Appendix 4:

POPs Data handling Guidance

Acknowledgement

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BACKGROUND

The Stockholm Convention on Persistent Organic Pollutants is a multilateral environmental agreement to protect human health and the environment from Persistent Organic Pollutants (POPs). Signed in 2001 and in force since May 2004, it aims to eliminate or restrict the production and use of the aforementioned POPs.

Therefore, key elements of the Convention include the requirement that developed countries provide new and additional financial resources and measures to eliminate the production and use of intentionally produced POPs, eliminate unintentionally produced POPs where feasible, and manage and dispose of POPs wastes in an environmentally sound manner.

To evaluate its effectiveness the Stockholm Convention determines, in its article 16 paragraph 2 on the effectiveness evaluation, the periodic evaluation on the presence of the chemicals listed in Annexes A, B and C as well as their regional and global environmental transport, by comparable monitoring data.

To facilitate such evaluation, the Conference of the Parties (COP), at its second meeting, adopted decision SC-2/13 on effectiveness evaluation in which it decided to "implement the elements for a global monitoring plan". Important elements were requirements for the first evaluation, monitoring for future evaluations and development of guidance for data comparability, among others (UNEP, 2008). At its fourth meeting, the Conference adopted decision SC-4/31 by which it adopted the Global Monitoring Plan (GMP) for persistent organic pollutants (POPs), the terms of reference and mandate of the regional organization groups (ROG) and the global coordination group (GCG).

The Global Monitoring Plan provides a harmonized organizational framework for the collection of comparable monitoring data on the presence of POPs from all regions, to identify changes in their concentrations over time, as well as on regional and global environmental transport[1].

The GMP was designed to facilitate linking together existing national, regional, and global activities on POPs monitoring; but the lack of capacity and capability of many countries and regions to participate in such a program revealed the need of capacity building and transfer of technology and know-how to improve the situation. To date, two projects have been implemented to strengthen the capacities of the countries with the support from UNEP, GEF and other donors. The data generated by these projects and from other sources like global, regional, or national POPs monitoring programs, provide information for the preparation of regional and global reports.

To meet the objectives of the Global Monitoring Plan, (support the preparation of regional reports of comparable information on environmental background levels), the monitoring plan

[1] http://www.pops.int/Implementation/GlobalMonitoringPlan/Overview/tabid/83/Default.aspx

must provide guidance on how information is to be gathered, analyzed, statistically treated, and reported.

At its sixth meeting, the implementation plan for the GMP was updated (UNEP, 2013), describing the approach for acquiring core data for subsequent evaluations, including criteria to evaluate programs and capacities related to core media data and referring to the GMP Guidance as the main document for standardization, recommending its review and update as appropriate.

The GMP Guidance has been amended and updated in 2007, 2013, and 2019. This third edition (2019), published in 2021, includes the 30 POPs listed as of January 2019. Its objective is to:

> "Provide a uniform framework for all activities and tasks associated with collection, assessment and reporting of environmental background levels of the POPs listed in Annexes A, B, and C of the Stockholm Convention in order to provide comparable information for the Conference of the Parties as required in paragraph 2 of Article 16 of the Convention." (UNEP, 2021).

This document gives direction for the collection, treatment, interpretation, presentation, and storage of monitoring data, to meet the specific objectives set by the GMP. It also includes criteria for setting sampling stations, suggested number of stations per region, core matrices, sampling methods and frequencies, among others.

Standard Operation Procedures (SOP) for sampling and analysis of POPs were also developed and for data storage and handling an electronic tool containing a multilevel data repository, analytical tools and a visualization platform, named GMP DWH, was established and is available to the ROGs for their work with POPs monitoring data since 2014. It includes an interactive on-line data capture system and handling, and a presentation module. (UNEP; 2021).

Data handling under the Global Monitoring Plan is responsibility of the members of individual Regional Organization Groups (ROGs) and the Global Coordination Group (GCG) as specified in Chapter 1 of the GMP Guidance. Data generated and provided need to be comparable, validated and harmonized and capable of revealing trends over time in emissions and/or exposure to contaminants of concern, in the various regions. (UNEP; 2021). Data compiled are designed to achieve the goals of the GMP, but countries can benefit from these data and use it to evaluate specific national concerns or in support of informed decision making at the national level.

