VERIFICATION REPORT

Organization verified

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

Bryan Mirick, Environmental Engineer
360-817-3131 | bmirick@wafertech.com

Subject

AWM has verified the GHG emissions in the responsible party's GHG statement for the period of reporting year 2020, which comprise the following:

- process emissions
- stationary combustion
- indirect emissions (electricity)

Responsibilities of the client

The responsible party is responsible for the preparation and fair presentation of the GHG statement in accordance with the criteria specified in this report. This includes designing, implementing and maintaining a data management system relevant to the preparation and fair presentation of a GHG statement that is free from material misstatement.

Responsibilities of AWM

AWM's responsibility is to express an opinion on the GHG inventory based on our verification. AWM conducted our verification in accordance with ISO 14064-3. This requires that we comply with ethical requirements and plan and perform the verification to obtain the agreed upon level-of-assurance that the GHG emissions in the GHG statement are free from material misstatement.

Evidence-gathering procedures

Strategic analysis

AWM did not identify any material risk from items such as the verification sector, scope of the client and the verification, or significant changes in the client.

Results of the risk assessment

AWM did not identify any material risk to the objectives of this verification as a result of the client's GHG management system or data collection systems.

Evidence gathering

Process
- Inventory and purchasing records for CH4, SF6, CHF3, and FC-770 (45% of total inventory)

Stationary combustion
- Natural gas invoices (8% of total inventory)

Electricity
- Electric invoices (30% of total inventory)

Total evidence requested = 84% of total inventory

Site visits

Per ISO 14064-3:2019 section 6.1.4, no special site visits were deemed necessary for this verification. Key considerations included this being a Limited assurance, previous GHG verification experience, this verification team being on-site for ISO 14001 in 2020, and there being no significant changes to the WaferTech GHGMS.

Description of the verification work

AWM conducted recalculations of each of the sources identified in the evidence gathering section. This was conducted remotely on 4/8/2021 with the results presented below. In addition, AWM conducted an audit of the GHGMS against the cited verification criteria on 4/9/2021. Results for conformance are presented in Appendix A.

Process / Emission type	WT mt CO2e	AWM mt CO2e	% Correlation	% Sampled
C2F6	5,433.4854	5,901.0291	92%	3%
C3F8	0.0000	0.0000		
C4F8	6,465.1570	6,465.1313	100%	4%
CF4	25,524.9907	25,732.1963	99%	15%
CH2F2	6.3923	6.3923	100%	0%
CHF3	12,676.7672	12,646.4797	100%	8%
N2O	8,768.4634	8,768.2626	100%	5%
NF3	6,356.0472	6,355.9404	100%	4%
C5F8	0.0148	0.0147	101%	0%
SF6	14,976.8306	14,979.5688	100%	9%
CH3F	0.5842	0.5842	100%	0%
FC770	22,235.2200	22,235.2200	100%	13%
Natural Gas	14,134.610	14,195.1896	100%	8%
Diesel Fuel	28.2563			
Electricity	50,610.0481	50,554.4980	100%	30%
TOTAL	167,216.8671	167,840.5070	99.63%	>99%

Process / Emission type	WT mt CO2e	AWM mt CO2e	% Correlation	% Sampled
Electricity RECs	-50,610.0481	-50,610.0481	100%	99%
Carbon offsets	-460.0000	-460.0000	100%	1%
	-51,070.0481	-51,070.0481	100%	100%

AWM recalculated >99% of WaferTech's RY2020 emissions and found <1% discrepancy.

Verification opinion

Based on the process and procedures conducted, there is no evidence that the GHG statement:

- is not materially correct and is not a fair representation of GHG data and information;
- has not been prepared in accordance with related International Standards on GHG quantification, monitoring and reporting, or to relevant national standards or practices.

Discrepancies found during this verification total less than the materiality threshold of 5%.

