ELECTRICITY MANAGEMENT SERVICES LIMITED

REPORT ON INSPECTION AND TESTING OF STANDARD METALLURGICAL COMPANY (SMC) 15MW GAS TURBINE GENERATOR AND 132KV SUBSTATION, GBARA VILLAGE, SAGAMU, OGUN STATE ON 5TH & 6TH MARCH, 2015

ELECTRICITY MANAGEMENT SERVICES LIMITED

4, Dar Es Salem Crescent, Off Aminu Kano Crescent, Wuse II, Abuja, FCT

RE: CONSTRUCTION OF 132KV OHTL AND ASSOCIATED SUBSTATION FOR THE CONNECTION OF SMC TO NATIONAL GRID

INSPECTION REPORT OF:

SUMMARY OF OBSERVATIONS AND RECOMMENDATIONS

Your request for the inspection, testing and certification of the above underlined project refers. Please be informed that the inspection was carried out on the 5th and 6th of March, 2015. Find below the observations and recommendations of Electricity Management Services Limited (EMSL) inspection team for your implementation and compliance.

CLIENT: Standard Metallurgical Company (SMC), Lebanon

SUPERVISING AGENCY: Transmission Company of Nigeria (TCN)

INSPECTING/TESTING AUTHORITY: Electricity Management Services Limited (EMSL)

INTRODUCTION

The project consists of one number Carterpillar (Turbomach) gas-fired power plant of 15MW capacity, step-up transformers for export purposes (5MW) and step-down transformers for factory use (10MW). Generation is at 11KV with an initial step-up to 33KV and subsequent and further step-up to 132KV. The company plans for future expansion in which it generates more power for export to the grid, while increasing its production capacity.

S/NO	PROJECT AREA	OBSERVATIONS	PICTORIAL VIEW OF ITEM	RECOMMENDATION
1.	**GENERATING STATION**	There was one number Caterpillar (Turbomach) 15MW gas fired turbine engine generating plant, encased below with a sound proof cabin, and projecting upwards with specially designed ventilators and exhaust chimneys. However, detailed technical data and specifications of the plant were not made available to the inspecting team, but was promised to be sent afterwards. The Power Plant is centrally situated with adequate provision for space. Generator area was surrounded by well landscaped green area.	  	It is recommended that the generation area be guarded with dwarf mesh fence and danger notices to prevent unauthorized entry. Soft and hard copies of generators technical specifications should be presented to the inspecting team for proper confirmation of equipment data and for documentations. Commendable Layout and installation.

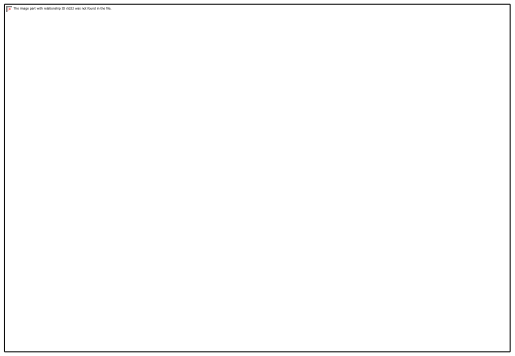
2.	**GENERATING STATION**	The generated voltage from the generators and other technical data were to be furnished to the inspecting team in due course. However, obvious provision for future expansion has been made in the Power Station and substation areas.		 **Exposed fire extinguishers should be shaded from the direct effect of rainfall and sunshine, as well as accumulation of dust.**
3.	**GENERATING STATION**	Gas turbine monitor/control room was a small cubicle built inside the lower cabin and manned by one operator that had to be locked in the enclosure.		**It is recommended that individual monitoring and confinement in such sensitive area should be avoided, notwithstanding the three shifts of work in place. Alternatively, a transparent opening could be created to enable the visibility of the operator from outside without opening the door.**

There were also two numbers (diesel fired) standby private generating plants of 1250KVA capacity each.

4.	**GENERATING STATION**	The two numbers private generating plants' house was not completely enclosed enough to prevent unauthorized entry. Besides, the cable trenches and trays were exposed to danger.		Sufficient barricade should be put in place to forewarn unauthorized persons about inherent dangers around high voltage environments. Concrete slabs of appropriate sizes should be constructed and cable tray covers to cover up the places for the safety of all.
		There were no insulation mats Provided at the floor of the generator control panels.		Provision of insulation mats of appropriate sizes, rating and quality is recommended for all high, medium and low voltage control panels.
		The installed 3.15MVA11/0.415KV, transformer was not properly protected with either wire mesh (as was the case for the 500Kva, 11/0.415kV distribution transformer and the		

R.M.U. shown below) or other sufficient barriers.

