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VERIFICATON REPORT ON GHG EMISSIONS REDUCTION

TEDOM - AVIA PRAGUE PLANT

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REPORT TITLE	Verification Report on GHG Emissions Reduction
	TEDOM s.r.o. - AVIA Prague Plant
ORDER NO.	51 618 610
CLIENT	TEDOM s.r.o.
AUTHOR	Ing. Jan Kalužík
PARTICIPATOR	Ing. Pavel Doležel
VERIFIER	
DIVISION MANAGER	Ing. Jiří Synek

ORGREZ, A.S.
CERTIFICATION BODY OF GHG EMISSIONS
HUDCOVA 76
657 97 BRNO

E-mail: tepchem@orgrez.cz
GSM: 724 220 181, 602 595 427
tel.: 541 613 291, fax: 541 613 299

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1 Corresponding Legislation

- Methodical instruction issued by the Department of climate changes of the Ministry of Environment due to calculating a reference level (Baseline) for energy-projects landfill gas utilization
- Decree of Ministry of Industry and Trade No. 345/2002 specifying measures for compulsory verification and meters subject to type approval
- Decree No. 65/2006 which modifies the Decree of Ministry of Industry and Trade No. 345/2002 Coll. specifying measures for compulsory verification and meters subject to type approval
- Directive No. 80/2008 Coll., on the National Allocation Plan of the Czech Republic for the period of 2008 - 2012

2 General Information on the Implementor

2.1 Name of Project

TEDOM s.r.o. - AVIA Prague Plant
Likvidace skleníkových plynů na skládce TKO Ďáblice – II.Etapa

2.2 Address of Plant

Beranových 140
199 00 Praha 9 Letňany

2.3 Operator

TEDOM s.r.o.

2.4 Operator‘ s Registered Number

433 719 31

2.5 Type of Plant

Incineration plant combusting landfill gas and generating electricity. The equipment is involved in the Joint Implementation Project and its nominal heat input is below 20 MW.

2.6 Number of Resolution for Permission to Release GHG Emissions

As the plant with its input is not incorporated in the trade system demanding emission permissions (Directive issued on February 25, 2008 on the National Allocation Plan of the Czech Republic specifying the trading period 2008 - 2012, Annex No. 2), no amount of permissions has been allocated to **TEDOM s.r.o., Avia Prague Plant** and this source is not listed in NAP for the trading period at all.

2.7 Reporting period

This verification is related to emission announcement of Avia Prague Plant for the period of 2002 – 2007 as well as for 2008.

3 Description of Plant

Incineration power plant with its total heat input 13.717 MW is operating on the AVIA Prague Plant and consisting of five incineration sources:

- landfill combustion - JEN 1 cogeneration unit, with heat input rate of 2.357 MW
- landfill combustion – JEN 2 cogeneration unit, with heat input rate of 2.357 MW
- landfill combustion – CAT 1 cogeneration unit, with heat input rate of 3.001 MW
- landfill combustion - CAT 2 cogeneration unit, with heat input rate of 3.001 MW
- landfill combustion - CAT 3 cogeneration unit, with heat input rate of 3.001 MW

Furthermore, on the municipal refuse landfill in Prague – Dablice the power source with the total heat input of 0.846 MW is operating and consisting of two incineration sources:

- landfill combustion - CHP 1 (cogeneration unit 1), with heat input rate of 0.423 MW
- landfill combustion - CHP 2 (cogeneration unit 2), with heat input rate of 0.423 MW

For detailed description see Annex 1.

