

# **RE-INSPECTION REPORT**

## **GBARAIN POWER PLANT, BAYELSA STATE**

### **RE – INSPECTION OF GBARIAN POWER PLANT**

The re – inspection of the above named project was carried out on the 18<sup>th</sup> March, 2015 by Electricity Management Services Limited (**EMSL**) Inspection Team, **NIPP** and **ROCKSON ENGINEERS**. The attendance list shall be forwarded in due course.

### **PROJECT OBJECTIVE:**

To provide adequate, reliable and continuous supply of electricity to National grid, gbarain and its environ

### **PROJECT SCOPE:**

The Gbarain power plant project comprises of the following;

- Gas supply, meter and condensation station
- Water treatment and denim plant
- Effluent treatment plant
- 2 x 126.1MW (ISO) GE PG 9i71E Gas Turbine/brush alternators
- Turn in – turn out of the existing 132kV Ahoada-Yenogoa DC OHTL
- 1 x 60MVA, 132/33kV transformer
- 2 x 143MVA, 15/132kV step up transformer
- 1 x 3MVA, 33/0.415kV Auxiliary transformer
- 2 x 2600, 6.6/0.433kV station transformer
- 2 x 25MVA, 15/6.6kV transformers
- 2 x 3.5MVA black start generators
- 1 x 1000kVA emergency diesel generator
- Control and protection equipment building
- 132/33kV switchyard
- Transmission line

## **POWER PLANT:**

The alternator supply is 15KV from a brush alternator powered by a GE Frame 9E gas turbine running initially in Open Cycle mode. Provision for the use of CCHP in the future has been made on these turbines.

Part of the 15KV generated voltage is passed through a step-down 15/6.9/0.415KV transformer that will serve the station. The other arm of the supply is stepped up to 132KV for subsequent transmission to the national grid. The work on the generator side is still in progress.

## **GAS SUPPLY AND METERING UNIT:**

- The gas supply, gas heating and gas metering facilities were virtually completed
- Piggings of the line from SPDC supply end being awaited
- All panels have been properly earthed

## **SWITCHYARD:**

- Civil Engineering Works Done
- Sand filling, fencing, grouting of gantries foundation nuts and bolts, earth cable termination on the fence (Jackson Fence), gravelling, access road not completed
- Communication equipment and cables installed but not connected to the panel
- Termination/connection of incoming and outgoing transmission lines conductors to switchyard has been completed
- Many lighting poles on ground, only few were installed
- 60MVA, 132/33kV transformer has been connected
- Synchronization between the power plant, switchyard and grid control yet to be done
- Switchyard lightning arrestors were improvised by merging 2no's 60kV lightning arrestors
- Sky wire linking the switchyard and transmission lines not connected. (Promised to be connected before commissioning date)
- Some cable trenches not covered with concrete slabs, work in progress
- Steel electric poles supporting the conductors from 60MVA transformer to 3MVA transformer were not earthed

## **TRANSMISSION LINE**

- The 132kV galvanized transmission lattice towers for turn in, turn out are of excellent quality, well insulated
- Arcing horns installed not in proper alignment
- Vibration dampers installed
- Tower identification numbers, danger notice and phase identification plates fitted on the towers
- Growing vegetation noticed on some towers cleared
- Bolts and nuts used in fixing the tower members have been tacked to prevent easy loosening by vandals
- Step bolts provided on one leg side of the towers have been removed up to the anti – climbing devices positions
- The conductor size and sky wires of the turn in, turn out section at gbarain power station differs with those of the existing Ahoada –Yenogoa OHTL, this may affect smooth power flow along the line

## **CONTROL AND PROTECTION BUILDING:**

The switchyard control and battery supply/battery bank rooms were well laid out with adequate provision for air conditioners. A demonstration of the capabilities of this digital substation was undertaken during the previous visit, to determine performance of;

- Opening and closing of isolators and circuit breakers
- Switching Interlocks
- Flexibility of the HMI and alarm marshaling
- Bus coupling and protection
- Transformers switching and protection
- Distance/Remote protection
- Local operations of the couplers, earthing switches,etc
- Metal doors in the control room earthed but not with appropriate earth cable size

