance, MUB will be responsible for: (i) providing counterpart assistance for environmental safeguards, as required (at least an Environmental Engineer/Scientist as the main environmental safeguard staff in the PMO); and (ii) firming up the necessary collaboration with subproject districts and relevant agencies to ensure compliance with environmental safeguard obligations.

34. **Subcenter redevelopment authority (SRA).** The SRA will be set up under the jurisdiction of the Vice Mayor for Urban Development and Investment within MUB as a city owned enterprise. This special purpose delivery vehicle will facilitate, coordinate and manage the redevelopment and densification process. More specifically, it will assist in realizing Subcenter Development Plans (SDPs) and ensure the strict application of the development plan, principles, land use ratios, and construction standards; and supervise private sector participation in the construction of residential units/compounds, in accordance with community needs and expectations, and private sector interests. SRA will also (i) facilitate obtaining the necessary inputs and/or assistance from the subproject khoroots, communities and concerned private sector to meet environmental safeguard obligations; and (iii) firm up collaboration with subproject khoroots in consultations and information disclosure, environmental monitoring, and implementation/observance of the grievance redress mechanism.

35. **Ulaanbaatar water and sewerage authority (USUG)** as a sub-implementing agency, responsible for: (i) providing technical assistance and support to the PMO in EMP implementation; (ii) as operator for the completed water and sewerage structures, observing the program's GRM and implementing environmental mitigation and monitoring measures that will address as minimum the requirements of the project EMP.

36. **Program management office (PMO)**, which will be established by the Mayor and be under the Vice Mayor for Urban Planning and Investment, will be responsible for undertaking and managing the day-to-day activities of the Program. Its Environmental Safeguard Staff (ESS) shall coordinate and supervise the EMP implementation, including but not limited to: (a) update the EMP after detail project design; (b) oversee incorporation of EMP recommendations into the design/bid documents; (c) ensure the procurement of environmentally responsible contractors; (d) ensure that an DEIA approval has been secured prior to the awarding of civil works contract; (e) set up baseline ambient air quality, noise & vibration levels, ground- & surface water quality & baseline statistics on incidence of diseases, road accidents and crimes occurring at night in the unlit roads in concerned khoroots; (f) set up and coordinate grievance management etc.; and (k) support the PIS-ES in conducting training, EMP compliance reviews, annual reporting, etc.

37. **Contractors** will develop, implement and (internally) monitor Contractor EMPs, fully responding to the P1-EMP. To ensure that the contractors comply with the P1-EMP provisions, the PMO with the help and technical support of PIS-ES, will prepare and provide the following specification clauses for incorporation into the bidding procedures: (a) a list of environmental

management requirements to be budgeted by the bidders in their proposals; (b) environmental clauses for contractual terms and conditions; and (c) the full P1-EMP in Mongolian.

38. **Licensed monitoring institute.** A licensed institute will be engaged to conduct baseline monitoring prior to construction, and quarterly environmental monitoring during project construction and operation, following the monitoring plan presented in **Table 4**. The licensed institute will comply with Mongolian Quality Assurance/Control procedures and regulations for sampling and monitoring of environmental media, and assess compliance with Mongolian environmental quality standards for ambient air, water and noise quality. The laboratory, to be contracted by the PMO, will submit quarterly environmental impact monitoring reports to the PMO.

39. **Project implementation support team,** its Environmental Specialist (PIS-ES), responsible for imparting technical advice, guidance support and “hands-on training” to the PMO and SRA, particularly its ESS, in EMP implementation of Project 1 implementation. The PIS-ES will provide support to the PMO, the PMO-ESS, and the SRA and USUG with (a) project preparation; (b) training, (c) yearly environmental progress and EMP compliance monitoring; (d) annual EMP monitoring and progress reporting; (e) identifying environment-related implementation issues and necessary corrective actions; and (f) undertaking site visits as required.

37. **Asian Development Bank (ADB),** responsible for undertaking reviews of relevant documents for clearance purposes and carry out periodic review missions to review (amongst others) the environmental aspects of Project 1.

38. **Table 5** shows the Institutional Organizational Structure for EMP implementation. The following table summarizes the roles and responsibilities of the institutions in conducting environmental and social assessments and implementing the environmental and social management plan (i.e., mitigation measures and monitoring plan) of Tranche 1.

Table 5: Institutional roles and responsibilities

Project Stage	Responsible Organization	Responsibilities
Project Preparation	MET	<ul style="list-style-type: none"> Conduct General EIA following Mon Procedures Review and approved DEIAs
	MUB, PMO	<ul style="list-style-type: none"> Request MET to conduct General EIA, comply with MET instructions Conduct IEE in accordance with ADB SPS 2009, and DEIAs in accordance with MON Law on EIA (latest amendment in 2012)
	PPTA Consultants	<ul style="list-style-type: none"> Support EA in preparing request to MET and IEE
	ADB	<ul style="list-style-type: none"> Review and approve IEE, including EMP, disclose on ADB website
Detailed Design	DSC	<ul style="list-style-type: none"> Incorporation of environmental mitigation measures in detailed designs, and bidding documents
	PMO, SRA, PIS-ES	<ul style="list-style-type: none"> Update EMP based on detailed design, as necessary Provide updated EMP to MET
Tendering	ADB	<ul style="list-style-type: none"> Approve updated EMP, if necessary
	PMO, SRA, DSC	<ul style="list-style-type: none"> Incorporate mitigation measures and the EMP clauses in tendering documents, civil contracts and contractors' construction management plans.
Construction	PIS, ADB	<ul style="list-style-type: none"> Review tendering documents; confirm project's readiness
	MUB	<ul style="list-style-type: none"> Advise on implementation of mitigation measures
	DSC	<ul style="list-style-type: none"> Provide support to PMO for monitoring impact and mitigation measures associated with subprojects including implementation of EMPs by contractors

Project Stage	Responsible Organization	Responsibilities
	Contractors	<ul style="list-style-type: none"> • Prepare and submit Contractor EMP, fully responsive to P1-EMP; • Implement mitigation measures and conduct internal monitoring/supervision
	PMO-ESS	<ul style="list-style-type: none"> • Coordinate GRM; • Supervise EMP implementation; • Conduct regular site inspections; • Prepare monthly EMP progress reports; • Conduct training; • Support PIS in preparing annual EMP monitoring and progress report
	Licensed Monitoring Institute	<ul style="list-style-type: none"> • Conduct scheduled environmental monitoring, • Prepare monitoring report
	PIS(PIS-ES)	<ul style="list-style-type: none"> • Advise on the mitigation measures; • Provide comprehensive technical support to PMO and MUB for environmental management; • Conduct training; • Conduct annual EMP compliance • Review; prepare annual EMP monitoring and progress reports.
	ADB	<ul style="list-style-type: none"> • Conduct review missions; • Review and approve annual EMP monitoring and progress reports, including disclosure
Operation	PMO	<ul style="list-style-type: none"> • Conduct EMP compliance review, • instruct MUB on environmental management requirements; • Prepare EMP monitoring and progress reports until PCR is issued
	SRA	<ul style="list-style-type: none"> • Implementation of mitigation measures as defined in EMP
	Licensed Monitoring Institute	<ul style="list-style-type: none"> • Conduct environmental monitoring following approved monitoring plan
	ADB	<ul style="list-style-type: none"> • Review and approve EMP monitoring and progress reports, disclose on ADB project website

