# VERIFICATION AND CERTIFICATION REPORT

## PROJECT FOR GHG EMISSION REDUCTION BY THERMAL OXIDATION OF HFC 23 IN GUJARAT, INDIA.

MONITORING AND REPORTING PERIOD:
06 MAY 2007 – 31 JULY 2007

REPORT NO. 2007-9007
REVISION NO. 02

DET NORSKE VERITAS

# VERIFICATION AND CERTIFICATION REPORT

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Summary:

Det Norske Veritas Certification AS (DNV) has been contracted by Gujarat Fluorochemicals Limited to carry out verification and certification of emission reductions reported for the "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India." in Ranjitnagar, India, for the period 06 May 2007 – 31 July 2007.

In our opinion, the project's reported GHG emission reductions for the period from 06 May 2007 – 31 July 2007 as reported in the Monitoring Report for the project (dated 11 August 2007), are fairly stated.

The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology (AM0001, version 02) and the monitoring plan contained in the registered Project Design Document. As a consequence, Det Norske Veritas Certification AS is able to certify that the emission reductions from the project during the period 06 May 2007 – 31 July 2007 amount to 1 852 977 tonnes of $CO_2$ equivalent.

| | | |
|---|---|---|
| Report No.:<br>2007-9007 | Subject Group:<br>Environment | |
| Report title:<br>Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India. | | |
| Work carried out by:<br>Ramesh Ramachandran, K. Venkata Raman, G.Murali. | | |
| Work verified by:<br>Michael Lehmann | | |
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**Indexing terms**

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## *Abbreviations*

| | |
|---|---|
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CEF | Carbon Emission Factor |
| CER | Certified Emission Reduction(s) |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| DNV | Det Norske Veritas |
| DNA | Designated National Authority |
| DOE | Designated Operational Entity |
| FAR | Forward Action Request |
| GHG | Greenhouse gas(es) |
| HCFC | Hydro-chlorofluorocarbon |
| HF | Hydro Fluoric Acid |
| HFC | Hydro-fluorocarbon |
| IPCC | Intergovernmental Panel on Climate Change |
| MP | Monitoring Plan |
| NG | Natural Gas |
| $N_2O$ | Nitrous oxide |
| NGO | Non-governmental Organisation |
| ODA | Official Development Assistance |
| PDD | Project Design Document |
| UNFCCC | United Nations Framework Convention for Climate Change |
| GWP | Global Warming Potential |

# 1 INTRODUCTION

Det Norske Veritas Certification AS (DNV) has been contracted by Gujarat Fluorochemicals Limited to carry out verification and certification of emission reductions reported by the "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India" (hereafter called the project) for the period 06 May 2007 – 31 July 2007. This report contains the findings from this verification assignment and a certification statement for the certified emission reductions. This revised report has been prepared specifically based on the clarifications sought with respect to the emission factor for natural gas as part of the request for review.

The verification team consisted of the following personnel:

| | | |
|---|---|---|
| Ramesh Ramachandran | DNV India | Team Leader |
| K.Venkata Raman | DNV India | GHG Auditor |
| G.Murali | DNV India | GHG Auditor |
| Michael Lehmann | DNV Norway | Technical Reviewer |
| Ivan Nestar | DNV Norway | Sector Expert |

## 1.1 Objective

Det Norske Veritas Certification AS has been engaged by Gujarat Fluorochemicals Limited to verify and certify the greenhouse gas (GHG) emission reductions reported for the "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India" for the period from 06 May 2007 – 31 July 2007, equating to 1 852 977 tonnes of $CO_2$ equivalent.

Verification is the periodic independent review and *ex post* determination by the Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of a registered CDM project activity during a defined verification period.

Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

## 1.2 Scope

The verification scope is:

- to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan,
- to evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement,
- to verify that the reported GHG emission data is sufficiently supported by evidence, i.e. monitoring records.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

The verification team has, based on the recommendations in the Validation and Verification Manual /20/, employed a risk-based approach, focusing on the identification of significant reporting risks.