It was also observed that undersized cables were used for terminations on the low voltage side.



The capacity of the MVA transformer requires that a more proactive safety approach should be adopted to forestall unforeseen bad situations that may arise otherwise.

5.	**MV/HV STATION**	**CONTROL**	The control rooms were spacious and sufficiently illuminated. However there were no air conditioning facilities, no proper ventillation and there were no insulation mats in place as at the time of this inspection. There was no provision of hand rails or other barriers that could prevent falling off from the pavement elevationcreated inside and outside of the control room. Use of standing fan was observed as the cooling device for the control panel busbars. Functional tests carried out to determine the effectiveness of the circuit breakers and other switchgear control systems were confirmed to be in proper operational condition except that the limit switches of	  	  Provision of recommended safety measures would secure both lives and installed infrastrucure. The worker captured in the pictorial above can easily slip over into the ditch behind him, hence the need for adequate barriers/rails to guard possible slippage. Deffective materials and construction work should be addressed as required by regulation.

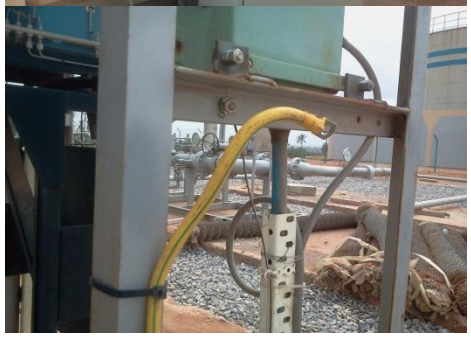
	two isolators in the 132KV substation need to be rechecked for proper alignment. Moreover, the support structure for isolator was observed to have cracked. The MV and HV room entrances were not so designated for easy identification, except for the blue coloured (with yellow stripes) metal barrier for the LV room and red coloured entrance for the MV room.	 	Boldly written “MV CONTROL ROOM’ DANGER! KEEP OFF with danger signs at the entrance shall serve.

6.

The air compressors and the compressed air receivers/surge vessels were well installed and identified.
Appropriate barricade should be provided to block already existing thoroughfare across the air compressor room.
Electrical supply cables were not channeled through appropriate ducts thereby exposing some high voltage cables to possible abrasions from continuously stepping upon them.

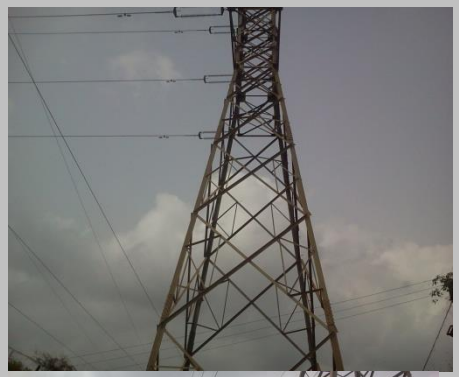
All air receivers/vessels must be hydrostatically tested with labels on the body showing SWP, Test pressure and Date of last test.

Install adequate danger signs and insulation mats for the control panels as required.

7.	**GASPLANT STATION**	The gas plant area was spacious enough with adequate granites and fire extinguishing facilities provided. Earthing terminals were also identified to be properly terminated except at one separate chamber where the terminal cable lug was flying unconnected. Fire extinguishers were sighted to be exposed to direct adverse effect of rainfall , sunlight and dust. The gas plant environment was not barricaded from unauthorized entry and tamper.	  	   All exposed fire extinguishers should be shaded. Terminate flying earthing cable lugs and barricade the entire gas plant arena from unauthorized entry/tamper.

8.	**132/33KV SUBSTATION**	The substation was a two bay turn- in (132/33KV) and turn-out (33/132KV) single circuit arrangement including an intermediate isolating tie section. Two numbers power transformers of 63MVA capacity each were installed. The substation was spacious enough and other substation ancillaries such as the lightning arrestors, circuit breakers CTs and VTs as well as line isolators were observed and identified. Most areas of the substation construction work were ongoing. Open cable trenches were yet to be covered with slabs.	  	Okay Covering concrete slabs should be provided to close up all ditches, trenches or ducts as required. Entire substation arena including power transformers should be properly fenced off with adequate danger notices.

9.	**132/33KV SUBSTATION**	Some gantry basement foundation in the substation were found to be suspended on bolts rather than on concrete structure.		The overall weighy of the gantry structure can tilt the affected gantries out of balance thereby resulting in major construction defects.
		Some metal channels used in the substation construction work were found to be rusting including some bolts and nuts.		Use of galvanized bolts and nuts and galvanized steel channels is recommended.
				