4 Subject and Verification Process

4.1 Documentation - Operator

- Invoices for electricity supply
- Electricity production and CHP own consumption records
- Documents about calibration electric meters
- Heat production records during 2002-2008
- CO_2 emissions reduction data during 2002 - 2008
- Technical parameters of each operating part and their operational process

4.2 Reliability, Credibility and Accuracy of Data

4.2.1 Emission Factors - Selection and Application

- **electricity emission factor** 1.15 tCO_2/MWh (2002 - 2003) – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization
- **electricity emission factor** 1.14 tCO_2/MWh (2004 - 2005) – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization

- **electricity emission factor** 1.12 tCO_2/MWh (2006 - 2007) – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization
- **electricity emission factor** 1.11 tCO_2/MWh (2008 - 2011) – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization
- **heat emission factor** 0.202 tCO_2/MWh – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization
- **CH_4 emission factor** 1,31 tCO_2/MWh_P – this value is used in compliance with Methodical instruction due to calculating a reference level for energy – projects landfill gas utilization

4.2.2 Calculations of Total Emissions Reduction

Landfill gas combustion produces CO_2 emission reductions in five cogeneration units - JEN 1, JEN 2, CAT 1, CAT 2 and CAT 3 installed in Avia Prague plant and two cogeneration units - CHP 1 and CHP 2 installed on the landfill in Prague – Dablice. To determine the baseline several levels are involved according to the origin of emission savings. Three fundamental types of emissions can be involved in the project:

- as a substitute for fossil fuel during electricity generation - $\mathbf{E_e}$
- as a substitute for fossil fuel during heat power generation - $\mathbf{E_t}$
- by landfill gas dissolution (% share of CH_4 is incorporated) escaping from the landfill- $\mathbf{E_{CH4}}$

The total annual $CO_{2eqv.}$ emissions saving reached due to the project implementation will be calculated from partial calculations of emission savings as follows:

$$\mathbf{E = E_e + E_t + E_{CH4}}$$

4.2.2.1 Fossil fuel substitution during electricity generation

Generated electricity is measured with calibration meter on the site of distributing to the distribution network, moreover, consumption inside each unit itself is measured. Factual operational values reached due to the project implementation are incorporated in calculating.

Annual electricity generation in MWh is calculated by subtracting of operational values according to the formula :

Annual electricity distributed into the network (MWh) = gross annual electricity (MWh) – consumption inside the unit (MWh)

Emission saving calculation

To transform the same electricity amount from heat power generated during coal burning we can calculate CO_2 amount into the atmosphere:

Annual emissions saving during electricity generation (tCO_2) = annual electricity distributed into the network (MWh) x electricity emission factor (tCO_2/MWh)

4.2.2.2 Fossil fuel substitution during heat production

Values measured with calibration meter during distributing to the heat network are base for calculating the reduction, i.e. operational values reached due to the project implementation.

Emission saving calculation

Within internal assignment of real emission reductions measured values of heat supply with calibration meter are used due to the project verification. Then CO_2 emission saving generated due to fossil fuel substitution:

Annual emissions saving during heat production (tCO_2) = utilized annual heat (MWh) / compensatory source efficiency (-) x heat emission factor (tCO_2/MWh)

4.2.2.3 Landfill gas dissolution escaping from the landfill

The amount of methane generated by the landfill is calculated from electricity production. Methane is the only one which can utilize landfill gas as energy, i.e. it is possible to do precise calculations of its consumption in cogeneration unit with familiar efficiency.

Fuel input necessary for annual output calculated from real electricity production:

Fuel input (MWh) = gross annual electricity (MWh) / electrical efficiency of cogeneration unit (-)

Emission saving resulting from landfill gas utilization is calculated consequently:

Annual emission saving due to landfill gas incineration (tCO_2) = fuel input (MWh) x CH_4 emission factor (tCO_2/MWh)

Fuel input necessary to maintain annual output is not measured directly but it is calculated from the measured value of electricity production and electricity production efficiency in each unit. Efficiency of cogeneration unit to be used for calculating fuel input is as follows :

- CHP Jenbacher JMS 320 35.1%
- CHP Tedom Quanto C1100 SP BIO 36.7%
- CHP Dagger TESI 4006 34.1% (38,2% since 2009)
- CHP Motorgas TBG 310 35.6% (37,6% since 2008)

- Calculation is performed on the basis of the Methodical instruction due to calculating a reference level for energy-projects landfill gas utilization

4.2.3 Usefulness of Selection and Application of Measuring Methods

Selected Method of CO_2 emission reduction verification and assignment was based on the requirements of valid legislation.