## 1.3 Description of the Project Activity

| | |
|---|---|
| Project Parties: | *The Republic of India, the United Kingdom of Great Britain and Northern Ireland, Netherlands, Japan and Italy.* |
| Title of project activity: | *Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India.* |
| UNFCCC registration No: | *0001* |
| Project Participants: | *Gujarat Fluorochemicals Limited of India, INEOS Fluor Limited and EDF Trading Limited of the UK, Cooperatieve Centrale Raiffeisen Boerenleenbank B.A. (Rabobank) and Noble Carbon Credits Limited of Netherlands, Sumitomo Corporation of Japan and Enel Trade S.p.A. of Italy.* |
| Location of the project activity: | *The project is located at the site of Gujarat Fluorochemicals Limited at Survey No. 16/3, 26, 27, Ranjitnagar, Dist. Panchmahal Gujarat – 389 380, the Republic of India.* |

In this project, Gujarat Fluorochemicals Limited has installed HFC 23 collection and thermal oxidation process equipment at its HCFC 22 manufacturing plant. HFC 23 is a by-product of the HCFC 22 manufacturing process. The project equipment collects the HFC 23 and decomposes the HFC 23 by thermal oxidation at 1200$^{o}$C in an oxidation chamber with air and steam, using natural gas as supplemental fuel. Any HCFC 22 present in the HFC 23 is oxidised in a similar manner.

The Gujarat Fluorochemicals plant has established a facility to capture HFC 23 from its vent. The project has been operating in this facility since February 2006, capturing and feeding the waste HFC 23 via an intermediate HFC 23 cold storage facility to the thermal oxidiser. All waste and oxidisation streams are monitored and recorded. The electricity used to maintain the cold storage of HFC 23 is accounted for as part of the electricity consumed by the project activities.

HFC 23 collection started on 13 February 2006, and emission reductions have thus been reported starting from 13 February 2006.

The emission reductions reported for the project for the period from 06 May 2007 – 31 July 2007 equate to 1 852 977 tonnes of $CO_2$ equivalent.

# 2 METHODOLOGY

The verification has assessed all factors and issues that constitute the basis for the reported emission reductions from the project. As the CDM Executive Board has not yet formally endorsed the application of any materiality principle for verification of emission reductions from CDM projects - implying that emphasis should be on the significant contributors to emission reductions - DNV has for this assignment decided to check all factors and issues with the same emphasis. Despite this, the team has during its preparations identified the key reporting risks and used the assessment to determine to which extent the project operator's control systems were adequate for mitigation of these key reporting risks. In addition, other areas that can have an impact on reported emission reductions have also undergone detailed audit testing. All HCFC 22 and HFC 23 production and HFC 23 oxidation records have been examined and verified for the reporting period.

**Duration of verification**

Preparations: *14 August 2007.*

On-site verification: *16 August 2007.*

Reporting*:* *17-18 August 2007*

## 2.1 Review of Documentation

The basis for the verification has been the monitoring report and Appendix 1 (Monitoring Workbook) from the project proponent for the period 06 May 2007 – 31 July 2007, dated 11 August 2007, the registered PDD and the approved baseline and monitoring methodology applicable to the project AM0001, version 2. The project operator has in addition supplied the verification team with instructions from its management system as well as data of HCFC 22 production volume, amount of collected HFC 23, etc, necessary for verification of the required emission factors.

## 2.2 Site Visit

Detailed verification of all data contained in the monitoring report was performed during a site visit at Gujarat Fluorochemicals Limited on 16 August 2007. During the site visit, the following personnel were interviewed or assisted the verification team:

| Name | Organization | Position |
|---|---|---|
| Deepak Asher | Gujarat Fluorochemicals Ltd | Group Head, Corporate Finance |
| Shrikant B. Gaitonde | Gujarat Fluorochemicals Ltd | Unit Head. |
| Manoj Agrawal | Gujarat Fluorochemicals Ltd | DGM, Accounts & Taxation |
| M.K.Jain | Gujarat Fluorochemicals Ltd | DGM-Technical Services |

These people were also present at the opening and closing meeting of the audit.

### 2.2.1 Audit Programme

The site visit had the following programme:

**August 16 2007**

| | |
|---|---|
| 09.00 | Opening meeting |
| 09.15 | Detail checking of daily monitoring records and calculation spreadsheets |
| 12.00 | Assessment of emission factors and calibration records |
| 14:00 | Plant investigation |
| 16:00 | Assessment of gas chromatograph operation and sampling |
| 17:00 | Follow-up remaining issues |
| 17:30 | Close-out meeting and presentation of findings |

## 3 VERIFICATION FINDINGS

Findings established during the verification may be that:

i) the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified;

ii) the verification has identified material misstatements in the reported emission reductions. Emission reductions with material misstatements shall be discounted based on the verifier's ex-post determination of the achieved emission reductions.

A forward action request (FAR) may be issued, where:

- the actual project monitoring and reporting practices requires attention and /or adjustment for the next consecutive verification period, or
- an adjustment of the monitoring plan is recommended.