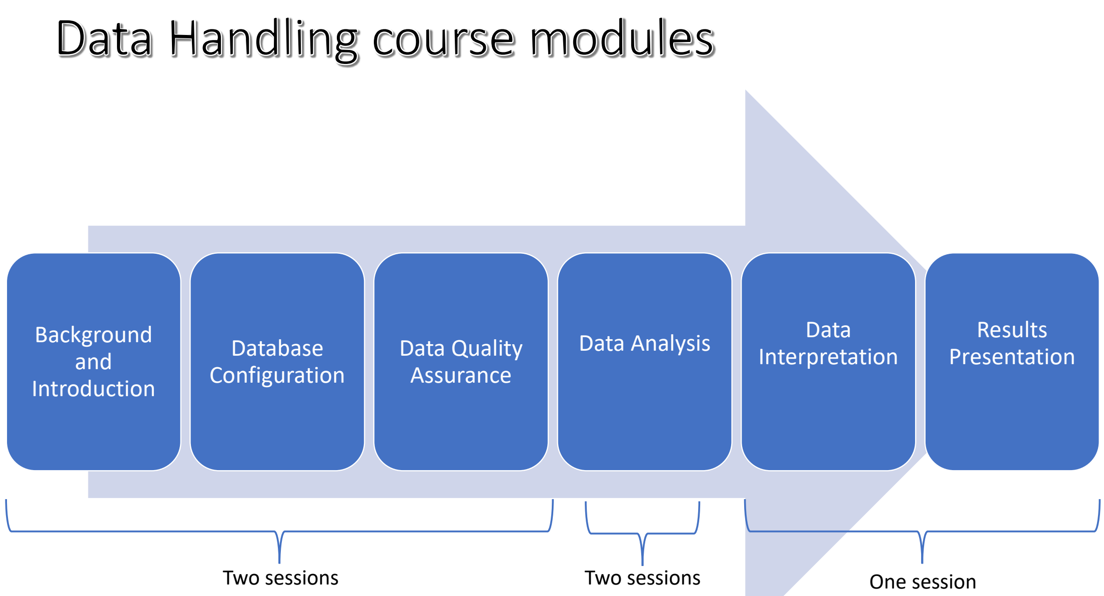
PURPOSE OF THIS DOCUMENT

The present POPs Data Handling Guidance intends to provide additional assistance, to six Pacific Islands in the processing, interpretation, and presentation of their own data using basic excel tools. The procedure for data handling is mainly based on the directions established by the GMP Guidance and use the GMP DWH tools as support.

The objective of this document, the training course and tutorials is to support building capacity on handling and interpretation of data on levels of POPs in national circumstances, to facilitate the use of POPs monitoring results for the preparation of the final project report of the UNEP/GEF POPs GMP II project, and for informed decision making and actions to reduce exposure to these chemicals.

This Guidance is organized into six modules according to the Data Management course, Figure 1, in order to facilitate the understanding of the lectures and help the participants during the training sessions.

Figure1. Data Handling Course modules



Module 1. INTRODUCTION TO DATA HANDLING

Several authors define Data Handling as the process of gathering, recording, and presenting information in a way that is helpful to others. It can be defined also as the method of performing statistical analysis on the given data and is used for comparing data and obtaining mean, median, and other statistical parameters to analyze, make predictions and choices, which are useful for both mathematics and science[2].

Data handling includes skills such as:

- Collecting data using a planned methodology.
- Recording data with precision and accuracy.
- Analyzing data to draw conclusions.
- Sharing data in a way which is useful to others

In conclusion data handling transforms records in information.

1.1 Steps of Data handling process

Three main steps in data handling are: Collection, analysis, and interpretation of data. Data collection is the systematic compilation of data; data analysis or organization for some authors, includes configuring a data base, formatting, quality assurance; analysis per se, involves working to uncover patterns and trends in datasets; data interpretation involves explaining those patterns and trends.

1. Data collection

Collecting data is the first step in data processing. In the concept of data handling, it is extremely important to know what these data are being collected for, before we actually collect it. A planned methodology must be established that includes the specifications of the data that are required to achieve the proposed objective.

Therefore, qualitative and quantitative objectives, data quality objectives, should also be set prior to data collection. These objectives are established to ensure that the decisions taken in relation to the achievement of the objective are within a specific degree of certainty.

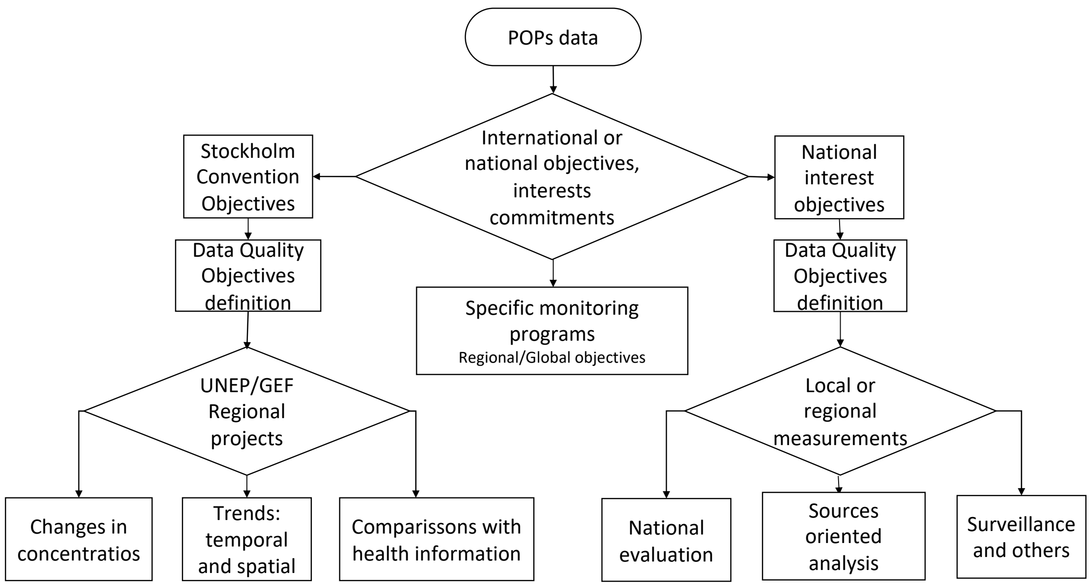
Data quality assessment is defined as a scientific and statistical assessment of a set of data to determine whether data are suitable for use according to a specific purpose and is significant only when related to the use for which the data was generated. Therefore, it is essential to know in what context data will be used to establish a relevant criterion in order to determine the convenience of using them.