## **TRANSFORMER AND OTHER EQUIPMENT DETAILS**

### **DIAMETER 2**

#### **TRANSFORMER I**

Make: SCHNEIDER  
Rated Power: 2600KVA  
Rated Voltage: 6600/433V  
Current Ratio: 227.44/3466.77A  
Vector Group: Dyn11  
Cooling: ONAN  
Frequency: 50Hz  
S/No: 12V – 2011 – W07 – 2 – 0008  
Impedance: 6.05%  
Year: 2011

#### **TRANSFORMER II**

Make: SCHNEIDER  
Rated Power: 2600KVA  
Rated Voltage: 6600/433V  
Current Ratio: 227.44/3466.77A  
Vector Group: Dyn11  
Cooling: ONAN  
Frequency: 50Hz  
S/No: RV -2011 – W15 -5 -0157  
Impedance: 6.00%  
Year: 2011

#### **TRANSFORMER (STATION)**

Make: FRANCE TRANSFO (Schneider)  
 Rated Power: 3000KVA  
 Rated Voltage: 33/0.415KV  
 Current Ratio: 52.5/4173.6A  
 Vector Group: Dyn11  
 Cooling: ONAN  
 Frequency: 50Hz  
 S/No: Nr – 413795 - 01  
 Impedance: 7.00%  
 Year: 2007  
 Insulation level: ICV – 170 -70

### **DIAMETER 1**

Make: HYUNDAI TRANS

	RATED POWER	RATED VOLTAGE	RATED CURRENT
HV	15/20/25MVA	15KV	577/770/962A
LV	15/20/25MVA	6.9KV	1255/1673/2092A

Vector Group: Dyn11  
 Cooling Class: ONAN/ONAF1/ONAF2  
 Frequency: 50Hz  
 S/No: 72079KF0016 - 002  
 Impedance: 9.01%  
 Year: 2008  
 Type of Insulation Oil: 1EC602096 UNINHIBITE

### **DIAMETER 2**

#### **AREVA EARTHING TRANSFORMER**

Make: AREVA TYPE GCU 4636  
 Rated Short - Time Power: 5975KVA

Rated Voltage ST.I: 34500V  
 Neutral Short - Time Current: 3600A 105  
 Vector Group: 2N  
 Cooling: ONAN  
 Frequency: 50Hz  
 S/No: 220440/04  
 Year: 2009  
 Insulation level: L1170AC70

**DIAMETER 2** (60MVA)

Make: Hyundai

	RATED POWER	RATED VOLTAGE	RATED CURRENT
HV	40/50/60MVA	132KV	175/219/262A
LV	40/50/60MVA	34.5KV	669/837/1004A

Cooling Class: ONAN/ONAF1/ONAF2

Vector Group: YND11

Frequency: 50Hz

S/No: 20072079TFC041 - 001

Impedance: 10.183%

Year: 2008

Type of Insulation Oil: 1EC602096 UNINHIBITED

**DIAMETER III**

**CURRENT TRANSFORMER**

Make: EMEK

CT: 36KV

S/N: 08F0051

CORE 1	0.2F55	20VA
CORE 2	5P10	20VA
CORE 3	5P10	20VA
CORE 4	5P10	20VA

RATIO	CORE1	CORE2	CORE3	CORE4
600/IA	1S <sup>1</sup> - 1S <sup>2</sup>	2S <sup>1</sup> - 2S <sup>2</sup>	3S <sup>1</sup> - 3S <sup>2</sup>	4S <sup>1</sup> - 4S <sup>2</sup>
1200/IA	1S <sup>1</sup> - 1S <sup>3</sup>	2S <sup>1</sup> - 2S <sup>3</sup>	3S <sup>1</sup> - 3S <sup>3</sup>	4S <sup>1</sup> - 4S <sup>3</sup>

Continuous terminal current: 1.2 x in/1th: 25kv/1 sec.

1dyn: 2.5x1th

Frequency: 50Hz

Rated Primary Current In: 500 – 1600A

Rated System Voltage: 132KV

Insulation Level: 145/275/650KV

Year: 2008.

