

Verification Report

Organization Verified

WaferTech, LLC
5509 NW Parker Street
Camas WA 98607-8557

Bryan Mirick, Environmental Engineer
(360-817-3131)

Assertion

AWM has determined that the client's emissions report for the year of 2019 may be **Verified without qualifications**.

Discrepancies found during this verification total less than the materiality threshold of 5% each for Scope 1 and Scope 2.

Verification Scope

Organizational boundaries

Organization: Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration.

- WaferTech is a wholly owned subsidiary of Taiwan Semiconductor (TSMC).

Physical infrastructure, activities, technologies, and processes

Facility: Single installation, set of installations or production processes (stationary or mobile), which can be defined within a single geographical boundary, organizational unit or production process.

- WaferTech manufactures integrated circuits (ICs) for customers. No research or design is performed at this facility, located at 5509 Parker St. Camas, WA. Operational boundaries are the property boundaries and include the onsite Linde Gas Yard.

GHG sources, sinks, reservoirs

Source: Physical unit or process that releases GHG into the atmosphere.

Sink: Physical unit or process that removes a GHG from the atmosphere.

Reservoir: Physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG removed ... by a ... sink or captured from a ... source.

- Fluorinated GHGs and N₂O purchased for the semiconductor manufacturing production process

Types of GHGs

- CO₂, CH₄, N₂O, HFCs, PFCs, SF₆

Time periods

- 2019

Scope Exclusions

- TSMC USA sales offices
- Offsite chemical storage
- Mobile sources

Criteria

Criteria for this verification shall be:

- a) ISO 14064-1 (Second edition, 2018-12)
- b) the client's GHG management system

Verification Objectives

This verification shall be performed with the objectives to confirm:

- a) conformance with applicable verification criteria, including the principles and requirements of relevant standards or GHG programs, within the scope of the verification;
- b) client's GHG inventory of GHG emissions and removals;
- c) any significant changes in client's GHG inventory since the last reporting;
- d) client's GHG-related controls.

Level of Assurance

Limited: A Limited assurance places less emphasis on detailed testing of GHG data and information. ISO 14064-3 defines Limited assurance as finding no evidence that the GHG assertion "is not materially correct and is not a fair representation of GHG data and information" and "has not been prepared in accordance with the related International Standard on GHG quantification, monitoring and reporting, or to relevant national standards or practices."

Materiality

A materiality threshold of 5% each (absolute value basis) of Scope 1 and of Scope 2 emissions will be used for this verification. Emission reporting must be accurate to within the 5% limit in order to issue a successful verification statement. Any misstatements below this limit may remain however they will be noted within the final report.

Description of the Work

AWM conducted an off-site audit on April 22, 2020 using the information provided by the client. The primary source for this audit was the FAB11 GREEN HOUSE GAS MANAGEMENT PLAN (A-RMS-02-03-013, Ver.13).

Stationary combustion emissions from natural gas were recalculated from original invoice data. Indirect emissions from electricity consumption were recalculated from original invoice data. Process emissions were recalculated using consumption values provided by WaferTech.

Results of the Risk Analysis



Scope 1

Facility / Activity	tCO2e	% of S1	% change
C2F6	3,165.0545	3%	-30%
C3F8	0.0000	0%	0%
C4F8	5,541.4095	6% ▶	-28%
CF4	17,388.5059	19% ▶	-43%
CH2F2	4.6330	0%	-13%
CHF3	8,998.7521	10% ▶	-23%
N2O	6,420.1819	7% ▶	-11%
NF3	5,627.2660	6% ▶	-18%
C5F8	0.0116	0%	-43%
SF6	11,965.8347	13% ▶	9%
CH3F	0.5842	0%	-9%
FC770	19,553.3100	21% ▶	20%
Natural gas	14,188.3050	15% ▶	8%
Diesel	25.4582	0%	-140% ▶
TOTAL	92,879.3066	100%	-8%

Scope 2

It was noted that WaferTech purchased RECs to offset 100% of Scope 2 emissions.