Figure 2: Implementing Organizational Structure for EMP⁶



⁶ SOURCE: FAM

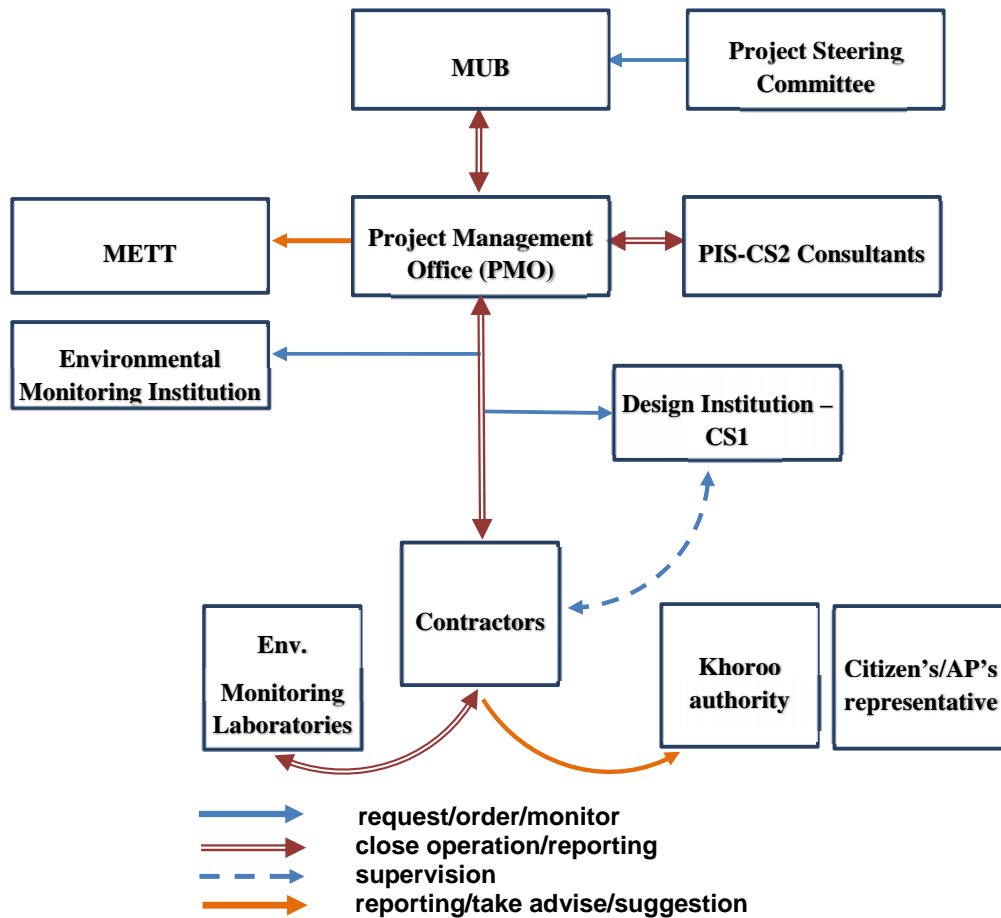


Figure 3: Project EMP implementation Arrangement

Institutional Strengthening and Training

39. Considering the limited skills and experience of the program’s key players, technical assistance from environmental specialists and capacity development during initial project implementation will be needed for institutional strengthening. Capacity development will put emphasis on on-the-job training in implementing their responsibilities in environmental management of the project, particularly in EMP implementation.

40. The general objective of the training on **Environmental Safeguard Requirements** is to enhance the capacity of the MUB/SRA/USUG/PMO Personnel to ensure that the Municipality at the city, district and khoroo levels will have better perception and understanding of environmental issues related to implementation of Ulaanbaatar Urban services and Ger Areas Development Investment Program emphasis to Project 1 (Bayankhoshuu and Selbe Subcentres) and will be capable of implementing mitigation measures and subsequent monitoring. It is also important that the officials and staff of these agencies who will be involved in the Project have a good understanding of relevant MON and ADB environmental assessment procedures and requirements. This training manual has been devised to assist and help the project implementing

agencies (MUB) to ensure that Ger Area Development plan interventions are environmentally sound and sustainable.

41. Capacity building related to environment safeguards will be implemented through:

- Project Implementation Support Team (CS2)
- Capacity Development Program under the Institutional Strengthening and Capacity Development Component (CS4)

42. While carrying out technical assistance, the PIS environmental specialists will conduct lectures/seminars on topics relevant to EMP implementation and will ensure that the EMP implementation will be a “hands-on” training for the PMO, particularly its environmental safeguard staff, as well as the MUB, SRA, USUG, and the concerned Khoroos.

43. Training Capacity building workshop on *ADB and Mongolian Government’s Safeguard Policies and Principles concerning Environmental and Social Safeguards* was conducted (5th November, 2015). In Table 6 shown topics for Capacity building/training related to environment safeguards, developed by the PIS environmental specialists.

Table 6: Proposed Topics for Capacity Building/Training under PIS

Topic	Objectives	Subtopic	Target Participants
1. Legal Framework	<ul style="list-style-type: none"> • Know a list of applicable national (Mongolian) and Donor (ADB) environmental assessment requirements • Acquainted with pertinent regulation and standards governing the environmental quality, health and safety, protection of sensitive areas and any other relevant regulation governing the proposed Ger Areas development investment program interventions 	1.1 Relevant GoM laws, regulations & standards on environmental assessment & management 1.2 ADB Safeguard Policy Statement-2009(Environment) 1.3 Environmental Assessment Procedure under the Program-Harmonizing the GoM & ADB Safeguard Requirements 1.4 Environmental Quality and Health and Safety Standards	MUB-DE, USUG, PMO, Concerned Environmental Department of three districts of Project 1 (Songino Khairkhan District for Bayankhoshuu Sub-center, Sukhbaatar District and Chingeltei District for Selbe Sub-center); Concerned Representatives of Khoroos Government Unit (Khoroos 7, 8, 9, 10, 28 in Songino Khairkhan District, Khoroos 14 in Sukhbaatar District and Khoroos 14, 18 in Chingeltei District)
2. Baseline and Public Consultation	<ul style="list-style-type: none"> • Understand the objective of baseline and its importance in the EIA and type of information needed for baseline • Know various methodology adopted for baseline data collection • Identify the principles and requirements for consultation with 	2.1 Baseline Data Collection 2.2 Meaningful Consultation and Information Disclosure 2.3 Grievance Redress Mechanism	Concerned personnel of MUB, PMO, CS1, UN Habitat

	stakeholders and the tools and techniques that can be used for this purpose.		
3. Impact Assessment and Mitigation Measures	<ul style="list-style-type: none"> Provide an overview of the tools and methods used to identify, predict and evaluate different types of impacts Understand the role of mitigation in EIA process and its importance for impact management 	3.1 Identification and Assessment of Impacts 3.2 Possible Environmental Impacts –Project 1 3.3 Mitigation Measures	Concerned personnel of MUB, PMO, CS1, UN Habitat
4. Environmental Management and Monitoring Plan (EMMP)	<ul style="list-style-type: none"> Identify the principles, elements, and contents that are used for preparing Environmental Management and Monitoring Plan Find out major institutional arrangements for EMP implementation 	4.1 Guiding Principles of EMP 4.2 EMP Implementation arrangements <ul style="list-style-type: none"> Institutional responsibilities Environmental monitoring and reporting 4.3 Performance Indicators 4.4 Occupational and Community health and safety	Concerned Engineers of PMO (Executing as well as implementing level), Engineers of CS1, Personnel of CS4, Civil Works Contractors
5. Environmental Sound Construction Management	<ul style="list-style-type: none"> Able to knowledge about Environmental Specification in contract documents and their implications Guide on Good construction practice 	5.1 Construction/Engineering Practice 5.2 Environmental Specification for Bid Documents 5.3 Incorporating EMP into Bid Documents 5.4 Environmental Code of Practice 5.5 Environmentally responsible procurement	Concerned Engineers of PMO (Executing as well as implementing level), Engineers of Design Supervision Consultants (CS1), Personnel of Capacity Development Consultants (CS4), Civil Works Contractors

44. The Capacity Development Program shall invite external experts to conduct lectures/seminars on other environmental management topics such would be requested later on by the PMO, MUB, SRA, and/or USUG.

45. The cost requirement for the conduct of the courses and seminars by external experts is included in the overall budget for Capacity Development Program.

D. Monitoring and Reporting

46. Environmental monitoring and inspection activities and findings will be documented for purposes of reporting, record keeping, verifying, referring and evaluating the environmental performance of the Tranche 1. The documentation shall also be used as basis in correcting and enhancing further environmental mitigation and monitoring. Environmental monitoring reports (EMRs) will be prepared as follows (see also **Table 7**):

- (i) Monthly internal progress reports will be prepared by the Contractors during construction, submitted to PMO and DSC. These monthly reports will include; (a) physical progress of the component; (b) mitigation measures implemented; (c)

- grievances received, resolved, closed and/or directed to other mechanisms; (d) emergencies responded to; and (e) corrective actions taken.
- (ii) Quarterly Environmental impact monitoring reports will be prepared by the licensed monitoring institute contracted by the PMO to report on the results of environmental quality monitoring as specified in the EMP. The reports will include the analysis results and assessment of compliance/non-compliance with the EMP, Mongolian and international standards.
- (iii) Semi Annual Environmental monitoring reports will be prepared by the PMO through the support from Project Implementation Support Team (PIS) for submission to ADB. These semi-annual monitoring reports will include: (i) physical progress of T1 components; (ii) mitigation measures implemented; (iii) non-compliance with EMP; (iv) progress of capacity development; (v) unforeseen issues and concerns and status of corrective actions; (vi) findings of informal public consultations; (v) grievances received, resolved, closed and/or directed to other mechanisms; and (vi) performance evaluations of Contractors.
- (iv) Annual EMP monitoring and progress reports, by the PMO through the support from PIS for submission to the ADB and MET to comply with environmental agreement in the loan and Mongolian Law on EIA.

Table 7: Environmental Reporting Plan

Report From	Report To	Purpose	Frequency
Contractor	PMO, DSC	Progress on EMP Implementation	Monthly
Licensed Monitoring Institute	PMO	Environment quality monitoring through laboratory analysis	Quarterly
PMO with support from PIS	ADB	Project progress reports (including section on EMP implementation progress)	Semi Annual
PMO with support from PIS	ADB	EMP progress reports	Annually, until PCR is issued

47. Based on environmental monitoring and reporting systems in place, the PMO shall assess whether further mitigation measures are required as corrective actions, or improvement in environmental management practices are required. The effectiveness of mitigation measures and monitoring plans will be evaluated by a feedback reporting system. The PMO will play a critical role in the feedback and adjustment mechanism. If the PMO identifies a substantial deviation from the EMP, or if any changes are made to the scope of Project 1 that may cause significant adverse environmental impacts or increase the number of affected people, then the PMO shall immediately consult MET and ADB to get their approval and identify EMP adjustment requirements.