4.2.4 Trend analysis

Trend analysis determines CO_2 emissions development in the period of 2002 - 2008 in accordance with production parameters , particularly, in compliance with the electricity amount generated in cogeneration units.

Year	2002	2003	2004	2005	2006	2007	2008
CO_2 emissions [t]	78 010	137 449	137 734	127 837	119 353	121 098	107 366
E production [MWh/year]	15 432	27 230	27 949	25 941	24 482	24 754	21 934
Correlative coefficient	0.1978	0.1981	0.2029	0.2029	0.2051	0.2044	0.2043

As in the aforementioned annual CO_2 emission reduction ratio remains to generated electricity approximately stable in the relevent period.

4.3 Verification Process Description

4.3.1 Variables Involved in Calculations

Process analysis was launched by the crosscheck of variables involved in calculations. Validity was verified consequently:

- gross amount of electricity production in the period of 2002 - 2008
- amount of electricity distributed into the network in the period of 2002 - 2008
- application and use of regular electricity emission factor
- application and use of regular heat emission factor
- application and use of regular CH_4 emission factor

Identified disagreements:
Emission reductions achieved by dissolution of landfill gas escaping from the landfill as well as the applied method of assignment, as for the method and applied electricity efficiency of cogeneration unit when determing fuel input, are in compliance with the Methodical instruction. However, to determine fuel input more precise method can be even considered, i.e. the method based on flow measurement of landfill gas. To determine this it is essential to know the landfill gas heating value (landfill gas composition is measured).

Conclusion of this verification part
All values of emission factors have been applied in accordance with the Methodical instruction due to calculating a reference level for energy-projects landfill gas utilization.

4.3.2 Assessment of Compliance with Verification Methodology

Process analysis was furthermore dealt with the compliance of the applied method of CO_2 emission reduction verification and assignment resulting from the project in AVIA Prague plant in accordance with the requirements of valid legislation. The Verifier has checked and acknowledged the validity of the assigned emission reductions by means of crosscheck calculation.

Identified disagreements:
None have been found in correspondence with valid legislation.

Conclusion of this verification part:
No specific conclusions resulting from this verification part.

4.3.3 Computer Information Systems

To calculate CO_2 emission reductions MS Excel file is being used which can process annual balance sheet. It has been verified:

- validity of data entry

Identified disagreements:
None have been found in correspondence with valid legislation.

Conclusion of this verification part:
No specific conclusions resulting from this verification part.

4.3.4 Measurement and Measuring Devices

Subsequent measuring devices have been verified in the process analysis:

- electric meter of power supply into the network
- electric meters of electricity produced in each cogeneration unit

It has been verified that these measuring devices:

- *have been approved by the relevant body*
- *comply with the requirements in the Metrology Act, are provided with AMS and ČMI official brands (seals are intact), and are liable to regular validation in accordance with the Decree of MIT No.345/2002 Coll.*

Identified disagreements:
Measuring devices (electric meters) which measure gross electricity generation at each cogeneration unit do not correspond with requirements stated in the Metrology Act, and they are not provided with official brands and seals (are neither calibrated nor validated regularly).

Conclusion of this verification part:
It is compulsory to calibrate this measuring device to verify the accuracy of device applied to determine gross electricity production.

4.4 Summary of Modifications

4.4.1 Technological Modifications

Within 2002-2008 two fundamental modifications in applied technology were performed in the AVIA – Prague plant.

1. By the end of 2007 new combustion engine was implemented with Motorgas TBG 310 cogeneration unit.
2. By the end of 2008 new combustion engine was implemented with Dagger TESI 4006 cogeneration unit.

In both cases the performed modification has resulted in greater electricity production and consequently greater efficiency of CHP utilization.

4.4.2 Verification Methodology Modifications

No modifications have been specified in the methodology of CO_2 emission reduction verification and assignment.

4.4.3 Organizational Modifications

Within 2002 - 2008 no modifications in the owner's position and project operator - TEDOM, s.r.o. were performed in AVIA Prague plant.