Facility / Activity	tCO2e	% of S2	% change
Electricity	44,434.5174	100% ▶	-4%
TOTAL	44,434.5174	100%	-4%

GHG Information Verified

Report date: 29 March 2019 (A-RMS-02-03-013)

Site / Facility	Scope 1 tCO2e	S2 Location tCO2e	S2 Market tCO2e
WaferTech LLC, Camas Washington	92,879.3066	44,434.5174	N/A
Total			

Recalculation Results

Scope 1



Site / Facility	Activity	Client tCO2e	AWM tCO2e	Difference tCO2e	% Difference	% Material	% Sample
FAB11	C4F8	5541.4095	5541.4095	0.000	0.00%	0.00%	5.97%
	CF4	17388.5069	17815.5440	427.0371	2.43%	.46%	18.72%
	CHF3	8998.7552	8992.3047	-6.4475	-0.07%	-0.01%	9.69%
	N2O	6420.1819	6488.5387	68.3568	1.06%	0.07%	6.91%
	NF3	5627.2660	6562,7741	935.5081	15.35%	1.01%	6.06%
	SF6	11959.3872	11928.7394	-30.6479	-0.26%	-0.03%	12.88%
	FC770	19533.3100	19477.2000	-56.1100	-0.29%	-0.06%	21.03%
	Natural Gas	14188,3050	14654.9927	466.6877	3.30%	0.50%	15.3%
Total						1.9%	96.53%

Scope 2 Location

Site / Facility	Activity	Client tCO2e	AWM tCO2e	Difference tCO2e	% Difference	% Material
FAB11	Purchased Electricity	44435	45266	831	1.87%	1.87%
Total						

CONFORMANCE WITH PROTOCOLS

WaferTech has made no significant revisions to the greenhouse gas management system since the previous verification.

5 GHG inventory boundaries

- 5.1 Organizational Boundaries: A-RMS-02-03-013:13 FAB11 Green House Gas Management Plan C.I., after this known as the GHGMP defines the organizational and operational boundaries in Section 2 Scope and Section 6 Operational Boundaries. The scope of the verification includes operations at 5509 NW Parker St, Camas, WA. As described in Section 6, WaferTech consolidates its facility-level emissions and removals using the control approach.
- 5.2 Reporting boundaries:

- 5.2.1 Establishing reporting boundaries: Reporting boundaries have been defined as noted above. Direct and indirect GHG emissions and removals are identified in GHGMP Sections 6, 7 & 8.
- 5.2.2 Direct GHG emissions and removals: Direct GHG emissions are quantified separately in GHGMP Attachment 11. There are no sinks or removals included in the inventory.
- 5.2.3 Indirect GHG emissions and removals: Section 8.1 documents the determination to include indirect emissions from imported electricity which is currently the only indirect source. No indirect emissions are excluded.
- 5.2.4 GHG inventory categories: Section 9.2 Selection of Quantification Methodology describes this process as applicable. WaferTech has aggregated GHG emissions into the categories of: a) direct GHG emissions and removals, b) indirect emissions from imported energy. There are no biogenic emissions to be included in the report. The identified categories are documented separately in Attachment 11.

6 Quantification of GHG emissions and removals

- 6.1 Identification of GHG sources and sinks: As noted above, direct and indirect GHG emissions and removals are identified in GHGMP Sections 6, 7 & 8. There were no excluded sources identified during the verification.
- 6.2 Selection of quantification approach:
 - 6.2.1 General: The quantification approach is based on availability of data from multiple sources as described in Section 9.1.1. and 9.2. The data collection represents currently available technology and is not affected by cost. WaferTech has minimized uncertainty as noted in Section 10 Assessment of Uncertainty, Table 4. Emission factors have been taken from 40 CFR 98 Subpart I for 200 mm wafer size.
 - 6.2.2 Data selection and collection used for quantification: As identified and documented in Section 9.2 of this report.
 - 6.2.3 Selection or development of GHG quantification model: WaferTech utilizes 40 CFR 98 Subpart I methodologies to calculate process emissions.
- 6.3 Calculation of GHG emissions and removals: Review of Attachment 11 confirms calculations in accordance with the quantification approach described. Attachment 11 states calculated emissions for EY2019. AWM confirmed the GWPs used were the latest IPCC data. WaferTech quantified no removals from imported electricity. Emissions from Imported electricity are quantified and documented using the methodology shown in Sections 8 and 9 of the GHGMP. There is no exported electricity.
- 6.4 Base-year GHG inventory:
 - 6.4.1 WaferTech has established 2011 as the historical base year for GHG emissions. Base year emissions were quantified based on the 2011 calendar year. This base year (2011) GHG inventory is documented as Attachment 1 to the GHGMP. The baseline covers a single year as noted above. 2011 was chosen because it was the first year for which WaferTech was required to report annual GHG emissions to EPA.
 - 6.4.2 Review of base-year GHG inventory: Section 12.2 identifies the circumstances for which recalculation of the inventory base line would be appropriate. WaferTech has not recalculated its base-year inventory for the reasons identified within the Standard. Subsequent base-year calculations will be documented as applicable.