E. Project Readiness Indicator

Table 8 presents the Readiness Indicators which provide a measure of whether environmental commitments are being carried out and environmental management systems are in place before construction.

Table 8: Readiness Indicators Pre-Construction

Indicator	Measurement Methods	Measurement	
Environmental Supervision in place	<ul style="list-style-type: none"> Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works. 	Yes	No
	<ul style="list-style-type: none"> Licensed Monitoring Institute contracted 	Yes	No
	<ul style="list-style-type: none"> Site specific GRM established 	Yes	No

Bidding documents and contracts with environmental safeguards	<ul style="list-style-type: none"> Bidding documents and contracts incorporate the environmental loan assurances 	Yes	No
	<ul style="list-style-type: none"> Bidding documents and contracts incorporate the EMP mitigation and monitoring requirements 	Yes	No
EMP financial Support	<ul style="list-style-type: none"> The fund from ADB is in place to support the EMP implementation 	Yes	No
Contract documents	<ul style="list-style-type: none"> Environmental requirements of EMP included in contract documents for civil works construction contractors 	Yes	No
	<ul style="list-style-type: none"> Contractor (CEMP) developed and submitted to PMO and PIS for review and approval 	Yes	No

48. Performance indicators for monitoring environmental performance in relation to key project risks and impacts during construction are set out in Table- 9

Table 9: Performance Indicators During Construction

Indicator	Measurement Methods	Measurement	
Stakeholders Interviews	<ul style="list-style-type: none"> Interviews with stakeholders in project area before each construction season, submitted to representatives of khoroo (by Contractor) 	Yes	No
Water and effluent Monito	<ul style="list-style-type: none"> Quarterly monitoring results submitted to PMO (by Licensed Monitoring Institute) 	Yes	No
Health and safety Reporting	<ul style="list-style-type: none"> Monthly reports submitted to DSC (by contractors) 	Yes	No
EMP Implementation	<ul style="list-style-type: none"> DSC monitor mitigation implementation and confirm compliance, reporting monthly to PMO 	Yes	No

F. Environmental Specifications for Bid Documents

49. The Contractor shall be responsible for implementation of environmental provisions outlined in the EMP. All works undertaken towards protection of environmental resources as part of the EMP and as part of good engineering practices while adhering to relevant specifications will be deemed to be incidental to works being carried out.

50. Environmental specifications will be included in the technical specifications of bid document. (Annex 1)

ANNEX 1. Environmental Clauses to be integrated into Bid Documents

1.0 General

1.1 The Contractor shall be responsible for implementation of environmental provisions outlined in the EMP in addition of adhering to all environmental provisions in the applicable specifications for the works will be adhered to as part of good engineering practices.

1.2 All works undertaken towards protection of environmental resources as part of the EMP and as part of good engineering practices while adhering to relevant specifications will be deemed to be incidental to works being carried out and no separate payment will be made unless otherwise specified explicitly. The costs towards environmental management as per EMP unless otherwise provided as a separate head, will be deemed to be part of the BOQ of the project. The scope of works of the contractor towards the implementation of the environmental provisions shall be as follows:

- (i) Abide by all existing Environmental regulations and requirements fo the Government of Bangladesh, during implementation.
- (ii) Compliance with all mitigation measures and monitoring requirements set out in the EMP.
- (iii) Submission of a method statement detailing how the subproject EMP will be complied with. This shall include methods and schedule of monitoring.
- (iv) Monitoring of project environmental performance and periodic submission of monitoring reports.
- (v) Compliance of all safety rules at work, and Provision of adequate hearth and safety measures such as water, food, sanitation, personal protective equipment, workers insurance, and medical facilities.

1.3 The detailed provisions for specific environmental issues shall be as outlined in the EMP table on impacts and mitigation measures.

The general environment, health and safety obligations of the Contractor within this Contract, without prejudice to other official provisions in force, shall include the following.

- The Contractor shall ensure that the construction of project facilities comply with (a) all applicable laws and regulations of Mongolia relating to environment, health and safety; (b) the environmental safeguards stipulated in ADB's Safeguard Policy Statement (2009); and (c) all measures and requirements described in the EMP
- The Contractor shall prominently display contact details at the sites. The Contractor shall disseminate information on construction progress in a timely manner, including anticipated activities that might cause safety risk.
- The Contractor shall implement the relevant actions of the project grievance redress mechanism (GRM).
- The Contractor shall ensure that all workers treat residents and other stakeholders with respect, and undertake their work and behavior in a culturally respectful manner.

- The Contractor shall secure the necessary permits and licenses before undertaking the works.
- The Contractor shall assign the responsibility for coordination of the site-EMP to the site manager, and ensure that sufficient resources are available to implement the site-EMP.
- The Contractor shall provide equal pay for equal work, regardless of gender or ethnicity; provide those they employ with a written contract; provide the timely payment of wages; use local unskilled labor, as applicable; comply with core labor standards and applicable labor laws and regulations, including stipulations related to employment, e.g. health, safety, welfare, workers' rights, and anti-trafficking laws; and not employ child labor. Contractors shall maintain records of labor employment, including the name, ethnicity, age, gender, domicile, working time, and the payment of wages.
- The Contractor shall take necessary precautions to avoid damage to natural habitats, and interruptions to water supply, wastewater collection, heating and other utility services during the civil works.
- The Contractor shall prepare a site-EMP (Contractor EMP) based on the EMP.
- The Contractor shall take appropriate action against personnel not complying with these clauses and EMP.
- The Contractor shall document and report to the PMO any incidents caused by the works
- The Contractor shall inform the PMO of any unanticipated environmental, health and safety risks or impacts that may arise during implementation of the contract.

ANNEX 2. Environmental requirements for Heating Operation Boiler of the project

Basic requirement

Initial requirement set in project's FAM is to design heating plants with 8.4 MW, 20 MW, and 30 MW capacity with the intent of standardization of boiler equipment, combustion and emissions control, coal and ash handling and processing, water pumping systems, and building amenities such as office and shop space. Also, heating plants needs to be comprised of at least three coal-fired boilers of equal size, although the configuration may be altered to economically meet summer hot water requirements. Boiler equipment will have a minimum combustion efficiency of 80% and meet or exceed emission standards over all anticipated operating ranges, assuming the use of coal from the Baganuur Mine.

Heating plants will be designed to be located near residential areas and will meet the emissions exposure and maximum noise level requirements of MNS 4585:2007. Plant designs will also employ provisions for coal and ash storage and handling that effectively eliminate neighborhood exposure to dust emissions, and minimize exposure of plant workers to the extent possible.

Design of heating plants for the Bayankhoshuu and Selbe sub-centers can be combined but should be separated into two phases. Based on the present heating demand assumptions the first phase will be for design of an 8.4 MW standard plant, of which two will be constructed initially in Bayankhoshuu and three in Selbe. A sixth may be constructed later in Selbe.

The second phase design will be for a 30 MW plant for Bayankhoshuu and the design of a 20 MW plant and site design for an 8.4 MW plant in Selbe. The actual scope of the second phase may be refined based on the actual progress of development after the first phase is built.

Proposed detailed design

According to detailed design (01.02.2016) drafted by the DOWHA (CS1) the required land size for the construction of the Bayankhosuu heating plant (3 x 5Gcal/h) is about 9880 m² (1 ha) and the required land size for the construction of the Selbe heating plant (2 x 9Gcal/h + 1 x 5 Gcal/h) is about 10,916 m² (1.1 ha). The required land sizes are included the coal storage building, district heating facilities, control room, parking area and access road etc.

All materials and construction will be in compliance with the latest ASME Boiler Construction Code with regard to materials, thickness of tubes and plates, tests of materials, design of parts, pressure tests, type and size of auxiliary equipment, and other requirements.

The CS1 have had investigation of the technical/economic feasibility for construction of a coal fired heating plants examining certain types of boilers with different types of operation modes and focused on Circulating Fluidized Bed Combustion (CFBC) system with low load operation in addition to base load operation. Low load operation is defined as continuous operation at 40% of boiler maximum continuous rating (BMCR), or less.

The boiler design will have control of coal fuel, limestone and inert material feed into the boiler, including conveyors, air blowers, and all electrical and mechanic equipment is required to ensure automatic feed control at all loads.

The boiler and coal equipment will be located indoors. All parts of the equipment requiring protection from the weather, moisture, and temperature extremes will be made of weatherproof construction or be provided with watertight shields or enclosures.