In the context of FARs, risks may be identified, which may endanger the delivery of CERs in the future, i.e. by deviations from good reporting or management procedures. As a consequence, such aspects should receive a special focus during the next verification.

### 3.1 Assessment

The data presented in the monitoring report were assessed in detail by review of detailed project documentation and production records, interviews with personnel at Gujarat Fluorochemicals Ltd, collection of measurements, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of reported monitoring results and verify the correct application of the approved monitoring methodology. Data from other sources, such as the annual commercial report from the site and the emission factor for electricity, steam and natural gas reported from the utility centre operated by Gujarat Fluorochemicals Ltd., have also been assessed.

### 3.1.1 Factors used for project emission reduction calculations

All monitoring indicators required by the monitoring methodology AM0001, version 02, and required for reporting by the monitoring plan contained in the registered PDD as well as the management system for monitoring and reporting were assessed during the site visit. This included the following:

***"w", waste generation rate:***

The historical production ratio between HCFC 22 and HFC 23 for the manufacturing site in the three most recent years should be compared to the actual rate in order to establish that the production ratio does not increase as a result of the CDM project.

The verification team has assessed the reported "w" factor and compared this to production numbers of HCFC 22 and HFC 23 found in SCADA data sheets, as well as HFC 23 storage records. The cumulative reported ratio of 2.76% is correct and does not exceed the 2.9% threshold applied by the project for this factor.

***Other factors:***

In line with the registered PDD and the AM0001 (Version 2) methodology, on completion of the first year of operations of the project activity, the relevant emission factors used in the monitoring methodology have been reviewed based on the actual plant figures during the first monitoring year, and the more conservative of the two have been considered for the purpose of calculating the emission reductions.

For ***natural gas*** used by the thermal oxidiser, the emission factor has been reviewed and revised, from 2.94 x $10^{-3}$ tonnes $CO_2$/kg used in the first monitoring year, to 2.95 X $10^{-3}$ tonnes $CO_2$/kg, by recalculation based on the latest plant generation and natural gas supplier data. This value of 2.95 x $10^{-3}$ tonnes $CO_2$/kg has been verified by DNV and found appropriate.

The carbon emission factor for ***electricity*** consumed by the process is 6.0 x $10^{-4}$ tonnes $CO_2$/kWh electricity, based on actual use of natural gas. This factor remains unchanged. The records of natural gas consumption have been verified. It has also been verified that no grid electricity or other fuels have been used by the project during the monitoring period.

For the emission factor for ***steam*** used by the project, a revised carbon emission factor of 1.90 x $10^{-4}$ tonnes $CO_2$/kg steam has been calculated and used (revised from 1.60 x $10^{-4}$ tonnes $CO_2$/kg steam). This is based on actual use of natural gas, and a small quantity of fuel oil. The net calorific value has been provided by the fuel supplier (Gas Authority of India Limited). The records of natural gas consumption and fuel oil and all supporting calculations for the carbon emission factor have been verified and found appropriate.

Meters used for monitoring of ***electricity and steam consumption*** are standard commercial meters which have been calibrated as part of the calibration plan.

The factor for lime (F Lime) has been revised from 0.475 to 0.536 t$CO_2$/MT transport based on the composition of the delivered lime.

The Factor for DHF has been revised from 0.11 to 0.27 t $CO_2$/MT) based on actual plant figures.

Reporting of ***other emissions***:

Stack emission monitoring for particulate matter (PM), CO, HCl, HF, $SO_2$, $NO_x$, and total organic carbon emissions has been carried out in accordance with "Consolidated Consents and Authorisation" issued to the Gujarat Fluorochemicals Limited by the Gujarat Pollution Control Board. Though not required by local regulations, dioxin and $Cl_2$ are also monitored and are

found to be within relevant international emission norms. The records of the same have been verified.

***Temperature*** of the oxidiser has been verified to be consistently 1200±20$^{o}$C in the periods of oxidiser operation. During the audit evidence was provided to this effect for all periods the oxidiser had been in operation.

Data for the ***collected HFC 23*** and the ***quantity of HCFC 22 manufactured*** in the reporting period has also been supplied by Gujarat Fluorochemicals Limited and have been used to verify the reported emission reductions.

### 3.1.2 Monitored date for project emissions within the project boundary

The following data reported in the monitoring report from the project has been assessed in detail. Unless otherwise stated, the numbers reported are found to be correctly reported.

**1. Quantity (mass) of HFC 23 supplied to the destruction process, $Q\_HFC23_y$:**

This amount is reported on an automated data collection system, SCADA (Supervisory Control and Data Acquisition). The verification team has assessed all continuous and daily data and the aggregated numbers of SCADA and found these to be correct.