[2] https://www.cuemath.com/learn/maths-olympiad-data-handling-types/

To reach the GMP objective, qualitative and quantitative objectives for trend analysis are set in the GMP Guidance, but each country/agency must decide its data quality objectives and needs, e.g., the required accuracy and precision.

POPs data is used to achieve specific national or international objectives, interests, or commitments, but each monitoring program or project has its own objective(s) and its data quality monitoring objectives; and the collection of data should be designed according to the information that is needed. Figure 2 shows the usage of POPs data.

Figure 2. Usage of POPs data



The process of collecting data consists of the following steps:

- Determination of what information one intends to collect.
- Set a timeframe for the purpose of data collection.
- Selecting a data collection method.
- Collection of the data

In the case of the GMP, data are collected from different sources with different monitoring purposes; therefore, data should be validated before considering that it will be used for the effectiveness evaluation of the Stockholm Convention.

1. Data Analysis/Organization (configuring, formatting, quality assurance and analysis)

Once the data is collected, it then enters the data preparation stage. Data preparation, often referred to as "pre-processing" is the stage at which raw data is cleaned up and organized for the following stage of data processing. During preparation, raw data is diligently checked for any errors. The purpose of this step is to eliminate bad data (redundant, incomplete, or incorrect data) and begin to create high-quality data[3].

Under the GMP framework, reference laboratories perform a data preprocessing and deliver a kind of pre-process raw data to countries and UNEP. UNEP re-processes the data and delivers primary data to the secretariat (Figure 3) in an un-aggregated template established in the GMP DWH.

Data is then entered into its destination (perhaps a CRM or a data warehouse like the GMP DWH) or in a database template designed according to the settled objective and translated into a language that can be understood. This is the first stage in which raw data begins to take the form of usable data.

Data handlers usually extract data from available sources, including data lakes and data warehouses. It is important that the data sources available are trustworthy and well-built so the data collected is of the highest possible quality. The GMP DWH, as was said, is the GMP data repository. In it, POPs monitoring data is compiled from diverse programs, and ROG members can pull the data from different sources for their regional reports.

If data were inputted to a computer, then it is analyzed for interpretation. Processing is done using learning algorithms, though the process itself may vary slightly depending on the source of data being processed. If not, excel tools, statistic programs and graphs or charts could be used to process the data for analysis. Data that is often organized in graphs or tables for analysis may include facts, numbers, or measurements.

2. Data interpretation

The interpretation is the step in which data is finally usable to non-data scientists. It is translated, readable, and often in the form of graphs, videos, images, plain text, etc.). Members of the society, decision makers or institutions can now begin to self-serve the data for their own data analytics projects.

1.2 General procedure under the POPs Data Handling Guidance

POPs data under the GMP come from different monitoring programs, which have different data quality monitoring objectives as shown in figure 2. Strictly speaking, monitoring objectives rule the way data should be handled: how it is collected, organized and analyzed, and interpreted. Therefore, data handling procedure in this guidance will follow the directions of the GMP Guidance.

1. Directions for data collection are well documented in the GMP Guidance and, for the purposes of this POPs Data Handling Guidance data will be collected from UNEP primary data or the GMP DWH.

[3] https://www.talend.com/resources/what-is-data-processing/

2. Data analysis/Organization will include:
    a. Database configuration. Module 2. Includes the configuration of a database when the country received POPs data from the laboratory, from UNEP or when data are downloaded from the GMP DWH. For this, GMP DWH templates will be used. It also includes a procedure to aggregate data using excel tools.
    b. Data quality assurance. Module 3. Includes the procedures to ensure the quality of the data following the criteria from the GMP Guidance: consistency and completeness. In addition, it includes a procedure for locating monitoring stations and measuring distances between stations.
    c. Data analysis. Module 4. Includes pivot table procedure, graphs and tables to compare and analyze data, and trends analysis.

3. Data interpretation will be addresses in Module 5. It includes the interpretation of graphs, tables and statistical parameters and the use of information on POPs and presentation of results per Module 6 which will include basic rules and advice for the presentation of results.