10.	**132KV TRANSMISSION TOWERS**	The transmission towers were observed to be of galvanized steel as well as associated structures.We noticed composite type of insulators, arcing horns and vibration dampers. DETAILED TECHNICAL SPECIFICATIONS WERE YET TO BE SUBMITTED TO THE INSPECTING TEAM. There were no anticlimbing devices, no phase identification notices, no danger notices,no external earthing of the tower legs. Tower number six and some others were observed to be too close to the access road. Careless drivers have the tendency to crash into the towers. The existing 132KV network to which the proposed 132KV transmission substation	  	Reflexive caution signs should be installed on the towers affected. Use of anti climbing devices, phase identification signs, and danger notices are required by regulation for all transmission tower installations.  Reconstruction of the existing 132KV Ikorodu/Sagamu lines is strongly recommended in order to avert potential future hazards.

	is to be connected was observed to be too low and does not possess the regulation standard height. It was observed to be lower than existing 11KV network along the same axis. Station to the air compressor section, transformer substation structures and control panel rooms, tower structures and all associated ancillaries and they were found to be within specified values except at tower numbers 3, 5, and 7 where the values were between 2.04 and 3.37 ohms. All measured earth resistance values are tabulated in appendix 2 below.	 	Immediate improvement of earthing is recommended at all towers affected.

11.	**LIGHTNING ARRESTERS**	The entire substation and generator environment was well protected from lightning using sky wire in the substation and spikes covering the entire factory perimeter.	  	The turn-in turn-out sky wire should be in form of a mesh to cover the entire region designed to be protected.

12.	GENERAL RECOMMENDATIONS	i. Towers number 6, 9 and 10 should be guarded against vehicular movements. ii. Control room doors should be earthed. iii. Control rooms should be air conditioned. iv. Hand rails must be installed at the appropriate places. v. Under-sized transformer cables to be replaced with recommended sizes. vi. Sufficient fire fighting equipment to be provided at the generator house area. vii. Sufficient caution signs to be installed at strategic locations. viii. Switching mats of recommended ratings to be placed at required locations. ix. Isolators in the substation to be appropriately numbered. x. Tower bases to be provided with reflexive barriers. xi. Appropriate adjustment to be made to correct the tilting tower number 2 back to vertical position. xii. The obvious sagging between towers 10 and 11 as a result of the wider spanage between them should be addressed.

13.			The inspection team further recognized the continuous work in progress throughout the factory environment, and recommends that subsequent construction works should take into consideration all of the above recommendations for effective safety assurance in line with existing regulations.	
14.	**FACTORY CONVENIENCES**		There were no conveniences at the substation area nor at the generator arena for use by operators.	It is recommended that operator staff in the substation area as well as in the generator plant area should have nearby conveniences so that they may not leave their duty post to cover long distances when pressed.
15.	**REVIEW MEETINGS**	The Executve Director (TS) EMSL Engr T. Gidado reiterating Government's readiness to partner with private power providers to the listening attention of the management team of SMC.		

	The Director reminded the SMC team of the need to enforce safety regulations and ensure total compliance to specifications in his concluding remarks.		

Hard and soft copies of all design drawings and data are yet to be given to the EMSL Team by Standard Metallurgical Company (SMC).

Conclusion

Please note that the re-inspection and certification of the project will be carried out on your compliance with the action points/recommendations of this report and the necessary payment of Inspection and Re-inspection fees in the sum of **Nine Hundred and Fifty Nine Thousand, Two Hundred and Fifty Naira (₦ 959,250.00) only, as tabulated in appendix 3**

Signed by:

INSPECTING/TESTING AUTHORITY: ELECTRICITY MANAGEMENT SERVICES LIMITED …… DATE: ……..

SUMMARY

On site meeting was held on each day of the inspection exercise. The attendance is contained in the tables below:

DAY 1: 5th March 2015

S/NO.	NAME	ORGANISATION	DESIGNATION	E-MAIL ADDRESS	TELEPHONE
1	Engr T. Gidado	**EMSL**	ED (Tech)	engrgidado@yahoo.com	08034518055
2	Engr W. Metieh	**EMSL**	Senior Advisor	Cynbil.ltd@gmail.com	08070990009
3	Engr Alabi T. M.	**EMSL**	Assistant Director	Naotoy42@yahoo.com	08033874077
4	Engr K.O. Ikpo	**EMSL**	Area Inspection Engineer (Ogun State)	kaluiyke1965@yahoo.com	08037442084
5	Engr D. E. Owan	**EMSL**	Area Inspection Engineer Eko	owandaniel@yahoo.com	08069674280
5	Engr AdewaleOyinlade	**EMSL**	Area Inspection Engineer (Ikeja)	best_oyinlade@yahoo.com	08034417901
6	Nader Saade	**SMC**	Plant manager	nader@smc.com.ng	07037383104
7	Habib Hassoun	**SMC**	Manager – Project	h.hassoun@smc.com.ng	08102102410

Safety standards must be adhered to at all times in order to assure safety of lives and property, and to also ensure steady supply of energy to the grid.