The project has reported these numbers based on the lower reading of two flow meter readings, in a conservative manner. Version 2 of the Approved Methodology AM0001, under which the project activity has been registered, does not explicitly require the lower of two flow meter readings to be considered for calculations. However, the project participants have adopted the more conservative approach in considering the lower of the instantaneous data-logged readings of the two flow meters. The readings from both the flow meters are recorded automatically by SCADA. The project proponent has installed imported data monitor software which enables determination of the lower of the flow meter readings at time intervals of less than one hour.

It has been verified through continuous flow records in SCADA that the lower value of the two flow meters, at time interval of less than one hour, has been taken for computing the HFC23 flow.

The flow meters used to determine the amount of gas to the incinerator are calibrated and certified by the equipment manufacturer, Emerson Process Management (India) Pvt Ltd. and re-calibrated by means of “zero check” every week when the process is in operation. The regular zero check was demonstrated to the verification team during the site visit. Calibration records for the actual weeks are assessed and found in order.

If a deviation observed between the two flow meters is beyond a fixed threshold determined by the accuracy of the flow meters as certified by the vendors, an adjustment is carried out according to the documented procedures defined, and a “zero check” is conducted. The flow-meters are re-calibrated once in six months by an external calibration service provider.

**2. Purity (%) of HFC 23 supplied to the destruction process, HFC23y:**

The purity of HFC 23 is checked by sampling of collected gas once in every operating shift (usually, three times a day). The analysis is performed by a gas chromatograph (GC). The analysis was demonstrated to the verification team during the site visit.

The GC is self-calibrated, using a reference gas composed from standard gases with certificates of analysis. Calibration records for the actual months were assessed and found in order. The analytical personnel in charge of GC operation are formally qualified according to the documented management system.

**3. Quantity (mass) of natural gas used for the waste incineration process, Q_NGy:**

The amount of natural gas used for the waste incineration is reported when the oxidiser is in operation and aggregated into an automated data collection system, SCADA. The verification team has assessed all data in SCADA and the relevant spreadsheets and found these to be correct.

The flow meters used to determine the amount of natural gas to the oxidiser are calibrated regularly. Calibration records for the actual months were assessed and found in order.

**4. Quantity (mass) of HFC 23 in gaseous effluent, ND_HFC23y:**

The concentration of HFC 23 in the stack gas is sampled on a monthly basis using gas chromatography which is self-calibrated, using a standardised gas (See factor 2). The verification team has assessed the gas analysis for the period the oxidiser has been used for HFC 23 thermal oxidation and found the reported numbers to be correct. The stack gas flow is monitored continuously and recorded daily through the automated data logging system, SCADA.

### 3.1.3 Monitored data for project emissions outside the project boundary

**5. Quantity (kWh) of electricity consumption by the oxidation process, Q_F1,y,y:**

The cumulative amount of electricity used by the oxidation process is determined by meter readings when the oxidation process is in operation. There is a separate electricity meter for the oxidation process from the existing HCFC 22 manufacturing process, which is connected to the automated data collection system, SCADA. The verification team has assessed the electricity consumption for the period the oxidiser has been used and found the reported numbers to be correct.

**6. Quantity (kg) of steam consumption by the destruction process, Q_F2,y,y:**

The cumulative amount of steam used by the destruction process is determined by meter readings and automatically transferred to SCADA when the oxidation process is in operation. The verification team has assessed the steam consumption for the period the oxidiser has been used and found the reported numbers to be correct.

### 3.1.4 Monitored data for baseline emissions

**7. Quantity (tonnes) of HCFC 22 produced in the plant generating HFC 23 waste, Q_HCFC22y:**

The amount of HCFC 22 produced is assessed for the days applicable in the monitoring/reporting period. These data have been crosschecked with internal plant production records, commercial inventory control data, and statutory records of production (Production Report). The data reported are found to be correct. DNV has verified that the daily HCFC22 production does not exceed the maximum daily HCFC22 production capacity of 75 TPD, as per the validated and registered Project Design Document.

**8. Quantity (tonnes) of HFC 23 sold in the reporting period by the facility generating HFC 23 waste, HFC23_sold:**

No HFC 23 has been sold during the reporting period. This is verified via excise statements and returns filed with statutory authorities.

**9. Quantity (tonnes) of HFC 23 stored in the reporting period by the facility generating HFC 23 waste, HFC23_stored:**

The quantity (tonnes) of HFC 23 stored in the reporting period was verified based on stock records and calibrated level gauges.