Module 2. DATABASE CONFIGURATION

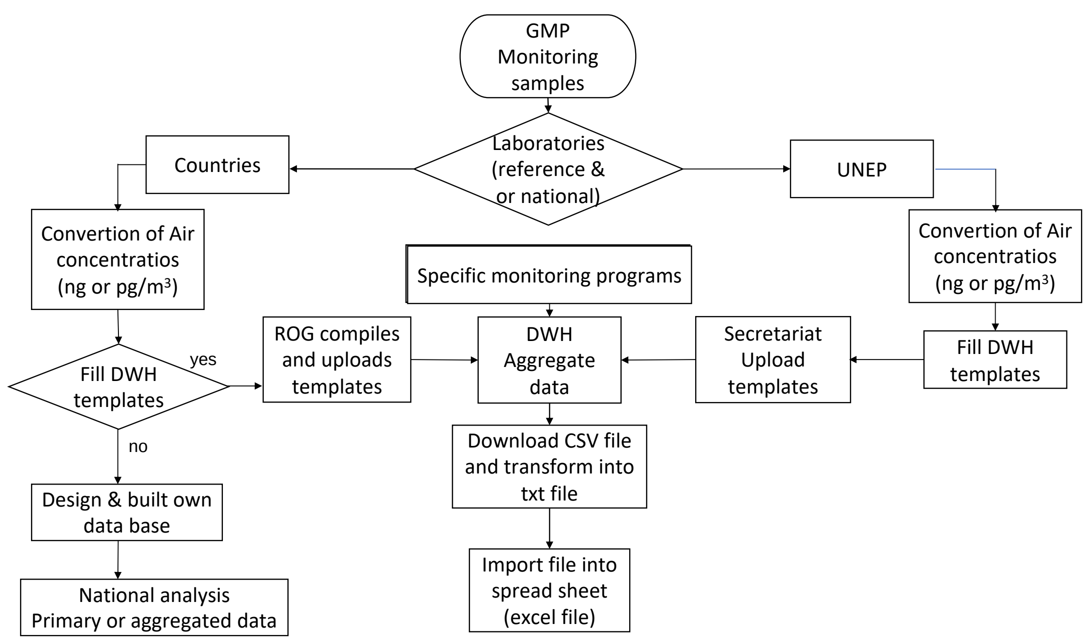
A database is any large collection of data that is usually stored in a computer and that can easily be used and added to.

The literal definition of a database is a collection of data which is organized and therefore easily accessed, managed and updated. The expansion of the definition of a database is that data is typically organized into rows, columns and tables which can be edited, deleted, and generally updated.

The configuration of a database consists mainly of two parts: the design of a template and the building of the database. The design of a template depends on the established objectives and the quality of the data required to achieve them. Building of the database consists of completing the template considering the data and metadata that are required.

In the case of the GMP samples, as mentioned, several steps are involved depending on where the data comes from. Data can generally be received directly from the national laboratory, the reference laboratory, or may have already been uploaded to the DWH. See figure 3.

Figure 3. Database configuration for GMP samples



For Air samples, the laboratories usually deliver the data in amount of substance per PUF or XAD (mass/PUF). If this is the case, a procedure to transform the data into concentrations should be applied. UNEP has developed a guidance for the conversion of POPs data from mass/PUF to mass/m^3 using Tom Harner's model. This guidance is included as Annex 1. For water and milk the laboratories deliver the data in concentrations, usually pg/l for water and ng/g fat or pg/g fat for milk.

2.1 Design of the database

Once the data are in concentrations, you must set up or design a database template or file. This file contains values for various configuration parameters that affect the use of the database. There are many ways to design a database template and a wide variety of formats, from manual to electronic formats that offer tools to expedite and even automate data handling. In our case, the database template consists of a structured table that is prepared in an Excel file (hereinafter referred to as the database), with which the data will be handled with dynamic tables and advanced Excel functions.

The database template includes the values of the concentrations of the parameters measured and additional metadata. The measurements include the name of the parameter, analytical method, the specification of the LOQ if necessary, the value per se, and the name of the laboratory which performed the analysis. The metadata include characteristics of the site: name, country, region, location, and meteorological information, among others and characteristics of the sampling: year, time (start and end of sampling) and type of sampling, among others.

The amended Guidance on the Global Monitoring Plan for Persistent Organic Pollutants (UNEP, 2021) organizes data as follows:

- **Primary GMP data:** are the results of measurements of POPs concentrations in samples of core matrices collected for the GMP, or other programs that are compatible with the goals of the GMP. They include both measurements of POPs in specific samples, and measurements of other covariables relating to these samples (e.g. biological covariates), that are necessary to interpret the POPs data in a meaningful way, including the location and timing of sampling;
- **GMP meta-data:** are any other data or information that describe the primary GMP data in some way. This can include information on the methodologies employed (e.g., for sampling and analysis) and the laboratories responsible for a particular set of analyses, or the design and implementation of programs that contribute to the GMP, etc. Please note that summary information on programs, chemicals monitored, data available and data structure is available in the GMP DWH and can be directly copied to a regional/global report;
- **Supplementary data:** Are any other data or information that may be accepted for use in the Stockholm Convention evaluation process. This might include relevant information and/or data from published sources (e.g. the peer reviewed scientific literature, existing assessment, etc.), results of modelling activities that may assist the data interpretation and evaluation, or results of research activities that may be relevant to interpreting the primary GMP data in a valid and meaningful way (e.g. process studies, food-web studies, etc.). Such data will comprise an important contribution to the Stockholm Convention evaluation process, especially in the initial period where the necessary data management infrastructure is still under development in some regions.