## **DIAMETER**

## **VOLTAGE TRANSFORMER**

Make: EMEK

Type: KGI – 145

CVT Serial No: 08e0220

CC Serial No: 08p0220

Rated Primary Voltage: 132/3KV (A -N)

Secondary winding: 1/ (1a – 1n): 10/3V class 02 – 60VA

Secondary winding: 2 (2a – 2n): 110/3v class 3p – 60VA

Simultaneous Burden: 120VA

Insulation level: 145/225/650KV

Frequency: 50Hz  
Voltage Factor: 1:2 Continuous 11.5 for 30 sec.  
Rated Capacitance: 6000PF  
Temperature Category: 25/45<sup>0</sup>C.

## **DIAMETER I**

### **LIGHTING ARRESTOR**

Make: Elimson METAL – OXIDE SURGE ARRESTER

Normal: Discharge current 10KA

Model: EPYG – 03

Unit: A

S/No; 488

Year: 2007

Normal: Discharge current 10KA

Model: EPYG

Unit: B

Rated: 60KV

S/No: 488

Year: 2007.

## **GENERAL OBSERVATIONS**

- Cable trenches in the control room fully covered with metal plates
- Communication cables installed but not terminated at the control panel end
- Eye wash basin not installed in the battery room
- Cable trenches in some areas in the switchyard not covered
- The four legs of the towers have been earthed with good earth resistance values
- AC and heat exchanger fan have been installed in battery room
- Wave traps installation done

- Sand filling and fencing completed
- Earthing termination on the fence poles completed
- Gravelling not properly completed – Target date 20<sup>th</sup> March, 2015
- Functional tests on protection, control and communication (132/33kV) side done
- Metal doors in the control building earthed though not with appropriate earth cable
- Switchyard lightning arrestors were improvised by merging 2no's of 60kV lightning arrestors
- Sky wire on the terminal towers and switchyard not connected
- Arcing horns installed but not in proper alignment (to be corrected on the day of commissioning)
- Some lighting poles on ground – work in progress
- Interface between the generating station and switchyard not done – work in progress
- Communication and SCADA installation not completed
- Cable trench in the switchyard not fully covered (to be completed before 26<sup>th</sup> March, 2015)
- Access roads in the switchyard not completed
- Steel electric poles supporting the conductors from 60MVA transformer to 3MVA transformer were not earthed
- No lightning arrestor on the turbine exhaust - chimney (highest point) [*NIPP in charge*]
- Transmission line right of way cleared of grasses

### **RECOMMENDATION:**

#### **SWITCHYARD:**

- Gravelling should be completed in areas where gravels are needed
- Sky wire between the terminal tower and the switchyard should be connected
- Lighting poles/lamps should be installed as adequate lighting points are needed

- Switchyard cable trenches that were not covered as at the time of visit should be covered
- Access road construction in the switchyard should be completed
- Steel electric poles supporting the conductors from 60MVA transformer to 3MVA transformer were not earthed

### **TRANSMISSION LINES:**

- Arcing horns installed on the line should be repositioned to have proper alignment

### **POWER PLANT:**

- Generator installation and interface between the switchyard should be properly done
- Lightning arrestor should be installed at turbine exhaust (highest point)
- Synchronization between power plant, switchyard, and grid should be done

### **CONTROL ROOM:**

- Communication cables should be connected to the panels
- Metal plates used as trench cover should be earthed

### **BATTERY ROOM:**

- Eye wash basin should be provided

### **CONCLUSION:**

The project has been inspected as reported. Some aspects of the work were in progress, upon completion of all outstanding work and effecting the recommended corrections a re- inspection shall be carried out to ensure that the installation conform with the extant electricity regulation cap 106 laws of federation of Nigeria 1990.

Moreover, appropriate statutory fees should be paid via bank draft to EMSL Port Harcourt zonal Office before certification.

Yours Faithfully,

**AgamIkechukwu**

*Zonal Inspecting Engineer*

**Note:** Project pictures are attached below for easy reference.



