## 3.2 Remaining Issues, CARs, FARs from Previous Validation or Verification

There were no specific issues from the previous verification.

## 3.3 Project Implementation

The project is implemented and has been in operation since early February 2006, when the process commissioning was completed. In mid February 2006, the storage of HFC23 commenced, and shortly thereafter, the incinerator was put into operation and the incineration of HFC 23 commenced.

The company continues the practice of recovering the solution after quenching (dilute HF) and sending it to the commercial market for use in steel pickling and other industries. This waste re-use method has been adopted after obtaining appropriate approval from the local environmental regulatory agency (Gujarat Pollution Control Board). In case recovery is not possible due to low purity, the same is being sent to the ETP as per the conditions prescribed by the local environmental regulatory agency.

The appropriate emission reductions for both the above practices have been correctly accounted for and the same has been verified.

## 3.4 Completeness of Monitoring

The monitoring of the project is complete and in accordance with the approved monitoring methodology AM0001, version 02, and the monitoring plan contained in the registered PDD. The monitoring methodologies and sustaining records were sufficient to enable verification of emission reductions.

## 3.5 Accuracy of Emission Reduction Calculations

For all factors where uncertainty occurs, the project operator has reported conservative values.

This applies to:

- Traces of HFC 23 in the gaseous effluent based on gas chromatograph samples
- Smaller reading of two flow meters
- Emission factors used for electricity, steam and natural gas

## 3.6 Quality of Evidence to Determine Emission Reductions

All necessary documentation is collected, referenced and aggregated and is easily accessible in hard-copy or electronic format. Measurements are performed by calibrated equipment, and the key data can also be cross-checked via other sources, such as sales and inventory data. No assumptions are used that have any material influence on reported emission reductions.

## 3.7 Management System and Quality Assurance

The Gujarat Fluorochemicals Limited plant has applied its management system to the HFC 23 destruction process. The procedures have been linked to the existing ISO 9001 quality management systems.

# 4 CERTIFICATION STATEMENT

***Introduction***

*Det Norske Veritas Certification AS (DNV) has been engaged by Gujarat Fluorochemicals Limited to verify the greenhouse gas (GHG) emission reductions of 1 852 977 tonnes of $CO_2$ equivalent reported for the "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India" for the period from 06 May 2007 – 31 July 2007.*

*The project has applied the approved baseline and monitoring methodologies AM0001, version 02, and emission reductions are reported in the monitoring report dated 11 August 2007. We express no opinion on the project's baseline, on the project nor on the validated and registered PDD.*

***Responsibilities of the HFC Thermal Oxidation Project management of Gujarat Fluorochemicals Limited and Det Norske Veritas Certification AS.***

*The management of the HFC Thermal Oxidation Project is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out within the monitoring report (dated 11 August 2007) The development and maintenance of records and reporting procedures in accordance with the approved monitoring methodology AM0001, version 02, and the monitoring plan contained in the registered PDD, including the calculation and determination of GHG emission reductions from the project, is the responsibility of the management of the HFC Thermal Oxidation Project.*

*It is DNV's responsibility to express an independent verification statement on the GHG emission reductions reported for the project for the period from 06 May 2007 – 31 July 2007 based on the verified emissions for the same period and the project's compliance with the approved baseline and monitoring methodology AM0001, version 02, and the monitoring plan contained in the registered PDD.*

***Basis of GHG verification opinion***

*Our verification approach was based on the requirements as defined under the Kyoto Protocol, the CDM modalities and procedures, as well as those defined by the CDM Executive Board and by the baseline and monitoring methodology AM0001 version 02.*

*Our verification approach draws on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Our examination includes assessment of evidence relevant to the amounts and disclosures in relation to the project's GHG emission reductions reported for the period from 06 May 2007 – 31 July 2007.*

*We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the reported amount of GHG emission reductions for the period from 06 May 2007 – 31 July 2007 are fairly stated.*

*We conducted our verification on the basis of the monitoring methodology AM0001, version 02, and the monitoring plan contained in the registered PDD of the project. The verification included:*

- *Collection of evidence supporting the reported data.*
- *checking whether the provisions of the monitoring methodology AM0001, version 02, and the monitoring plan in the PDD were consistently and appropriately applied.*

*We have verified whether the information included in the monitoring report for the project (dated 11 August 2007) is correct and that the emissions reductions achieved have been determined correctly.*

***Certification Statement***

*In our opinion, the GHG emission reductions stated in the monitoring report of 11 August 2007 for the "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India" for the period from 06 May2007 – 31 July 2007 are fairly stated.*