Primary GMP data (and supplementary data where these concern monitoring results from published sources) can be further sub-divided between:

- **Un-aggregated data:** individual sample measurement values (e.g. the concentration of PCB153 in air, sampled at location x at time y);
- **Aggregated data:** (statistically) summarized data, e.g. averaged values that summarize the measurements on a number of individual samples

In our case we are going to use and follow the standardized formats developed for the Global Monitoring Plan (GMP) Data Warehouse (DWH) for Un-aggregated data and aggregated data. The GMP DWH is an online tool developed for handling persistent organic pollutants (POPs) monitoring data generated in the frame of the Stockholm Convention on POPs (DWH, 2020). It gives a platform and excel formats to configure a database. Data structure in the GMP DWH is fully standardized into three key items: site, sampling attributes and measurement. The UNEP Guidance (Annex 1) also describes how to fill the DWH excel templates. DWH templates can be found in https://www.pops-gmp.org/index.php?pg=gmp3 in the Data Management Console, or in Annex 2.

The templates for un-aggregated data contain for each matrix:

1) ***Data sheets: Tables into which the reported data should be filled. Columns are described identically to the defined data structure.***

AIR DATA SHEET:

SITE								SAMPLING ATTRIBUTES							MEASUREMENT				
Site name	Latitude	Longitude	Region	Country	Site type	Potential source	Monitoring network	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory

WATER DATA SHEET:

SITE										SAMPLING ATTRIBUTES							MEASUREMENT				
Site name	Latitude	Longitude	Region	Country	Water type	Sea	Site type	Potential source	Monitoring network	Year	Start of sampling	End of sampling	Sampling type water	Depth (m)	Temperature (deg. of C)	Salinity (PSU)	Parameter	Analytical method	LOQ	Value	Laboratory

MILK DATA SHEET:

SITE				SAMPLING ATTRIBUTES				MEASUREMENT				
Site name	Region	Country	Monitoring network	Year	Start of sampling	End of sampling	Sampling type milk	Parameter	Analytical method	LOQ	Value	Laboratory

Each header cell in the data sheets has a description of what it should contain when you hover the mouse over it.

2) Example sheets. Example of a table with filled data.

SITE								SAMPLING ATTRIBUTES							MEASUREMENT				
Required field	*Required field*	*Required field*	*Required field*	*Required field*				*Required field*	*Required field*	*Required field*	*Required field*	*Required field for passive sampling*			*Required field*	*Required field*	*Required field if Value = 0*	*Required field*	
Text	*Numeric*	*Numeric*	*Codelist*	*Codelist*	*Codelist*	*Codelist*	*Codelist*	*Integer*	*text YYYY-MM-DD*	*text YYYY-MM-DD*	*Codelist*	*Codelist*	*Codelist*	*Text*	*Codelist*	*Codelist*	*Numeric*	*Numeric*	*Text*
Site name	**Latitude**	**Longitude**	**Region**	**Country**	Site type	Potential source	Monitoring network	**Year**	**Start of sampling**	**End of sampling**	**Sampling type air**	Sampling type air passive	Recalculation	Recalculation description	**Parameter**	**Analytical method**	LOQ	**Value**	Laboratory
Kosetice	49.58335	15.08334	CEE	Czech Republic		Agricultural		2010	2010-01-01	2010-01-02	Active				PCB 153 (pg/m3)	GC-MS	0.5	0	RECETOX
Kosetice	49.58335	15.08334	CEE	Czech Republic	Rural			2010	2010-01-01	2010-03-31	Passive	PUF	Harner's model		o,p-DDE (pg/m3)	GC-MS		4.12	
Bahia Blanca	-62.25	-38.75	GRULAC	Argentina	Rural	Agricultural	GAPS	2010	2010-01-01	2010-01-02	Active				HCB (pg/m3)	GC-MS-MS		39.82	RECETOX
Bahia Blanca	-62.25	-38.75	GRULAC	Argentina			GAPS	2010	2010-01-01	2010-03-31	Passive	PUF	Harner's model		Alpha-HCH (pg/m3)	GC-MS-MS		15.75	RECETOX

3) Code lists. Code lists for items with defined inputs.