4.5 Conclusions and Recommendations Resulting from Verification Reports

Considering results arising from verification work it is recommended to monitor, identify and assign CO_2 emission reduction in Avia Prague plant in a following way:

1. Values of all used emission factors have been applied in accordance with the Methodical instruction due to calculating a reference level for energy-projects landfill gas utilization

2. Electric meters measuring gross electricity generated in each CHP are not correspondent with the requirements determined in the Metrology Act as for calibrating and regular validation. I recommend to perform calibrating of individual measuring device and their subsequent validation or alteration for calibration measures.

5 Evidence of Verification Data Quality

5.1 Requirements for Accuracy

The operator followed the requirements in accordance with the Methodical instruction due to calculating a reference level for energy-projects landfill gas utilization during CO_2 emission reduction assignment in Avia Prague plant. No disagreement which would affect the quality and reliability of the assigned CO_2 emission reduction has been identified.

5.2 Compliance of Applied Methodology with Current Legislation to Determine Emissions

Assigned methodology of CO_2 emission calculations in the AVIA Prague plant to determine CO_2 emission reductions for the period 2002- 2007 and 2008 is in compliance with the approved Methodical instruction due to calculating a reference level for energy-projects landfill gas utilization.

5.3 Missing Documentation

During verification work the Certificate body did not come across any missing documentation which the operator would not be able to present.

5.4 Declaration on Emission Data Quality

The verifier has been satisfied sufficiently due to crosscheck of the sufficient amount of evidence because assignment on GHG emission reductions from AVIA Prague plant do not involve any relevant disagreements or faults.

6 Information on the Total Amount of GHG Emissions

CO_2 Emission	2002	2003	2004	2005	2006	2007	2008
AAU	*78 010*	*137 449*	*137 734*	*127 837*	*119 353*	*121 098*	*27 919*
ERU							*79 446*

Project	Vintage year	Total CO_2 emission
Avia Prague plant	*AAU 2002 - 2007*	***721 480 t***
	AAU 2008	***27 919 t***
	ERU 2008	***79 446 t***
	Total	***828 846 t***

7 Client's Declaration

We confirm that we have provided the Certification body with all necessary data and information and, consequently, we will make sure that the Validation Report or any of their part shall not be misused in any invalid way.

In……on……

……
signature of authorized representative

8 Date and Signature of Authorized Person on behalf of Certification Body

Brno, June 22, 2009

……
signature of Head Auditor

Brno, June, 22, 2009

……
signature of Head of the Certification Body

9 Information on Certification Body

9.1 Company Name

ORGREZ, a.s.

9.2 Company Address

Hudcova 76
657 97 Brno

9.3 Authorized Person

Ing. Jan Kalužík

9.4 Authorization

ME No. A-0013-08/473 from December 2, 2008.

9.5 Verification Team

Name	*position*
Ing. Pavel Doležel	Head auditor
Ing. Jan Kalužík	auditor

9.6 Authorization

9.7 Accreditation

9.8 Project description

Annex 1 - Project description:

72 wells have been realized on the TKO Dolni Chabry landfill totally. Gas is collected by two blowers and transported through underground gas pipeline whose total length is 2 km to the landfill in Dablice.

118 wells have been realized on the Dablice landfill so far which is interconnected by outlet pipe to landfill gas pump station. Moreover, gas is mixed in front of compressor plant and consequently compressed and transported through the underground gas pipeline to cogeneration heating plant in Prague – Letnany, in the AVIA, a.s. Prague plant. Cogeneration unit produces both heat and electricity. Two CHP JENBACHER JMS 320 units have been installed at present, each with the capacity of 826 kWel and 1290 kWt and three CHP TEDOM CAT with the capacity of 3 x 1100 kWel and 1292 kWt. Electricity is supplied to the distribution network, heat to the Avia a.s.

One CHP DAGGER TESI 4006 and CHP MORGAS TBG 310, with the output of 2 x 300 kW are implemented directly on the waste landfill in Dablice. Electricity generated in CHP covers internal consumption of the landfill area and heat is partially utilized to heat operator´s office buildings of ASA landfill.