*The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology (AM0001, version 02) and the monitoring plan contained in the PDD. Hence, Det Norske Veritas Certification AS. is able to certify that the reported emission reductions from the project during the period 06 May 2007– 31 July 2007 amount to 1 852 977* ***(One million eight hundred fifty two thousand nine hundred and seventy seven )*** *tonnes of $CO_2$ equivalent.*

Chennai, 27 September 2007

Ramesh Ramachandran
GHG Lead Auditor

Oslo, 27 September 2007

Lehmann Michael
Technical Director

# 5 REFERENCES

*Documents provided by the project participants that relate directly to the project:*

/1 Gujarat Fluorochemicals Limited: Monitoring Report for "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India" for the period 06 May 2007 – 31 July 2007 dated 11 August 2007.

/2/ PricewaterhouseCoopers Private Ltd., Gujarat Fluorochemicals Limited: Project Design Document for "Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India", 14 November 2003.

/3/ Gujarat Fluorochemicals Limited: CDM Project Appendix 1 ( Monitoring Workbook.).

*Background documents related to the design and/or methodologies employed in the design or other reference documents:*

/4/ CDM Executive Board: Approved Monitoring methodology AM0001, version 02, 7 April 2004.

/5/ Gujarat Fluorochemicals Limited: Production Report (daily), 06 May 2007 – 31 July 2007.

/6/ Calculation of the efficiency of the Steam generation at GFL.

/7/ Calculation of the efficiency of the Electricity generation at GFL.

/8/ Steam generation at GFL.

/9/ Power generation from Gas Based CPP.

/10/ Monthly Efficiency Monitoring Report.

/11/ Calibration Certificate, Waste Gas Flow Meter (FT-5707, 5707B).

/12/ Calibration Certificate, Natural Gas Flow Meter (FT-5712, 5712B).

/13/ Calibration Certificate, Steam Flow Meter to Thermal Oxidiser (FT-5703, 5703B).

/14/ Calibration Certificate, Steam Flow Meter to Effluent Treatment Plant (FT-5792, 5792B).

/15/ Calibration Certificate, Electricity Measurement (EM-5701, 5701B).

/16/ Calibration Certificate, Stack Flow Meter (FT-5776).

/17/ Excise statements and returns filed with statutory authorities.

/18/ Calibration chart for Gas Chromatograph.

/19/ Gas Chromatograph gas analysis. Weekly records.

/20/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF): Validation and Verification Manual. http://www.vvmanual.info.

/21/ Analytical Manual for Thermal Oxidation Plant.

/22/ Level 2 Manual (Thermal Oxidation Plant).

/23/ Consolidated Consent and Authorisation and subsequent amendment dated 17/04/2006 related to grant of permission for sale of Dilute Hydrofluoric Acid from Gujarat Pollution Control Board.

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# APPENDIX A
# VERIFICATION CHECKLIST

## Table 1: Data Management System/Controls

The project operator's data management system/controls are assessed to identify reporting risks and to assess the data management system's/control's ability to mitigate reporting risks.

The GHG data management system/controls are assessed against the expectations detailed in the table. A score is assigned as follows:

- Full - all best-practice expectations are implemented.
- Partial - a proportion of the best practice expectations is implemented
- Limited - this should be given if little or none of the system component is in place.

| Expectations for GHG data management system/controls | Score | Verifiers Comments (including *Forward Action Requests*) |
|---|---|---|
| ***A. Defined organisational structure, responsibilities and competencies*** | | |
| **A.1. Position and roles**<br>*Position and role of each person in the GHG data management process is clearly defined and implemented, from raw data generation to submission of the final data. Accountability of senior management must also be demonstrated.* | Full | It was defined in the management system documentation and well understood by the personnel. |
| **A.2. Responsibilities**<br>*Specific monitoring and reporting tasks and responsibilities are included in job descriptions or special instructions for employees.* | Full | Specific monitoring and reporting tasks are described in the relevant documented procedures. |
| **A.3. *Competencies needed***<br>*Competencies needed for each aspect of the GHG determination process are analysed. Personnel competencies are assessed and training programme implemented as required.* | Full | Competencies of the personnel in charge of monitoring and calculation process are deemed sufficient. Competency requirements are linked as part of ISO 9000 procedures. |