For AIR:

Region	Country	Site type	Potential source	Monitoring network	Sampling type air	Sampling type air passive	Recalculation	Parameter	Analytical method
Africa	Afghanistan	Urban	Industrial	AIR - GEF	Active	PUF	PRC	Aldrin (pg/m3)	GC-APCI-HRMS
Asia and Pacific	Albania	Sub-urban	Traffic	AMAP	Passive	SIP	Calibration	cis-Chlordane (= alpha) (pg/m3)	GC-APCI-MS-MS
CEE	Algeria	Rural	Residential	Colombia - POPs monitoring		XAD	Harner's model	trans-Chlordane (= gamma) (pg/m3)	GC-ECD
GRULAC	Andorra	Remote	Agricultural	EMEP			Herkert's model	Oxychlordane (pg/m3)	GC-ECNI-MS
WEOG	Angola	High altitude	Waste sector	Europe Air PUF			Others	cis-Nonachlor (pg/m3)	GC-HRMS
	Antarctica	Polar	Natural	GAPS				trans-Nonachlor (pg/m3)	GC-MS
	Antigua and Barbuda			GAPS GRULAC				o,p-DDT (pg/m3)	GC-MS-MS
	Argentina			IADN				o,p-DDD (pg/m3)	HPLC-DAD
	Armenia			Kosetice				o,p-DDE (pg/m3)	HPLC-FLU
	Australia			LAPAN				p,p-DDT (pg/m3)	HPLC-MS
	Austria			MONARPOP				p,p-DDD (pg/m3)	HPLC-MS-MS
	Azerbaijan			MONET				p,p-DDE (pg/m3)	
	Bahamas			MONET Africa				Sum 3 p,p-DDTs (pg/m3)	
	Bahrain			NCP				Sum 6 DDTs (pg/m3)	
	Bangladesh			TOMPs				Dieldrin (pg/m3)	
	Barbados			POPs Monitoring Project in East Asian Countries				Endrin (pg/m3)	
	Belarus			Chemicals in Environment (Ministry of the Environment, Japan)				HCB (pg/m3)	
	Belgium			China National POPs Monitoring				Heptachlor (pg/m3)	
	Belize							cis-Heptachlorepoxide (= exo, B) (pg/m3)	
	Benin							trans-Heptachlorepoxide (= endo, A) (pg/m3)	
	Bhutan							Sum 2 heptachlorepoxides (cis + trans) (pg/m3)	
	Bolivia							Mirex (pg/m3)	
	Bosnia and Herzegovina							PCB 28 (pg/m3)	
	Botswana							PCB 52 (pg/m3)	
	Brazil							PCB 101 (pg/m3)	
	Brunei							PCB 138 (pg/m3)	
	Bulgaria							PCB 153 (pg/m3)	
	Burkina Faso							PCB 180 (pg/m3)	
	Burundi							Sum 6 PCBs (pg/m3)	
	Cambodia							Sum 7 PCBs (pg/m3)	
	Cameroon							PCB 77 (fg/m3)	
	Canada							PCB 81 (fg/m3)	

For WATER:

Water type	Region	Country	Sea	Site type	Potential source	Monitoring network	Sampling type water	Parameter	Analytical method
Surface water - lake	Africa	Afghanistan	Atlantic ocean	Urban	Industrial	MONET Africa	Bulk	Aldrin (pg/l)	GC-APCI-HRMS
Surface water - river	Asia and Pacific	Albania	Arctic ocean	Sub-urban	Traffic	GMP UNEP	Passive	cis-Chlordane (= alpha) (pg/l)	GC-APCI-MS-MS
Surface water - estuary	CEE	Algeria	Indian ocean	Rural	Residential	China National POPs Monitoring		trans-Chlordane (= gamma) (pg/l)	GC-ECD
Surface seawater - costal	GRULAC	Andorra	Pacific ocean	Remote	Agricultural	UNU		Oxychlordane (pg/l)	GC-ECNI-MS
Surface seawater - ocean	WEOG	Angola	Southern ocean	High altitude	Waste sector	CRU - ALCOR		cis-Nonachlor (pg/l)	GC-HRMS
	International waters	Antarctica	Adriatic Sea	Polar	Natural	CRU - AMUND		trans-Nonachlor (pg/l)	GC-MS
		Antigua and Barbuda	Aegean Sea			CRU - ANT1		o,p-DDT (pg/l)	GC-MS-MS
		Argentina	Alboran Sea			CRU - ANT2		o,p-DDD (pg/l)	HPLC-DAD
		Armenia	Amundsen Gulf			CRU - ARK		o,p-DDE (pg/l)	HPLC-FLU
		Australia	Amundsen Sea			CRU - ENDEAVOR		p,p-DDT (pg/l)	HPLC-MS
		Austria	Andaman Sea			CRU - GA442		p,p-DDD (pg/l)	HPLC-MS-MS
		Azerbaijan	Arabian Sea			CRU - GA446		p,p-DDE (pg/l)	Multiple methods
		Bahamas	Arafura Sea			CRU - MALASPINA		Sum 3 p,p-DDTs (pg/l)	
		Bahrain	Aral Sea			CRU - MSM		Sum 6 DDTs (pg/l)	
		Bangladesh	Archipelago Sea			CRU - MSM08		Dieldrin (pg/l)	
		Barbados	Argentine Sea			CRU - NORTH		Endrin (pg/l)	
		Belarus	Baffin Bay			CRU - ODEN05		HCB (pg/l)	
		Belgium	Balearic Sea			CRU - ODEN07		Heptachlor (pg/l)	
		Belize	Baltic Sea			CRU - POLARSTERN07		cis-Heptachlorepoxide (= exo, B) (pg/l)	
		Benin	Banda Sea			CRU - POLARSTERN08		trans-Heptachlorepoxide (= endo, A) (pg/l)	
		Bhutan	Barents Sea			CRU - SNOWDRAGON		Sum 2 heptachlorepoxides (cis + trans) (pg/l)	
		Bolivia	Bass Strait					Mirex (pg/l)	
		Bosnia and Herzegovina	Bay of Bengal					PCB 28 (pg/l)	
		Botswana	Bay of Biscay					PCB 52 (pg/l)	
		Brazil	Bay of Campeche					PCB 101 (pg/l)	
		Brunei	Bay of Fundy					PCB 138 (pg/l)	
		Bulgaria	Beaufort Sea					PCB 153 (pg/l)	
		Burkina Faso	Bellingshausen Sea					PCB 180 (pg/l)	
		Burundi	Bering Sea					Sum 6 PCBs (pg/l)	
		Cambodia	Bismarck Sea					Sum 7 PCBs (pg/l)	
		Cameroon	Black Sea					PCB 77 (fg/l)	
		Canada	Bohai Sea					PCB 81 (fg/l)	
		Cabo Verde	Bohol / Mindanao Sea					PCB 105 (fg/l)	