7 Mitigation activities

- 7.1 GHG emission reduction and removal enhancement initiatives: In 2019 WaferTech purchased RECs for 100% of their Scope 2 emissions. Additionally, 2019 GHG emissions were reduced by 10% due to usage decrease efforts and converting to lower GWP products used in the manufacturing process. These reductions have been quantified and are noted in the GHG MP.
- 7.2 GHG emission reduction or removal enhancement projects: AWM also reviewed the REC retirement report which supports the purchase of RECs to offset the EY2019 Scope 2 emissions.
- 7.3 GHG emission reduction or removal enhancement targets: WaferTech has set no specific targets to reduce GHG emissions.

8 GHG inventory quality management

- 8.1 GHG information management:

- 8.1.1: GHGMP Section 13.1 describes the processes in place to ensure conformity with 14061-1 and consistency with the intended use of the GHG inventory. Routine and consistent checks are conducted by EH&S staff, accounting and management. If errors or significant variations are identified production staff are alerted to investigate and report back. GHGMP Section 13.2 describes documentation and record retention procedures.
- 8.1.2: WaferTech's GHG information management procedures include the following
 - a) GHGMP Section 13.3.3 states the EH&S Manager and Facilities Director are responsible for final review and approval of the GHG emissions report.
 - b) Training is addressed in Section 13.3.2 and includes multiple training platforms that may be used to ensure persons are qualified for their roles in the development of the GHG inventory.
 - c), d), e), f) - the GHGMP is reviewed on an annual basis by the EH&S staff to ensure information remains accurate and up to date. Senior management also reviews the IMP on an annual basis.
 - g) equipment is calibrated in accordance with quality and maintenance procedures
 - h) Data management is described in Section 11 Data Management. The section describes robust procedures for collection of data used in emissions calculation.
 - i) Table 4 of Section 10 describes the specific measures in place to ensure accuracy and minimize uncertainty related to the data sources utilized to compile the inventory.
 - j) Internal audits are conducted on an annual basis.
 - k) The GHGMP is reviewed by Senior Management on an annual basis.
- 8.2 Document retention and record keeping: WaferTech maintains a robust document control process: Extensive Document and Record Control System (EDW) A-RMS-02-03-013:13 FAB11 Green House Gas Management Plan C.I., and accompanying worksheets support the design, development and maintenance of the GHG inventory.
- 8.3 Assessing uncertainty: Uncertainty is assessed and documented in Section 10 Assessment of Uncertainty. Uncertainty at the GHG inventory category level is documented in Table 4. The addition of these elements meets the requirements of 14064-1 and minor nonconformity EY18-01 is closed.

9 GHG reporting

- 9.1 General: GHGMP Section 17.3 describes the process followed to develop the GHG inventory. The report has been prepared and documented as Attachment 11. No confidential data has been excluded from the report.
- 9.2 Planning the GHG report: GHGMP Section 17 describes the intended use of the report, the specific responsibilities for preparing the report, frequency, report structure and format, data to be included and policy on availability.
- 9.3 GHG report content:
 - 9.3.1 Required information: All required information can be found throughout the EY2019 GHGMP with the exception of the "Source of the GWPs used" and a "Disclosure describing whether the GHG inventory has been verified". These omissions resulted in minor nonconformities EY19-1 and EY19-2.
 - 9.3.2 Recommended information: WaferTech has incorporated the recommended information into the GHGMP as appropriate. For example a brief description of GHG Policies, strategies and programmes, reduction initiatives, RECs and GHG information management and monitoring procedures.
 - 9.3.3 Optional information and associated requirements: WaferTech purchased RECs to cover 100% of EY2019 Scope 2 emissions.

10 Organization's role in verification activities

- AWM conducted this verification to the requirements of 14064-1 and WaferTech's GHG Management Plan.

AWM has no conflict-of-interest with WaferTech preventing an impartial and objective verification

Qualifications and Discrepancies

There are no qualifications for this verification.



Final discrepancies are recorded in the “Recalculation Results” section of this report.

A list of issues and corrective actions found during this verification is attached to this report.


Conclusions

WaferTech’s EY19 emission inventory is Verified without Qualification.

Verification Body

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Approvals

AWM Lead Verifier	Date
	5/11/2019