Coal

The coal is transported from Baganuur coal mine in Mongolia by truck. The unloaded coal will be transferred by conveyor from the coal storage shed to the coal surge bin to meet required consumption rate. The coal handling system consists of the following:

- Coal unloading/storage system
- Conveying system
- Coal day silo feeding system
- Firefighting system

FGD system (use of limestone)

For desulfurization from combustion gas limestone (CaO-Lime powder) will be used. The FGD system will be installed to remove sulfur oxides ("SOx") from the flue gas as injection limestone powder in furnace. The FGD system is designed to remove SO₂ for all loads from minimum continuous through boiler maximum rating to meet the limits specified. All components of the system will be designed for any operation during startup and transient conditions. Limestone powder will arrive by trucks to the plant. The limestone powder is withdrawn from the trucks, and addressed to be storage in one silo for three boilers.

Ash handling system

Combustion products from boiler can be classified as bottom ash and fly ash. Bottom ash is ash that accumulates at the bottom of the furnace and it is not carried away by the flue gases. Fly ash is the fine particles carried by the flue gas and trapped by the economizer and bag filter. According to capital and O&M cost and ash disposal area estimation the fly ash handling system for the station will be designed with the dry type ash handling system.

One storage silo, receiving the bottom ash from three boilers, will be provided for the temporary storage of furnace bottom ash. The height and diameter of the silo not defined yet, but the effective net storage volume of the silo will not be less than the calculated volume of bottom ash produced by three boilers in 48 hours.

Fly ash will be stored in an ash silo prior to transportation to the cement plant for reuse or ash disposal area via a dump truck or tank lorry. Most of the ash product in the boiler can be reused for construction materials during cement manufacturing. However, to prepare any ash product that is not used, ash produced in the boiler can be transferred to the ash disposal area.

Fly ash silo will be provided for a complete emptying to keep available all the capacity for storing residues. Effective available capacity for storage volume of fly ash produced by three boilers will be as specified, in every case above 48 hours in the worst condition of coal.

Diesel oil

Diesel oil will be used for ignition/start-up of the boilers and for heating up the boiler and for operating emergency diesel generator. The Diesel oil will be delivered by road tanker to site.

The storage tanks required to be sized considering for one (1) time start-up operation of one (1) boiler on diesel oil during start-up up to 40% of boiler maximum rating and also eight (8) hours operating time of emergency diesel generator. 100% storage margin will be included for tank's storage capacity. The storage tank required to be designed in accordance with API 650 and furnished complete with necessary appurtenances required for a complete system.

Pumps designed to be rotary (screw or gear) type for Diesel oil and required to be constructed to permit ease of access for inspection and removal of rotating element without disconnecting the suction and discharge piping and without disturbing pump alignment. Whole set will be located as outdoor type with anti-freezing system installed.

Diesel oil needs to be able to manually unloaded from road tanker in the one (1) bay tanker unloading area through the pipe line that is directly connected to diesel oil storage tank for boilers and emergency diesel generator.

Water supply and treatment system

Water for heating station would be supplied from city water pipe line and be stored in raw water tank. The raw water will be used for potable water, service water and feeding for the water treatment system through activated carbon filter by means of softener feed water pumps, where the activated carbon filter will remove organic material, free chlorine and etc. The filtered water will be delivered to the softener, where all of most of the cation (Ca²⁺, Mg²⁺ and etc) will be removed from the filtered water by exchanging them with Na⁺ ions. Softeners will be regenerated with diluted NaCl.

Regeneration waste water will go to the waste water pond. The produced water from the water treatment system shall be stored in the softened water tank for use as DH piping makeup, Ash cooling system makeup, WT&DH polisher regeneration water and etc.

Wastewater treatment system shall treat all the wastewater including oily wastewater, chemical wastewater generated from plant in order to meet discharge limit before disposal. Waste water treatment system will consist of:

- Chemical waste water treatment system shall include two (2) waste water ponds, two (2) waste water pumps per each waste water pond, one (1) pH adjustment tank with agitator, one (1) treated water pond and two (2) treated waste water pumps.
- Oily waste water treatment system shall include one (1) oily waste water pond, two (2) oily waste water pumps and one (1) oily separator.
- Neutralization facilities including HCl storage tank, NaOH storage tank and injection pumps.

Chemical waste water generated from plant shall be delivered to normal waste water pond. Waste water shall be equalized and mixed by aeration in the waste water pond, then it shall be transferred to pH adjustment tank. The waste water shall be neutralized in the pH adjustment tank by means of acid and caustic dosing which is controlled pH analyzer located on pH adjustment tank. After pH adjustment, the treated waste water shall be transferred to the treated water pond. Finally, all treated waste water shall be discharged out of the plant boundary.

Oily waste water generated from plant shall be transferred to oily waste water pond and then enter the CPI oil separator by means of oily waste water pumps. The contained sludge of the water will be settled at the primary setting zone. The oily waste water will be overflowed inlet baffle and passed through the corrugated plate pack. While pass through the pack, the minute oil will be rising and remained sludge will be settled down to the bottom. Rising oil will float on the surface of the water and be removed by pipe oil skimmer with worm gear. The removed oil shall be collected into the scum tank and periodically removed by a tanker lorry. Treated water from CPI oil separator shall be directly transferred to normal waste water pond.

THE FBC SYSTEM

Combustion system development in power generation is discussed ranging from the pre-environmental era in which the objectives were complete combustion with a minimum of excess air and the capability of scale up to increased boiler unit performances, through the environmental era (1970–), in which reduction of combustion generated pollution was gaining increasing importance, to the present and near future in which a combination of clean combustion and high thermodynamic efficiency is considered to be necessary to satisfy demands for CO₂ emissions mitigation.

From the 1970s on, attention has increasingly turned towards emission control technologies for the reduction of oxides of nitrogen and sulfur, the so-called acid rain precursors. By a better understanding of the NO_x formation and destruction mechanisms in flames, it has become possible to reduce significantly their emissions via combustion process modifications, e.g. by maintaining sequentially fuel-rich and fuel-lean combustion zones in a burner flame or in the combustion chamber, or by injecting a hydrocarbon rich fuel into the NO_x bearing combustion products of a primary fuel such as coal.

Sulfur capture in the combustion process proved to be more difficult because calcium sulfate, the reaction product of SO₂ and additive lime, is unstable at the high temperature of pulverized coal combustion. It is possible to retain sulfur by the application of fluidized combustion in which coal burns at much reduced combustion temperatures. Fluidized bed combustion is, however, primarily intended for the utilization of low grade, low volatile coals in smaller capacity units, which leaves the task of sulfur capture for the majority of coal fired boilers to flue gas desulfurization.

During the last decade, several new factors emerged which influenced the development of combustion for power generation. CO₂ emission control is gaining increasing acceptance as a result of the international greenhouse gas debate. This is adding the task of raising the thermodynamic efficiency of the power generating cycle to the existing demands for reduced pollutant emission. Reassessments of the long-term availability of natural gas, and the development of low NO_x and highly efficient gas turbine–steam combined cycles made this mode of power generation greatly attractive also for base load operation.

However, the real prize and challenge of power generation R&D remains to be the development of highly efficient and clean coal-fired systems. The most promising of these include pulverized coal combustion in a supercritical steam boiler, pressurized fluid bed combustion without or with topping combustion, air heater gas turbine–steam combined cycle, and integrated gasification combined cycle. In the longer term,

catalytic combustion in gas turbines and coal gasification-fuel cell systems hold out promise for even lower emissions and higher thermodynamic cycle efficiency.

CFBC boiler system (technology)

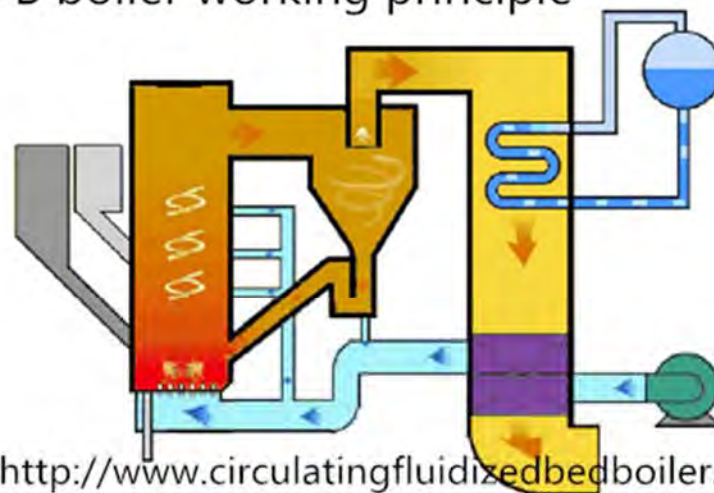
Circulating fluidized bed is a relatively new technology with the ability to achieve lower emission of pollutants. Extensive research has been conducted on this technology for the past 10 years because pollution in the world is getting more serious by the day and clean practice will be very crucial for the sustainability of the earth. The importance of this technology grew even more lately because of the tightened environmental regulation for pollutant emission.