Verification body

Advanced Waste Management Systems, Inc. (AWMS)
6430 Hixson Pike, Hixson, TN 37343
(423) 843-2206

Summary GHG statement

Scope 1 emissions (tCO2e): 116,606.8191
Scope 2 (electricity) emissions (tCO2e): 50,610.0481
RECs + Offsets (tCO2e): -51,070.0481
Total site emissions (tCO2e): 116,146.8190

Verification criteria

Criteria for this verification were be:

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

This verification was performed to a Limited level-of-assurance where the nature and extent of the verification activities have been designed to provide a reduced level of assurance on historical data and information

Verification scope

Boundaries (ISO 14043-3:2019, 5.1.6.a): WaferTech is a wholly owned subsidiary of Taiwan Semiconductor (TSMC) located at 5509 Parker St. Camas, WA. Operational boundaries are the property boundaries and include the onsite Linde Gas Yard.

Facilities, physical infrastructure, activities, technologies, and processes (ISO 14043-3:2019, 5.1.6.b): WaferTech manufactures integrated circuits (ICs) for customers. No research or design is performed at this facility,

GHG sinks, sources, and reservoirs (ISO 14043-3:2019, 5.1.6.c): Fluorinated GHGs and N2O purchased for the semiconductor manufacturing production process.

Types of GHGs (ISO 14043-3:2019, 5.1.6.d): CO2, CH4, N2O, HFCs, PFCs, SF6.

Time period (ISO 14043-3:2019, 5.1.6.e): 2020.

Approvals

Rob Ellis	April 12, 2021
Lead Verifier	Date

Appendix A: Conformance with Protocols

5 GHG Boundaries

5.1 Organizational boundaries

WaferTech as defined its organizational boundaries within Section 6 of the FAB11 GREEN HOUSE GAS MANAGEMENT PLAN C.I. (A-RMS-02-03-013, 4/1/2021). WaferTech reports as a single facility with multiple GHG sources within the site boundary. WaferTech consolidates its facility-level GHG emissions by the control approach. Use of the control approach is consistent with the use of the inventory (emissions the site is responsible for). WaferTech is not using different control approaches. WaferTech is wholly owned by TSMC.

5.2 Reporting boundaries

Operational boundaries are defined in section 6, including a list of exclusions (TSMC sales offices, offsite chemical storage, mobile sources). Section 7 of the GHGMS describes the direct GHG emissions. Examples include PFC emissions from the CVD and etch process, and boilers / VEX combustion. No removals are quantified (although RECs have been purchased as offsets). Section 8 states the indirect GHG emissions as imported electricity. Section 8 defines the indirect GHG emissions selected to be included in the inventory (electricity). No substantial quantities of indirect emissions are excluded. As stated, electricity has been selected as the indirect emission source included. Emissions from electric consumption are included in the 2020 inventory. Electric consumption is the significant contributor to indirect emissions (several small-scale electric vehicles are not included). The GHGMS is reviewed annually. The 2020 GHG inventory continues to aggregate emissions into categories: a) direct GHG emissions; b) indirect GHG emissions from imported energy; c) n/a; d) n/a; e) n/a; f) n/a. No biogenic emissions. Categories are listed as separate line items in the 2020 inventory. Process emissions (direct) are further broken down by chemical.

6 Quantification of GHG emissions and removals

6.1 Identification of GHG sources and sinks

Direct GHG emissions and removals as well are recorded in section 7 and indirect GHG emissions are recorded in section 8 of the GHGMS. AWM confirmed throughout the audit that GHG sources have been identified in accordance with the categories defined in 5.2.4. Removals are built into the Subpart I calculations (abatement equipment). AWM confirmed throughout this verification that the detail with which the sources and sinks are identified is consistent with the quantification approach. No mobile sources are included in the WaferTech GHG inventory as described in section 8 of the GHGMS (not reportable to EPA).