For HUMAN MILK:

Region	Country	Monitoring network	Sampling type milk	Parameter	Analytical method
Africa	Afghanistan	China National POPs Monitoring	Individual	Aldrin (ng/g fat)	GC-APCI-HRMS
Asia and Pacific	Albania	MILK - WHO	Pooled	Aldrin (ng/l)	GC-APCI-MS-MS
CEE	Algeria			cis-Chlordane (= alpha) (ng/g fat)	GC-ECD
GRULAC	Andorra			cis-Chlordane (= alpha) (ng/l)	GC-ECNI-MS
WEOG	Angola			trans-Chlordane (= gamma) (ng/g fat)	GC-HRMS
	Antarctica			trans-Chlordane (= gamma) (ng/l)	GC-MS
	Antigua and Barbuda			Oxychlordane (ng/g fat)	GC-MS-MS
	Argentina			Oxychlordane (ng/l)	HPLC-DAD
	Armenia			cis-Nonachlor (ng/g fat)	HPLC-FLU
	Australia			cis-Nonachlor (ng/l)	HPLC-MS
	Austria			trans-Nonachlor (ng/g fat)	HPLC-MS-MS
	Azerbaijan			trans-Nonachlor (ng/l)	
	Bahamas			o,p-DDT (ng/g fat)	
	Bahrain			o,p-DDT (ng/l)	
	Bangladesh			o,p-DDD (ng/g fat)	
	Barbados			o,p-DDD (ng/l)	
	Belarus			o,p-DDE (ng/g fat)	
	Belgium			o,p-DDE (ng/l)	
	Belize			p,p-DDT (ng/g fat)	
	Benin			p,p-DDT (ng/l)	
	Bhutan			p,p-DDD (ng/g fat)	
	Bolivia			p,p-DDD (ng/l)	
	Bosnia and Herzegovina			p,p-DDE (ng/g fat)	
	Botswana			p,p-DDE (ng/l)	
	Brazil			Sum 3 p,p-DDTs (ng/g fat)	
	Brunei			Sum 3 p,p-DDTs (ng/l)	
	Bulgaria			Sum 6 DDTs (ng/g fat)	
	Burkina Faso			Sum 6 DDTs (ng/l)	
	Burundi			Dieldrin (ng/g fat)	
	Cambodia			Dieldrin (ng/l)	
	Cameroon			Endrin (ng/g fat)	
	Canada			Endrin (ng/l)	
	Cabo Verde			HCB (ng/g fat)	
	Central African Republic			HCB (ng/l)	

The DWH also has documents of the data structure per matrix: Air, human blood and milk and water. It also offers other documents regarding the system: DWH management, data visualization, data import, a GMP DWH overview and a user guide on the GMP DWH for decision makers and users, among others. The DWH documents and factsheets can be downloaded in pdf format from: http://www.pops-gmp.org/dwh.

When data are included in these templates, completed sheets should be uploaded through the GMP DWH Data Management Console application (dmc.pops-gmp.org) by ROG members. The DWH accepts primary data or aggregated data.

2.2 Building of the database

It consists of filling the designed template, in our case the GMP DWH templates by matrix, with the information of your sampling campaign and the information of the measurements from the laboratories in concentration values. Depending on the monitoring objective, Primary GMP data can be handled in an aggregated or un-aggregated manner.

If you handle data in un-aggregated mode, you could get seasonal variations per year and comparisons between sampling periods, e.g. 4 in a year, every 3 months for air matrix, if the SOP for Passive Sampling recommended for the GMP projects was applied. It is recommended that comparisons be made considering the same period of the year to avoid bias.