The Mercury and Air Toxic Standards (MATS) enacted in December 2011 by EPA have forced all the countries in Europe and America to strictly adhere to this policy. This means that emissions such as metals, acid gases, organic compound, flue gas acids and other pollutants from power plants or industrial facilities have to meet the requirements set by EPA and upgrades have to be done for facilities that do not meet the standards. As a result, the demand for circulating fluidized bed technology will be predicted to sky rocket.

During the combustion phase, upwards jets of air will cause the solid fuels to be suspended. This is to ensure the gas and solids will mix together turbulently for better heat transfer and chemical reactions. The fuel will be burnt at a temperature of 760°C to 927°C to prevent nitrogen oxide from forming. While burning, fuel gas such as sulfur dioxide will be released. At the same time, sulfur-absorbing chemical such as limestone or dolomite will be used to mix with the fuel particles in the fluidization phase, which will absorb almost 95% of the sulfur pollutants.

Alternatively, the sulfur absorbing chemical and fuel will be recycled to increase the efficiency of producing a higher quality steam as well as lower the emission of pollutants. Therefore, it will be possible to use circulating fluidized bed technology to burn fuel in a much more environmental friendly method as compared to other conventional processes.

CFB boiler working principle



CFB technology burns fuels without fire or burners in the furnace but through a process of fluidization mixes the fuel particles with limestone which captures the sulfur oxides that are formed and the low temperature reduces nitrogen oxide formation. The limestone and fuel are recycling multiples times which increases both the efficiency of producing high quality steam to produce power and also reduces pollution due to its ability to burn fuel in a clean way than the conventional processes. **Circulating fluidized bed technology(CFB)** also offers the flexibility of using both coal as well as biomass fuels.

Air supply is from under the bed at high pressure. This lifts the bed material and the coal particles and keeps it in suspension. The coal combustion takes place in this suspended condition. This is the Fluidized bed. Special design of the air nozzles at the bottom of the bed allows air flow without clogging. Primary air fans provide the preheated Fluidizing air. Secondary air fans provide pre-heated Combustion air. Nozzles in the furnace walls at various levels distribute the Combustion air in the furnace.

Fine particles of partly burned coal, ash and bed material are carried along with the flue gases to the upper areas of the furnace and then into a cyclone. In the cyclone, the heavier particles separate from the gas and falls to the hopper of the cyclone. This returns to the furnace for recirculation. Hence the name Circulating Fluidized Bed combustion. The hot gases from the cyclone pass to the heat transfer surfaces and go out of the boiler.

To start with the bed material is sand. Some portion is lost in the ash during the operation and this has to be made-up. In coal fired boilers the ash from the coal itself will be the makeup material. When firing bio fuels with very low ash content sand will be the makeup bed material. For high Sulphur coals Limestone addition to the bed material reduces SO₂ emissions.

CFBC uses crushed coal of 3 to 6 mm size. This requires only a crusher not a pulverizer. From storage hoppers Conveyer and feeders transport the coal to feed chutes in the furnace. Startup is by oil burners in the furnace. Ash spouts in the furnace remove the ash from the bottom of the furnace. it is CFB boiler working principle.

Advantages

The increase in fluidized bed combustion boiler system use in today's industrial world is largely due to the inherent advantages of the technology.

Uniform Particle Mixing: Due to the intrinsic fluid-like behavior of the solid material, fluidized beds do not experience poor mixing as in packed beds. This complete mixing allows for a uniform product that can often be hard to achieve in other combustion boiler system designs. The elimination of radial and axial concentration gradients also allows for better fluid-solid contact, which is essential for reaction efficiency and quality.

Uniform Temperature Gradients: Many chemical reactions produce or require the addition of heat. Local hot or cold spots within the reaction bed, often a problem in packed beds, are avoided in a fluidized situation such as an FBR. In other combustion boiler system types, these local temperature differences, especially hotspots, can result in product degradation. Thus, FBRs are well suited to exothermic reactions. Researchers have also learned that the bed-to-surface heat transfer coefficients for FBRs are high.

Ability to Operate boiler in Continuous State: The fluidized bed nature of these systems allows for the ability to continuously withdraw product and introduce new reactants into the reaction vessel. Operating at a continuous process state allows manufacturers to produce their various products more efficiently due to the removal of startup conditions in batch processes.

Disadvantages

As in any design, the fluidized bed combustion boiler system does have it draw-backs, which any boiler system designer must take into consideration.

Increased Boiler Vessel Size: Because of the expansion of the bed materials in the boiler, a larger vessel is often required than that for a packed bed combustion boiler system. This larger vessel means that more must be spent on initial startup costs.

Pumping Requirements and Pressure Drop: The requirement for the fluid to suspend the solid material necessitates that a higher fluid velocity is attained in the boiler. In order to achieve this, more pumping power and thus higher energy costs are needed. In addition, the pressure drop associated with deep beds also requires additional pumping power.

Particle Entrainment: The high gas velocities present in this style of boiler often result in fine particles becoming entrained in the fluid. These captured particles are then carried out of the boiler with the fluid, where they must be separated. This can be a very difficult and expensive problem to address depending on the design and function of the system. This may often continue to be a problem even with other entrainment reducing technologies.

Lack of Current Understanding: Current understanding of the actual behavior of the materials in a fluidized bed is rather limited. It is very difficult to predict and calculate the complex mass and heat flows within the bed. Due to this lack of understanding, a pilot plant for new processes is required. Even with pilot plants, the scale-up can be very difficult and may not reflect what was experienced in the pilot trial.

Erosion of Internal Components: The fluid-like behavior of the fine solid particles within the bed eventually results in the wear of the boiler vessel. This can require expensive maintenance and upkeep for the reaction vessel and pipes.

FBC type boilers in Mongolia

The CFBC boiler system is quite new in Mongolia. One of the latest practice installing the system is located in Baruun Urt soum of Sukhbaatar aimag. The power station has been built under irrevocable aid of the S.Korea, represented by its international cooperation agency KOICA, and with a financing of USD five million in three year's duration. The project executed as an upgrade/realignment of the 17.8 MW heating facility previously financed by the ADB in 2007, which was not adequately operated and managed, resulting in a significant drop in efficiency. As a consequence, the city urgently needed to make improvement in order to ensure stable supply of heat. The KOICA's project integrated heating systems aimed to enable centralized heat supply to bring efficiency up and ensure a stable supply of heat and hot water to 10,000 local residents and improved efficiency translated into the reduced use of energy, contributing to the resolution of air pollution in the long run.

The Mongolian Ministry of Fuel and Energy, the main beneficiary of this project, mentioned that it will use the model of the Baruun-Urt project in establishing heating systems in other cities and areas that lack proper infrastructure.

In particular, the Baruun-Urt project involved the establishment of a solar power generation system to generate heat that boils water. This represents environmentally-friendliness of this project in the city where precipitation is low while sunlight is strong. Being recognized for its contribution, Mongolian Chamber of Commerce gave KOICA Green Economy Award. It is hopeful that other cities in Mongolia adopt the model of the Baruun-Urt project to ensure a stable supply of heat and hot water.

The Baruun-Urt thermal power station pilots another eight thermal stations planned to come into service in province centers next future.

According to web based search several private Mongolian companies have had contract with Chinese ZG Boiler company on installing CFB Boilers in cement and smelting plants. But detailed information on these contracts are missing. Main parameters of coal fired CFB boiler provided by ZG Boiler company are as follows:

Model: ZG-280/9.81-M1

- Steam capacity: 280t/h
- Steam pressure: 9.81MPa
- Steam temperature: 540°C
- Feed water temperature: 215°C
- CFB boiler for smelting industry

280 ton CFB boiler structure

- Separator entrance is added with spiral flow diverter and offset center tube
- Optimized placement of dense-phase heating surface
- Improved design of combustion equipment
- The optimization of slag drop pipe
- Auxiliary feedback device
- The optimization of water and steam system

Current research and trends

Due to the advantages of fluidized bed combustion boiler systems, a large amount of research is devoted to this technology. Most current research aims to quantify and explain the behavior of the phase interactions in the bed. Specific research topics include particle size distributions, various transfer coefficients, phase interactions, velocity and pressure effects, and computer modeling.

Due to the advantages of fluidized bed combustors a wide range of different fuels is utilized. The fuels range from anthracite, medium and low rank coals to peat, wood residues, biomass waste, sewage sludge and other sludges to plastics and municipal solid waste. Because of this wide range of fuels pollutants such

as heavy metals, particulates, alkali, NO, NO₂, N₂O, SO₂, SO₃ and HCl may be formed during the fuel conversion process depending on the fuel and operating conditions.

These pollutants may lead to difficulties in operation of the fluidized bed combustor e.g. because of slagging and fouling the heat transfer may decrease or the efficiency of the SCR catalyst. High concentrations in the flue gas may lead to health problems and pollution of the environment.

BASIC ENVIRONMENTAL REQUIREMENTS FOR THE PROPOSED HS DESIGN

Based on data stated in detailed design characteristics and general impact assessment of coal based heating stations, following environmental components should be in the center during the construction and operation stages of the heating station.