6.2 Selection of quantification approach

AWM confirmed via recalculation that WaferTech is using quantification methodologies that minimize uncertainty and yield accurate, consistent, and reproducible results. In addition, Table 4 within section 10 of the GHGMS addresses WaferTech's assessment of uncertainty per input, data source, and estimated risk (e.g. Purchasing data for C4F8, CF4, C2F6, CH2F2, CHF3, N2O & SF6 > Purchasing records > <1%). These methodologies consider technical feasibility and cost (not relevant). Section 9 of the GHGMS explains and documents WaferTech's quantification approach. As stated in 6.2.1, Table 4 in section 10 documents the data source for each input. Per regulatory requirements, WaferTech uses EPA 40 CFR Subpart I to calculate process emissions, EPA table C-2 emissions factors for stationary combustion, and eGRID emission factors for electric consumption emissions. As stated, Section 9 of the GHGMS explains and documents the justification for the selection of the models.

6.3 Calculation of GHG emissions and removals

Attachment 7 records WaferTech's 2020 calculations in accordance with the quantification approach selected. Attachment 7 presents WaferTech's 2020 inventory in tonnes of CO2e. AWM verified appropriate GWPs were used. No biogenic emissions reported for RY2020. Electricity consumption was quantified in the RY2020 inventory, and there was no electricity exported from generation.

6.4 Base-year inventory

WaferTech has selected RY2011 as the baseline year (as stated in section 1.1 of the GHGMS). This baseline year is quantified on the same calendar year basis as all other inventory years. Reporting year 2011 was the first year reported under the ISO 14064-1 GHGMS. Section 12 of the GHGMS records WaferTech's decision on selecting 2011

as the base-year inventory as well as the criteria that would prompt a rebaseline. There has been no trigger to re-baseline. As stated in 6.4.1, WaferTech has established a set of criteria prompting recalculation of the base-line inventory (e.g. EPA revised GHG reporting regulations require changed reporting for 2011). RY 2011 baseline calculations are included in the GHGMS as Attachment 1.

7 Mitigation activities

7.1 GHG emission reduction and removal enhancement initiatives

For RY2020 RECs were purchased to cover electrical consumption, and Carbon Offsets were purchased to cover natural gas usage. Additionally, reductions are made through the use of abatement equipment for process emissions, described in Section 11.6 GHG Emission Reductions and Removal Actions, but have not been modified or added to over the previous year.

7.2 GHG emission reduction or removal enhancement projects

Offsets and RECs are listed separately in Attachment 12 of the report.

7.3 GHG emission reduction or removal enhancement targets

No GHG reduction targets have been set for RY 2020.

8 GHG inventory quality management

8.1 GHG information management

WaferTech has established and maintains information management procedures in accordance with sections a) - e) of this part:

a) ensure conformity with the principles of this document - GHGMP overall contains these procedures, specifically Section 13 GHG Information Management, and FAB11 EMS Records Managment O.I.
b) ensure consistency with the intended use of the GHG inventory - see above
c) provide routine and consistent checks to ensure accuracy and completeness of the GHG inventory - Section 14 Auditing & Verification, Section 15 Management Review, and Section 16 corrective Action
d) identify and address errors and omissions - see above
e) document and archive relevant GHG inventory records, including information management activities and GWPs - Section 13.2 Records Management and Reducing Uncertainty contains information on retention of records, which were available as requested during the re-calculation.

These procedures include consideration of parts a) - k) in this section:

a) identification and review of the responsibility and authority of those responsible for GHG inventory development - Section 13.3.3 states the EH&S Manager and Facilities Director are responsible for the final review and approval.
b) identification, implementation and review of appropriate training for members of the inventory development team - Section 13.3.2 covers formal and informal training for identified roles in preparing the report
c) identification and review of organizational boundaries - Section 14 Auditing and Verification & Section 15 Management Review, EH&S Staff review annually, and senior management reiew annually.
d) identification and review of GHG sources and sinks - see above
e) selection and review of quantification approaches, including data used for quantification and GHG quantification models that are consistent with the intended use of the GHG inventory - see above
f) review of the application of quantification approaches to ensure consistency across multiple facilities - see above
g) use, maintenance and calibration of measurement equipment (if applicable) - Section 11 Data Management contains information on collection of data
h) development and maintenance of a robust data-collection system - see above
i) regular accuracy checks - internal audit - see above
j) periodic internal audits and technical reviews - internal audit - see above
k) periodic review of opportunities to improve information management processes - management review - see above

8.2 Document retention and record keeping

Wafertech utilizes the EDW (Extensive Document and Record Control System) to maintain control of documented information. Section 11 Data Management lays out processes for maintaining information on the GHG inventory. Per verification activities, all required documentation was available to complete re-calculations.