| Expectations for GHG data management system/controls | Score | Verifiers Comments (including *Forward Action Requests*) |
|---|---|---|
| ***B. Conformance with monitoring plan*** | | |
| **B.1. Reporting procedures**<br>*Reporting procedures should reflect the monitoring plan content. Where deviations from the monitoring plan occur, the impact of this on the data is estimated and the reasons justified.* | Full | No deviation from the monitoring plan has been found. |
| **B.2. Necessary Changes**<br>*Necessary changes to the monitoring plan are identified and changes are integrated in local procedures as necessary.* | Full | No changes were identified to the monitoring plan. |
| ***C. Application of GHG determination methods*** | | |
| **C.1. Methods used**<br>*There are documented description of the methods used to determine GHG emissions and justification for the chosen methods. If applicable, procedures for capturing emissions from non-routine or exceptional events are in place and implemented.* | Full | Integral part of the methods used to determine GHG emissions are documented properly.<br>HCFC22/HFC23 ratio (w) was properly monitored and calculated in line with the procedure. |
| **C.2. Information/process flow**<br>*An information/process flow diagram, describing the entire process from raw data to reported totals is developed.* | Full | An information/process flow are defined and understood by the concerned personnel. |
| **C.3. Data transfer**<br>*Where data is transferred between or within systems/spreadsheets, the method of transfer (automatic/manual) is highlighted - automatic links/updates are implemented where possible. All assumptions and the references to original data sources are documented.* | Full | No mistake of data manual transfer has occurred. |
| **C.4. Data trails**<br>*Requirements for documented data trails are defined and implemented and all documentation are physically available.* | Full | All necessary raw/intermediate data is maintained properly.<br>Non-routine event has been recorded and maintained properly. |

| Expectations for GHG data management system/controls | Score | Verifiers Comments (including *Forward Action Requests*) |
|---|---|---|
| ***D. Identification and maintenance of key process parameters*** | | |
| **D.1. Identification of key parameters**<br>*The key physical process parameters that are critical for the determination of GHG emissions (e.g. meters, sampling methods) are identified.* | Full | The key physical parameters are identified. |
| **D.2. Calibration/maintenance**<br>*Appropriate calibration/maintenance requirements are determined.* | Full | Necessary calibration and/or maintenance for the measurement equipment have been conducted according to the documented procedures. |
| ***E. GHG Calculations*** | | |
| **E.1. Use of estimates and default data**<br>*Where estimates or default data are used, these are validated and periodically evaluated to ensure their ongoing appropriateness and accuracy, particularly following changes to circumstances, equipment etc. The validation and periodic evaluation of this is documented.* | Full | GWP of HFC23 used to determine the GHG emission reduction is in line with IPCC-SAR (GWP=11 700). |
| **E.2. Guidance on checks and reviews**<br>*Guidance is provided on when, where and how checks and reviews are to be carried out, and what evidence needs to be documented. This includes spot checks by a second person not performing the calculations over manual data transfers, changes in assumptions and the overall reliability of the calculation processes.* | Full | No calculation and reporting error has been encountered thus checking and reviewing system deem effective. |
| **E.3. Internal verification**<br>*Internal verifications include the GHG data management systems, to ensure consistent application of calculation methods.* | Full | The data necessary for calculating GHG emissions and the calculation results have been archived properly. It is fully understood among the relevant personnel. |

| Expectations for GHG data management system/controls | Score | Verifiers Comments (including *Forward Action Requests*) |
|---|---|---|
| **E.4. Internal validation**<br>*Data reported from internal departments should be validated visibly (by signature or electronically) by an employee who is able to assess the accuracy and completeness of the data. Supporting information on the data limitations, problems should also be included in the data trail.* | Full | Data used for calculation don't include any mistake and the validation is deemed sufficient. |
| **E.5. Data protection measures**<br>*Data protection measures for databases/spreadsheets should be in place (access restrictions and editor rights).* | Full | Data protection and back-up procedures are defined and maintained properly. |
| **E.6. IT systems**<br>*IT systems used for GHG monitoring and reporting should be tested and documented.* | Full | Data collection and reporting system, SCADA, is connected with DCS of the thermal oxidation process and its master data is securitised properly. |