The following sections identify the potential impacts on the environment from the proposed project based on the nature and extent of the various activities associated with the project implementation and operation, as well as the current status of the environmental quality at the project site. Both beneficial (positive) and adverse (negative) impacts are considered. The impact of the proposed heating station is studied in two distinct phases:

1. During the construction phase which may be regarded as temporary or short term; and
2. During the operation phase which would have long term effects.

The critical areas of environmental concern for which the impacts and their predictions are taken into consideration are listed below:

1. Air Quality
2. Noise
3. Land and Soil
4. Water Quality
5. Hydrology and Drainage
6. Terrestrial Ecology
7. Socio-economic aspect

The impacts can be further categorized as positive impacts and negative impacts depending upon their nature, potential and magnitude. Table 1 presents the matrix showing the impacts during the construction and operation stage of the proposed expansion project.

Table 1. Matrix showing the Impacts from the Proposed HS

No.	Impacts	Negative Impact		Positive Impact		Not Applicable
		Short Term	Long Term	Short Term	Long Term	
A	Construction Phase					
i	Pressure on local infrastructure	V				
ii	Contamination of Soil	V				
iii	Impact on water quality	V				
iv	Impact on air quality including dust generation	V				
v	Impact on flora & fauna		V			
vi	Noise pollution	V				
vii	Traffic congestion and loss of access	V				
viii	Staking and disposal of construction material	V				
viii	Public health and safety	V				
ix	Social impact				V	
B	Operational Phase					
i	Increase in air and noise levels		V			
ii	Disposal of solid waste and landscape waste		V			
iii	Induced development	V			V	
iv	Employment generation				V	
v	Quality of life				V	
vi	Positive boost to the local economy				V	
vii	Public health & Safety				V	

Construction activities normally spread over pre-construction, preparatory construction, machinery installation and commissioning stages and end with the induction of manpower and start-up.

Pre-construction phase basically involves completion of all legal formalities with respect to the No Objection Certificates from the various statutory bodies, surveys/ studies required, acquisition of land, settlement of all issues related to compensation, if any, finalization of contract for procurement of machinery/ equipment, recruitment and hiring of requisite skilled, semi-skilled manpower and labour, provision of space and other facilities like water supply, disposal of wastewater and solid waste etc. on temporary basis for the contracted labour to be employed and provision for storage of machinery and materials to be used for construction.

Preparatory construction phase mainly consists of transportation of machinery, equipment and materials to the site for construction, demolition of existing structure, clearing and levelling of land, construction of foundations, buildings and approach roads.

Machinery installation and commissioning involve activities like fabrication work, cutting, welding and construction of buildings and other facilities, laying of cables and pipelines etc. It involves testing of plant for any type of leakages and designed capacity.

Land use and land environment Impacts:

According to detailed design (01.02.2016) the required land size for the construction of the Bayankhosuu heating plant (3 x 5Gcal/h) is about 9880 m² (1 ha) and the required land size for the construction of the Selbe heating plant (2 x 9Gcal/h + 1 x 5 Gcal/h) is about 10,916 m² (1.1 ha). The required land sizes are included the coal storage building, district heating facilities, control room, parking area and access road etc.

The land environment would be impacted due to the demolition, construction related activities such as excavation of earth and earthwork, civil construction work etc. Land may also get contaminated around construction site, machine maintenance area, construction material storage and preparation site, and haulage road.

The existing stations' area is evenly plain with elevation around 1320-1400 meters. Therefore no land filling is required. Only leveling of land will be done for site development.

Mitigation Measures:

- Excavated soil from foundation work will be back filled.
- Surplus quantity of rubbish will be cleared and utilized to fill up low laying areas immediately after completion of construction activities.
- The top soil from the productive land area shall be preserved and reused for plantation purposes. It shall also be used as top cover of embankment slope of internal and peripheral roads for growing vegetation to protect soil erosion. It will be ensured that all excavated earth is utilised within site for levelling and road embankment purposes.

Soil Quality Impacts:

As the construction activity will involve mainly excavation work with top soil being used for landscaping, no adverse impact is envisaged from the project during this phase.

Mitigation Measures:

- Fuel and lubricants shall be stored at the predefined storage location.
- The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- Construction vehicles and equipment shall be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil.
- All efforts shall be made to minimise the waste generation. Unavoidable waste shall be stored at the designated place prior to disposal.
- To avoid soil contamination at the wash-down and re-fuelling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized Waste Oil Recycler.
- To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.

- Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided during construction phase.
- Non-bituminous wastes should be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit.
- Bituminous wastes will be disposed of in an identified dumping site approved by the MEGDT.

Water Quality Impacts:

The likely impacts on water quality during the construction phase may arise from inappropriate disposal of construction waste and wastewater generated from the construction sites. Wastewater generated from the site during the construction contains suspended materials, spillage and washings from the various areas. In addition to that, the presence of labours and other work force in the construction site will generate little quantity of wastewater during construction phase of the project.

During the construction phase of HSs, water will be used for construction of civil structures, dust suppression and drinking purpose. The water requirement shall be met standards set for safety arrangements. During the spring and summer season, there are chances of wash out of mud and debris in the run-offs. This may result in suspended solids and turbidity in run offs water during the spring and summer flooding period. However, this impact will be temporary in nature and shall be lasting only for the duration of the construction period. Efforts will be made to reduce the suspended solids content of storm water run-offs by routing the storm water drains through settling tanks/catch pits.

The domestic water requirement during construction phase probably will be limited to drinking water and for sanitation. All the domestic wastewater generated from the site needs to be sent to septic tanks followed by soak pits, in order to not contaminate the ground water in the nearby areas.

Mitigation Measures:

- The drainage system of construction site will be connected to the existing drainage system at an early stage.
- All the debris resulting from the site shall be disposed off separately.
- Settling tanks shall be provided to prevent to discharge of excessive suspended solids.
- An oil trap shall be provided in the drainage line to prevent contamination by accidental spillage.
- To prevent contamination from accidental spillage of oil the storage areas will be bounded and will be inspected and cleaned at regular intervals.
- Proper storm water management system shall be integrated in design phase and civil works shall be carried out accordingly at project site. Efforts will be made to reduce the suspended solids content of storm water run-offs by routing the storm water drains through settling pits.
- Toilets will be provided for construction workers and waste water generated from toilets needs to be treated in septic tank.

Air Quality Impacts:

The sources of air emission during construction phase will include site clearing, demolition activities, vehicle movement, material storages and handling and operation of construction equipment. Emissions from them are expected to result in temporary degradation of air quality, primarily in the working environment affecting construction employees. The impacts on the ambient air quality during construction shall be monitored according to standards to avoid any further adverse impacts to the vicinity areas.

The emission of particulate matter during the construction phase will be generated from the activities like demolition, receipt, transfer and screening of aggregate, crushing activity, road dust emissions. In addition, emissions from various construction machinery fuelled by diesel and from mobile source will be in the form of VOC, CO, NOx and SO₂. The emissions from stationary and mobile diesel engines with respect to their working/ movement are presented in Table 2.

Table 4.2 : Exhaust Emissions for Stationary and Mobile Machinery¹

Source	PM ₁₀	VOC	CO	NO _x	SO ₂
Diesel exhaust emissions (idle)	0.043 g/min	0.208 g/min	1.57 g/min	0.917 g/min	18.8 S g/l
Diesel exhaust emissions (moving)	0.4 g/mile	3.18 g/mile	18.82 g/mile	8.5 g/mile	18.8 S g/l

¹ (Source: AP 42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources of United State Environmental Protection Agency (USEPA))

Hence the impacts on the ambient air quality during construction phase will be temporarily for short duration and reversible in nature and restricted to small area.

During operation phase, the air emissions will be from:

- Plant Stacks
- Emergency Power Supply System
- Coal Handling and stockpiles.

The ambient air quality in respect of air pollutants will change during the operation phase due to the operation of the proposed project. Air borne pollution envisaged to be caused by wind and traffic movement from access roads. Also fugitive dust will be generated from handling and feeding of raw materials. There shall be fugitive dust during raw material handling, junction houses and transfer points.