8.3 Assessing uncertainty

Uncertainty is assessed in Section 10 Assessment of Uncertainty - Table 4. Quantitative estimates are available for each, ranging from less than 1% (purchasing records) to 15% (facilities trends and kitchen use assumptions).

9 GHG reporting

9.1 General

WaferTech has prepared a report in accordance with procedures in GHGMP 17.3, and is included as Attachment 12 to the GHGMP. Per review of the program and verification of the data, the GHG report was complete and accurate. The Verification statement can be requested to EHS. No confidential data is withheld from the report.

9.2 Planning the GHG report

The GHGMP covers all aspects of planning the report, including items a) - g) in this section:

a) GHGMP purpose and objectives are included in Section 1 Purpose.
b) GHGMP intended use and users are documented in Section 17.3 Reporting of GHG: US EPA and Washington State Dept of Ecology.
c) the responsibilities preparing and producing the report are delegated to the Environmental Engineer in GHGMP Section 17.3.
d) GHGMP Section 17.3 defines frequency as annually.
e) GHGMP Section 17 defines the structure and format, including emissions by GHG and product, HTF emissions, removals (or lack thereof).
f) data and information to be included in the report - see above
g) policy on availability and methods of dissemination of the report - see above, plus TSMC and potentially Semiconductor Industry Association (SAI).

9.3 GHG report content

Required information to include in the report, including items a) - t), are found in various places in the GHGMP:

a) description of the reporting organization - included in section 2 Scope
b) person or entity responsible for the report - Section 17.3 - Environmental Engineer
c) reporting period covered - 2020 - Attachment 12
d) documentation of organizational boundaries (5.1) - Section 2 Scope
e) documentation of reporting boundaries, including criteria determined by the organization to define significant emissions - Section 6 Operational Boundaries, Section 7 Direct GHG Emissions, and Section 8 Indirect GHG Emissions
f) direct GHG emissions - Section 7 Direct GHG Emissions contains mentions of all of these
g) biogenic CO_2 emissions and removals - no biogenic sources or removals
h) no removals are identified in the report
i) no significant sources were excluded
j) quantified indirect GHG emissions separated by category in tonnes of CO_2e (5.2.4) - these are included in Attachment 12
k) base year selection is determined to be 2011 in Section 12
l) no changes have been made to the base year
m) reference to, or description of, quantification approaches, including reasons for their selection (6.2) - Section 9 Quantification of GHG Emissions and Removals contains all of these
n) no changes have been made to the quantification approaches
o) no removals are made
p) uncertainties are detailed in Section 10 Assessment of Uncertainty - Table 4, including 14 different areas of uncertainty
q) uncertainty assessment description and results (8.3) - see above
r) Section 1 Purpose lists ISO 14064-1 as a criteria for reporting
s) Section 14.2 External Validation and Verification states that AWM will perform the verification

t) GWPs are included in Attachment 12, and Section 9.1.1.7 contains sources for all (40 CFR 98 Subpart A Table A-1, 2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol 3 Table 6.5.

Recommended information, where applicable, were included as well. For example, EHS policy is include in Section 5 Environmental, Health and Safety Policy, but explanations of differences in previous and current periods was not included, as there were no emissions differences. Optional information was included as well. No contractual instruments were noted, however, RECs were purchased to offset electrical consumption, and Carbon Offsets were used to cover natural gas usage. These are included in Attachment 12.

10 Organization's role in verification activities

AWM has been contracted to conduct an independent verification of RY2020 data. AWM is accredited to ISO 14065, and the qualified verifiers meet the requirements of ISO 14066.