Table 2: Detailed audit testing of risk areas and random testing

| **Areas of residual risks** | **Additional verification testing performed** | **Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)** |
|---|---|---|
| *List the residual areas of risks (Table 2 where detailed audit testing is necessary.*<br>*In addition, other material areas may be selected for detailed audit testing.* | *The additional verification testing performed is described. Testing may include:*<br>➢ *Sample cross checking of manual transfers of data*<br>➢ *Recalculation*<br>➢ *Spreadsheet 'walk through' to check links and equations*<br>➢ *Inspection of calibration and maintenance records for key equipment*<br>➢ *Check sampling analysis results*<br>➢ *Discussions with process engineers who have detailed knowledge of process uncertainty/error bands.* | *Having investigated the residual risks, the conclusions should be noted here. Errors and uncertainties should be highlighted.*<br>*Errors and uncertainty can be due to a number of reasons:*<br>➢ *Calculation errors. These may be due to inaccurate manual transposition, use of inappropriate emission factors or assumptions etc.*<br>➢ *Lack of clarity in the monitoring plan. This could lead to inconsistent approaches to calculations or scope of reported data.*<br>➢ *Technological limitations. There may be inherent uncertainties (error bands) associated with the methods used to measure emissions e.g. use of particular equipment such as meters.*<br>➢ *Lack of source data. Data for some sources may not be cost effective or practical to collect. This may result in the use of default data which has been derived based on certain assumptions/conditions and which will therefore have varying applicability in different situations.* |
| - ID No. 1 (q_HFC23y)<br>➢ Accuracy of raw data<br>➢ Record of unusual events | - ID No. 1 (q_HFC23y)<br>➢ Calibration and maintenance records of HFC 23 flow meters verified and are OK.<br>➢ Records of actions taken have been maintained properly. | No errors, uncertainties or areas of improvement were identified. |
| - ID NO. 2 (P_HFC23y)<br>➢ Manual data transfer | - ID No. 2 (P_HFC23y)<br>➢ Review process verified OK | No errors, uncertainties or areas of improvement were identified. |

| Areas of residual risks | Additional verification testing performed | Conclusions and Areas Requiring Improvement (including *Forward Action Requests*) |
|---|---|---|
| - ID No. 3 (Q_NGy)<br>➢ External data collection<br>➢ Applied calculation | - ID No. 3 (Q_NGy)<br>➢ Recalculation was made to confirm the correctness OK | No errors, uncertainties or areas of improvement were identified. |
| - ID No. 4 (ND_HFC23y)<br>➢ Accuracy of raw data<br>➢ Manual data transfer | - ID No.4 (ND_HFC23y)<br>➢ Certificate of calibration by equipment manufacturer verified OK<br>- | No errors, uncertainties or areas of improvement were identified. |
| - ID No. 5 (Q_Powery)<br>➢ External data collection<br>➢ Applied calculation | - ID No. 5 (Q_Powery)<br>➢ Recalculation was made to confirm the correctness OK<br>- | No errors, uncertainties or areas of improvement were identified. |
| - ID No. 6 (Q_Steamy)<br>➢ External data collection<br>➢ Applied calculation | - ID No. 6 (Q_Steamy)<br>➢ Recalculation was made to confirm the correctness OK | No errors, uncertainties or areas of improvement were identified. |
| - ID NO. 7 ($Q\_HCFC_y$)<br>➢ Manual data transfer | - ID NO. 7 ($Q\_HCFC_y$)<br>➢ Review process verified OK | No errors, uncertainties or areas of improvement were identified. |
| - ID NO. 8 (HFC23_Sold)<br>➢ Manual data transfer | - ID NO. 8 (HFC23_Sold)<br>➢ Review process verified OK | No errors, uncertainties or areas of improvement were identified. |

| Areas of residual risks | Additional verification testing performed | Conclusions and Areas Requiring Improvement (including *Forward Action Requests*) |
|---|---|---|
| - Other data | - Other data | |
| - ($Q\_Lime_y$)<br>➢ Manual data transfer<br>- | - ($Q\_Lime_y$)<br>➢ Review process verified OK | No errors, uncertainties |
| - ($Q\_Caustic_y$)<br>➢ Manual data transfer | - ($Q\_Caustic_y$)<br>➢ Review process verified OK | No errors, uncertainties |
| - ($Q\_Solidwaste_y$)<br>➢ Manual data transfer | - ($Q\_Solidwaste_y$)<br>➢ Review process verified OK | No errors, uncertainties |
| - ($Q\_DHF\_Sold_y$)<br>➢ Manual data transfer | - ($Q\_DHF\_Sold_y$)<br>➢ Review process verified OK | No errors, uncertainties |
| - (Change in HFC 23 storage)<br>➢ Consistency between storage tank level gage and DCS readings<br>➢ Power consumption for storage | - (Change in HFC 23 storage)<br>➢ Crosscheck between tank level gage and control room indication was made to confirm the consistency OK<br>➢ Accounting for extra power consumed for cold storage was verified OK | No errors, uncertainties |
| - ("w" ratio)<br>➢ Manual data transfer | - ("w" ratio)<br>➢ Crosscheck between SCADA data and inventory control report verified OK | No errors, uncertainties |

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