Mitigation Measures:

- Vehicles delivering loose and fine materials like sand and aggregates shall be covered.
- Loading and unloading of construction materials shall be made at designated locations in project area with provisions of water fogging around these locations.
- Storage areas should be located downwind of the habitation area.
- Water shall be sprayed on earthworks periodically.
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- The asphalt plants, crushers and the batching plants shall be sited at in the downwind direction from the nearest settlement and after securing a No-Objection Certificate (NOC) from the Environmental /Safety engineers. Hot mix plant if set up by contractor for road construction, shall be fitted with stack of adequate height to ensure enough dispersion of exit gases.
- Bitumen emulsion and bitumen heaters should be used to the extent feasible.
- Regular water sprinkling of unpaved haulage roads.
- Mask and other PPE shall be provided to the construction workers.
- Diesel Generating (DG) sets shall be fitted with stack of adequate height as per regulations (Height of stack = height of the building + 0.2 V KVA).
- Low sulphur diesel shall be used in DG sets as well as construction machineries.
- Air quality monitoring should be carried out during construction phase. If monitored parameters are above the prescribed limit, suitable control measures shall be taken.
- The idling time of the construction equipment can be reduced by automatically shutting the engine off after a pre-set time without intervention from the operators.
- Control fugitive dust by water sprinkling as well as the use of bag filter
- All transfer points and Belt Conveyors needs to be fully enclosed. Ventilated air shall pass through Bag Filters. SO₂ originates mainly from combustion of fossil fuels. The flue gas from the Boilers shall be treated in ESP and then released through a stack of adequate height.
- Adequate stack height needs to be provided for better dispersion of flue gas as per the regulations.
- Adequate green landscape should be designed by the project proponent for further control of air pollution due to fugitive emissions at site.

Noise Quality Impacts:

The general noise levels during construction phase such as due to working of heavy earth moving equipment and machinery installation may sometimes go up to 90 dB(A) at the work sites in day time. The workers in general are be likely to be exposed to an equivalent noise level of 80-90 dB(A) in 8 hours shift for which all statutory precautions will be implemented. Use of proper personal protective equipment will further mitigate any adverse impact of noise to the workers.

The noise generation will be considerable during such type of large scale construction activities. Typical Noise sources during construction phases are mentioned in Table 3.

Table 3. Typical Noise Sources during construction phase

Description	Noise Level (dB(A))
Earth Movers	
Dozers	95-100

Front Loaders	72-84
Backhoes	72-93
Tractors	76-96
Tipplers/Trucks	82-94
Material Handlers	
Concrete Mixers	75-83
Concrete Pumps	81-83
Cranes (movable)	75-86
Vehicular Traffic (Construction material and plant machinery)	85-98
Stationary Equipment	
DG Sets	90-95
Pumps	69-71
Compressors	74-86
Impact Based Equipment	
Pneumatic Wrenches	83-88
Jack hammer and rock drills	81-98
Pile drivers (peak)	95-105

Phases of construction activities at project site are not yet defined. However, necessary mitigations are required to be implemented during construction period such as proper placement of heavy machineries, following standard operating procedure etc. This noise level will attenuate fast with increase in distance from noise source.

Impacts due to noise during construction activities will be maximum since the site is within the heavy settled area. Therefore, noise generating construction activities shall be carried during the day time only.

Mitigation Measures:

- All equipment shall be fitted with silencers and will be properly maintained to minimize its operational noise.
- Noise level will be one of the considerations in equipment selection which will favour lower sound power levels.
- Stationary noise making equipment needs to be placed far from inhabited areas
- The timing for construction activities shall be regulated, such that all noise generating construction activities in odd hours say after school hours.
- The provision of temporary noise barrier (Barricading) shall be made near identified sensitive locations or near the noise source during construction.
- Plantation along the boundary wall shall be made at start of construction itself.
- Protection devices (ear plugs or ear muffs) shall be provided to the workers operating near high noise generating machines and their shifts shall be rotated.
- Noise measurements should be carried out to ensure the effectiveness of mitigation measures and develop a mechanism to record and respond to complaints on noise. Data shall be reviewed and analysed by the project manager for adhering to any strict measure.
- Smooth flow of traffic should be ensured on the internal road to avoid idling and honking of vehicles.

Solid waste generation (Hazardous and Non-Hazardous) and Disposal Impacts:

During construction phase, solid waste such as excavated soil, debris, stone, bricks, sand, metal waste, polythene sheets, etc. shall be generated. This waste may contaminate soil at plant site temporarily and will be restricted to a small area. Excavated topsoil needs to be used for backfilling/ plantation and as soon as construction is over, all wastes from the site shall be cleared with due care, meeting regulatory requirement, if any.

There is potential for accidental spills while re-fuelling or servicing vehicles and through the breakage due to wear and tear. Procedures for maintenance of equipment will ensure that this risk is minimized and clean-up response is rapid if any spill occurs. During construction phase, waste oil will be generated as and when lubricating oil is changed. Waste oil will be collected and stored in leak proof steel drums. The waste oil drums will be properly identified with label of what is contained in local and English language. It will be

mainly disposed off by selling to appropriate vendors as per Hazardous Waste (Management, Handling and Transboundary Movement) Regulation & amendments thereafter¹.

Municipal solid waste generated by the construction work force will be collected, segregated and will be sent to the solid waste disposal site/ land-fill allocated by the local administrative authorities. Hence impacts will be insignificant, reversible and for short duration only.

Mitigation Measures:

- Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized Waste Oil Recycler.
- Non-bituminous wastes should be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit.
- Bituminous wastes will be disposed of in an identified dumping site approved by the State Pollution Control Board.

Socio-economic Environment Impacts:

The construction will involve generation of a lot of employment, both direct and indirect, which will affect the economy of the study area. But these impacts will be temporary and will revert back to the original conditions once the construction work is over and the temporary labour force moves away. The labour strength engaged in the construction is not yet defined. Thus, the bidding entity should consider impacts on the physical and aesthetic resources during the detailed EIA survey.

Terrestrial Ecology Impacts:

Terrestrial flora can be affected by the dusty environment to be created due to vehicular movement during construction phase. Increment in the density of the dust particles (SPM) in the atmosphere can affect the surrounding plant/crop vegetation in following ways:

- a) Blockage and damage to stomata
- b) Reduction in chlorophyll content
- c) Abrasion of leaf surface or cuticle

All these disturbances ultimately affect photosynthesis process and plant metabolism which leads to reduction in plant growth up to some extent.

Noise level of the project area will be increased during construction phase. Although there is no specific noise-sensitive flora has been recorded near to project site but avifauna and small animals can be affected by increased noise level. In such cases they can change their habitat.

It was noticed that the project area does not associated with any Protected area's network of Mongolia and there is no wildlife migratory routes present in the project area. Primary study also confirmed that there is no removal of any significant flora from the project area, no removal of prey of predatory animals and no noises disrupting breeding behaviour or use of breeding grounds.

Mitigation Measures:

Dust generation will be managed through the following:

- A regular water spraying on un-tackled roads used for transportation
- A periodic plantation of fast growing, evergreen, broad leaved, dust-resistant indigenous plant species

Any impacts associated with the congregation of labour can be managed through the following:

- No permanent camping in vegetation rich area and riverside (Selbe area)

¹ Joint order of ministers of environment, health and culture - 324-318-336, Government resolution #135, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal etc.

- A provision of fuel for labourers engaged in construction activities
- Restriction on poaching/hunting and removal of any vegetation

According to the Law on Soil Protection and prevention of desertification article 7.2.4 the project should design vegetation cover (green landscape) in no less than 10 percent of the whole project area to reduce air and noise pollution in their surrounding area.

ENVIRONMENTAL REGULATIONS TO BE CONSIDERED

In terms of regulation on power and heating generation system, the proposed project shall consider following list of primary regulations for further procedures in selecting, constructing and operating Heating Station for the project.

Stockholm Convention - Special consideration of requirements set in Article 5 and Annex C of the Stockholm Convention should be applied, because persistent organic pollutants may be unintentionally produced and released as a result of operation of the HS.

Law on Soil Protection and Prevention of Desertification - The soil protection law includes measures to prevent desertification from the intensification of agriculture, mining, road construction, and urban land use as well as climate change. The law provides guidance to facilitate a safe and healthy environment for the population, and to prevent soil damage and lower soil fertility from overgrazing and desertification, and systems to prevent soil erosion. The law also contains measures to establish accountability in environmental protection along with more elaboration on soil degradation, desertification gradation criteria and soil assessment methodology.

Law on Air Quality - The purpose of this law is to regulate actions related to the protection of ambient air, prevention of air pollution, and reduction and monitoring of emissions of air pollutants. If an international treaty to which Mongolia is a party is inconsistent with this law then the provisions of the international treaty shall prevail. It lists government powers with respect to air quality protection, including the approval and management of the implementation of the National Programme for Air Protection and Climate Change.

Renewable Energy Law - The Law allows private sector independent power producers to build and operate facilities using renewable energy sources and to deliver the electricity produced to distribution networks and offers incentives to encourage private sector investments in renewable energy, the main one being the establishment of thresholds for feed-in-tariffs. Under the Law, the Energy Regulatory Authority will set tariffs and prices for other renewable energy generation facilities such as geothermal and biomass. Project developers will be compensated from the Renewable Energy Fund for the price differential between actual cost and the end-user tariffs applied under the jurisdiction of the respective authority. Tariffs set under this Law will be consistently valid for a minimum of 10 years. The Ministry of Mineral Resources & Energy can use public funds to carry out feasibility studies for the sector; governors of various administrative units are required to make decisions allowing 'possession' of state lands for the purpose of establishing renewable energy facilities; governors are encouraged to lease independent renewable energy power sources to an entity or individuals. The Energy Law underpins the Renewable Energy Law so it should be referred to for the general rules and conditions relevant to power generation.