DAY 2: 6th March 2015

S/NO.	NAME	ORGANISATION	DESIGNATION	E-MAIL ADDRESS	TELEPHONE
1	Engr T. Gidado	**EMSL**	ED (TS)	engrgidado@yahoo.com	08034518055
2	Engr W. Metieh	**EMSL**	Senior Advisor	bmetieh2006@yahoo.com	08070990009
3	Engr Alabi T. M.	**EMSL**	Assistant Director	naotoy42@yahoo.com	08033874077
4	Engr K. O. Ikpo	**EMSL**	Area Inspection Engineer Abeokuta	kaluiyke1965@yahoo.com	08037442084
5	Engr Adewale Oyinlade	**EMSL**	Area Inspection Engineer, Ikeja	Best=oyinlade@yahoo.com	08034417901

1. The Standard Metallurgical Company, Gbara Village, Sagamu Ogun State is not recommended for certification pending the satisfactory compliance and full implementation of all observations by the inspecting team of EMSL

APPENDIX 1

TRANSFORMER DETAILS

S/No.	Make	Capacity (KVA)	Voltage Ratio (KV)	Cooling	Serial No.	% Impedance	Vector Group	Year
1	Shenda Electric	63000	132/33	ONAF/ONAN	CK131044-1	11.75	YNd11	2013
2	Shenda Electric	63000	33/132	ONAF/ONAN	CK131044-2	11.75	YNd11	2013
3	Shenda Electric	20000	33/11	ONAN	CK131260-1	8	YNd11	2014
4		3150	11/0.433	ONAN			Dyn11	
5		500	11/0.415	ONAN				

The data on the nameplate of the last two transformers were not easily accessible because the transformers were energized during this inspection exercise. However the client has promised to supply every necessary document to the inspecting team.

APPENDIX 2

EARTH RESISTANCE READINGS IN OHMS (Ω)

AREA	POINT 1	POINT 2	POINT 3	POINT 4
Transmission Tower 1	1.26	1.32	1.32	1.38
2	0.22	0.32	0.26	0.24
3	2.04	2.14	2.16	2.17
4	1.04	1.02	1.02	1.02
5	1.55	3.19	1.66	1.66
6	0.66	0.55	0.55	0.55
7	3.25	3.33	3.34	3.37
8	1.28	1.33	1.34	1.27
9	0.41		0.41	
10	0.47	0.53	0.47	1.22
11	0.25		0.21	
Turbine Power House	0.3	0.5		
Air Compressor Plant	1.96	0.99	1.02	0.59
Diesel Fired Generator plant 1	0.46	0.46	0.46	0.67
2	0.67	0.56	0.45	
Substation Yard				
Surge arraster	0.14			
Capacitor V.T.	0.15			
C. T.	0.19			
C. T. 2	0.21			
Isolator 1	0.4			
Gantry Structure	0.26			
C. T. 3	0.2			
C. B.	0.19			
Isolator 2	032			
support	0.22			
Isolator 3	0.17			
C. B.	0.18			

C. T.	0.25			
63MVA transformer 1 body	0.17			
63MVA Transformer 2 body	0.16			
	0.72	0.22		
Isolator 4	0.47			
C. T.	0.18			
C. B.	0.24			
Isolator 5	0.21			
Isolator 6	0.47			
Intermediate Isolator	0.47			
Isolator 7	0.23			
C. B.	0.43			
Isolator 8	0.40			
Substation Panel	0.63			
Lightning Arrester	0.84			

APPENDIX 3

INSPECTION FEES

S/N	SCOPE	CHARGE (₦)
1	Generators	70,000
2	Transformers	522,500
3	Lines (132KV, 33KV, 11KV and 0.433/0.415KV)	17,000
4	Control Rooms	30,000
	Total	**639,500**
	Re-inspection ($\frac{1}{2}$ of Inspection Fees)	319, 750
	Grand Total	**959,250**

This is not a Certificate*