The Energy Law - The Energy Law regulates matters relating to energy generation, transmission, distribution, dispatching and supply activities, construction of energy facilities and energy consumption. The law is based on economic principles, market mechanisms and the rights and obligations of both the industry and the consumers. The law changes the operations and regulations of the energy sector. On the structural side, the law creates generation, transmission, dispatch, distribution and supply entities for the energy industry. On the regulatory side, it provides that each of these new entities will have to apply for licenses for operation, and separately for electricity and district heating. The Law calls for the establishment of an Energy Regulatory Agency (ERA) that will be responsible for administering its provisions. The amendment to the Energy Law adds a new regulation that sets energy prices and tariffs which account for power production costs and profit margins. The price and tariffs for electricity and heating production, and the amount of fuel supplied (for generation of heat and electricity) will be regulated. The amendment aims to increase private sector participation, business development and investments in the energy sector. The increased business interest and participation of private sector will result in the increased development of the energy sector.

Green Development Policy (GDP) - This Policy defines Green Development as “a transition to a development model that results in sustaining well-being of people by ensuring environmentally friendly, inclusive economic growth or increasing efficient consumption of natural resources and sustainability of ecosystem services”. Key indicators for measuring progress will include the savings of natural resources derived from production and services, level of recycling, green employment and green procurement growth, reduction of usage of energy, water, GHG emissions and ecological footprint per unit of production. The GDP establishes six strategic objectives to ensure green development: (i) promote resource efficient, low GHG emission and zero-waste production and services; (ii) preserve ecosystem balance; (ii) introduce financing, tax, lending and other incentives; (iv) promote green employment, poverty reduction and engraining/promoting green life style; (v) promote “Live in harmony with nature” living and cultural values; and (v) develop and implement population settlement plan in accordance with climate change, availability of natural and other resources in regions and restoration capacity. For each one of these strategic objectives, the GDP establishes a number of specific and measurable targets. For example: • Reducing GHG emission in the energy sector by: increasing energy efficiency by 20% by 2030; ensuring the share of renewable energy relative to total energy production of 20% by 2020 and 30% by 2030 and 2030; renewing energy and industrial sector technologies; reducing wasteful consumption and losses; and optimising pricing policies. • Reducing building heat losses by 20% and 40% by 2020 and 2030, respectively, through the introduction of green solutions, energy efficient and advanced technologies and standards, including a green building rating system, energy audits and the introduction of incentives to promote these initiatives. • Processing of agricultural raw materials, including animal skin, wool and Climate Change Legislation – Mongolia 11 cashmere up to 60% and 80% by 2020 and by 2030, respectively, through the promotion of sustainable agriculture development and development of greentech, export-oriented manufacturing industry cluster. • Protecting at least 60% of Mongolia’s water flow and spring water area and the expansion of protected areas to 25% and 30% by 2020 and 2030, respectively, and creation of sustainable financing mechanisms. • Enhancing forest absorption of carbon by intensifying reforestation efforts and expanding forest areas to 9% of the country’s territory by 2030. • Providing at least 90% of population with access to hygienic drinking water and improve sanitation facilities by increasing water supply and sewerage capacity and productivity. • Promoting efforts aimed to reclaim at least 70% of degraded, polluted and abandoned land due to production activities. • Promoting green investment equivalent to not less than 2% of Mongolia’s GDP per year on green development, reducing GHG emissions, increasing productivity and energy efficiency. • Providing that at least 20% of public procurement shall be the procurement of environmentally sound, effective and resource efficient goods, works and services • Developing clean technologies and innovation by investing in science and technology research, experimentation/testing, and make these catalysts for green development. • Increasing the green area share by 15% by 2020 and 30% by 2030 through replanning of urban settlement areas. • Reducing solid waste for landfills by 20% by 2020 and 40% by 2030.

Policy National Renewable Energy Programme (2005-2020) - The National Renewable Energy Programme was approved by the Parliament to increase the adoption of renewable energy in the energy system, improve the structure of power supplies, and promote renewable energy in off-grid settlements to ensure ecological balance and improve economic efficiency. The Programme is being implemented in two stages: the first stage from 2005-2010 and second stage from 2011-2020. It aims to promote reliable, independent and effective operation of centralised energy grids and regional power supply systems by increased use of renewable energy. Another objective of this Programme is to provide power to all distant settlements, which require a significant amount of resources to be connected to the centralised power grid system, by introducing renewable energy generating systems. The Programme is related to the Energy Law and the 100,000 Solar Houses (Gers), which aims to provide rural areas with electricity through the utilisation of solar energy. It also establishes a target to increase the share of renewable energy, relative to total electricity production, reaching 3-5% by 2010 and 20- 25% by 2020.

National Action Programme to Promote Quality and Environmental Management Systems - The National Programme to promote quality and environmental management systems calls for legislative and structural changes to support cleaner production and an ecolabelling scheme. The Programme is implemented in 3 stages: the first stage from 2002- 2006, the second from 2007-2011, and the third between 2012 and 2016.

Law on Environmental Impact assessment – The law aims to protect the environment, prevent ecological imbalance, ensure minimal adverse impacts on the environment from the use of natural resources, and regulate relations that may arise in connection with the assessment of environmental impacts of and approval decisions on regional and sectoral policies, development programs and plans and projects. The law was amended in 2012 to improve the quality of regulation, ensure responsible, environmentally friendly and sustainable development, improve economic efficiency, introduce international standards in environmental auditing and the "polluter pays" principle, increase public participation in environmental decision-making, and secure funds for environmental protection.

CONCLUSION / RECOMMENDATIONS

1. The proposed boiler system is a quite new technology in the world, even in Mongolia, which have less impact to the air, using limestone to reduce the SO_x related pollutants to the air.
2. As a new technology, the system have advantages and disadvantages that should be considered during bidding procedures especially, to increase performance with expectations for further extensions.
3. Surveys and assessment of the FBC system states that the system is designed to reduce air pollutants,
4. Even the system is aimed to reduce the air pollutants it is not meant that there would not be any impacts. Basic environmental requirements included in this document and needs to be considered by the CS1 and construction company. Impact will be minimized to a large extent by implementation of the EMP
5. However, due to specifics of proposing technology, the construction company needs to have detailed EIA approved by the MEGDT and obliged to follow it during construction and operation stages.
6. Additionally, the detailed EIA should address following issues:
 - a. Compliance with the existing ambient air quality standards will be achieved by implementation of measures outlined in EMP. This needs to be coupled with the continuous monitoring of air pollutants within and around the project site as well as in adjoining areas.
 - b. To assess the impact of air emissions from various continuous point sources, air dispersion modelling study have to be conducted during the DEIA
 - c. The sufficiency of the land for proposed heating stations should be assessed in detail during the detailed EIA
 - d. Additionally, the cumulative impacts of the proposed HS should be assessed during the detailed design and DEIA.

ANNEX. Classification of projects subject to general Environmental Impact Assessment

Types of the project	Responsible authority	
	Ministry of green development and tourism	Aimags, municipality level governing administration
1. Mining projects	-All kind of mining exploration	exploration of commonly distributed natural resource /mineral/ in respected areas
2. Heavy plant projects	- ore processing plant - ore enrichment plant - Chemical plant - By product coke industry - Rest of kinds	
3. Light and food industry projects	State first string industry/plants	Small and medium business in local level
4. Agricultural projects	- Water reservoir - Irrigation system - All activities related to bring virgin lands under cultivation	-Local level forestation projects Green facilities, gardens In the areas where planning agricultural development
5. Infrastructure development projects	- Power stations with capacity of above 1 mVt - Power line with capacity of over 35 kV - Heating line - Hydropowerstations - Railway - Airports - International and national level Paved road - International and national level communication lines - Crude oil reservoirs	- Power stations with capacity of below 1 mVt - Power line with capacity of below 35 kV - Heating line capable for respected area - Local level roads, communication and petrol stations
6. Service projects	- Hotels, guesthouses, tour camps and other services with capacity of above 50 beds per day	- Hotels, guesthouses, tour camps and other services with capacity of above 50 beds per day - Tourism services
7. Other projects: - Urban development - Military and civil ward projects - Water supply system - Waste water treatment plant - Waste disposal point	- for the urban/city/municipality with population of above 10000	- for the urban/city/municipality with population of below 10000
8. Biodiversity projects	- National level fish farms - Introduction, exploration and other activities related to animal and plant species	- Game hunting - Forest plantation farms - Fish farm to supply local needs
9. Projects holding service and farming of genetically modified related organisms	Cloning Breeding Planting Importing Trans-boundary marketing of GMOs	Planting of GMOs Hold on small medium enterprise using GMOs Forestation and restoration activities
10. Hazardous and radioactive chemicals, dangerous waste projects	Processing, use, storage, convey and neutralization activities of hazard and radioactive chemicals' waste	
11. Activities in the Special Protected areas	Activities within the boundary of the State protected areas	Activities within the boundary of the local protected areas