To improve the power, the GMP Guidance (2021) recommends, to register or measure at the chemical analysis, the appropriate confounding variables, and adjust the concentrations for varying covariates by means of, for example, ANCOVA (Analysis of Covariance) (Bignert, 2002).

When data is handled in aggregate mode, seasonal variations are lost. However, "an aggregation of the values in every year is necessary to achieve values not influenced by the seasonal variation" (Kalina, 2017). In the case of air monitoring with passive samplers, sometimes the concentrations of the PUFs are so low that several time periods need to be added when analyzing the PUFs. In these cases, the metadata should indicate how the concentration values were calculated.

To meet the objectives established in the GMP Guidance (UNEP; 2021), it will be necessary to aggregate the data annually per **parameter, site, country, monitoring network[4] and year,** and the corresponding statistical parameters will have to be included in the database: minimum, maximum, mean, median, and standard deviation, among others. Additionally, you should adjust other fields of your un-aggregated data base, like start/end of sampling, and you must add some columns like number of values for the calculation of the statistical parameters and number of values under LOQ.

As was mentioned, templates for aggregated data of the three core matrices are also provided by the GMP DWH. You can download the templates from the GMP DWH https://www.pops-gmp.org/index.php?pg=gmp3 in the Data Management Console, or you can find them in Annex 2.

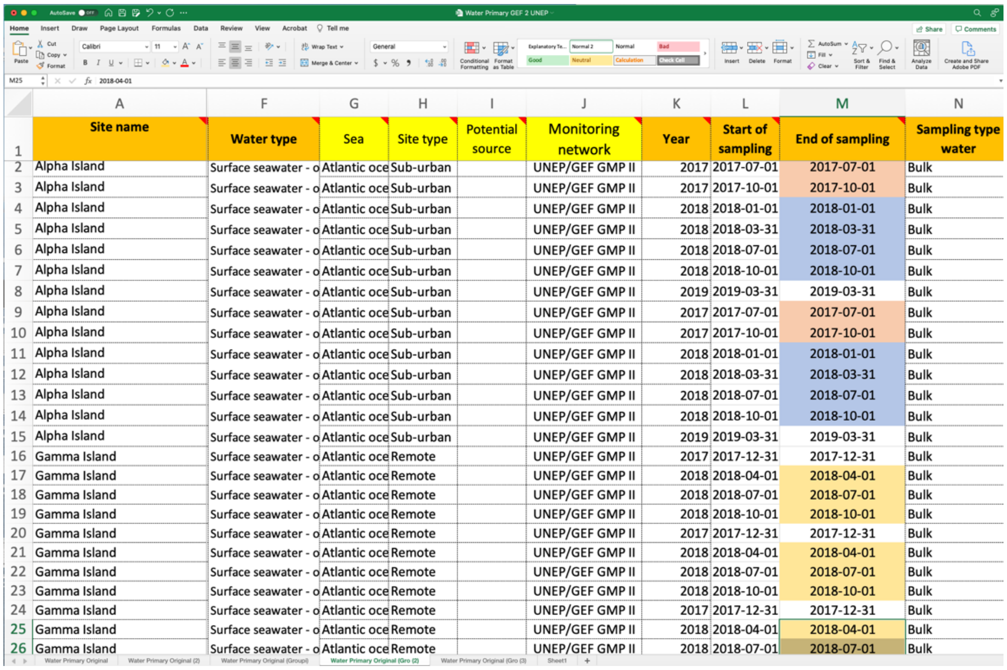
According to the Data Warehouse guidelines for managing data from the Global Monitoring Plan 2021, the following aggregated values and measures of variability are computed:

- **Arithmetic mean** – mean of all concentration values. If the original value is lower than limit of quantification, a substitution value computed as the limit is used instead.
- **Median** – non-parametric analogue of the mean computed in the same way as a 50th percentile.
- **Geometric mean** – a parametric statistic used for estimation of a central tendency of log-normally distributed data, which is suitable especially for air pollution measurements.
- **Standard deviation** – a parametric measure of variation. If only one record is used for computing the aggregation, standard deviation is not determined.
- 5th and 95th percentiles are computed as non-parametric measures of variation.
- **Minimum and maximum** are computed as 0th and 100th percentile.
- **Start/end of the sampling** in a particular year are determined as a start date of an initial sampling and an end date of a final sampling within the year. If the sampling period exceeds start/end of the year, the value of 1 January/31 December is used instead.
- **Sampling frequency** is determined as a characteristic period between the two successive samplings. The term “characteristic” means that at least 50% of the time between two successive samplings was in this period. In case of months, some margin of tolerance is added due to uneven length of calendar months. For non-periodic sampling and sampling with only one sample in a year, the value of “12 months” is used as the characteristic period.

It is very important to review the monitoring periods, start/end of sampling, carried out in a monitoring year before the aggregation of the data. Sometimes, the latest monitoring period of a year ends in January of the following year, and you must consider this when you group your data for the aggregation. The following example shows what this mean:

[4] If the monitoring network uses multiple sampling techniques, then you will also need to consider the type of sampling.

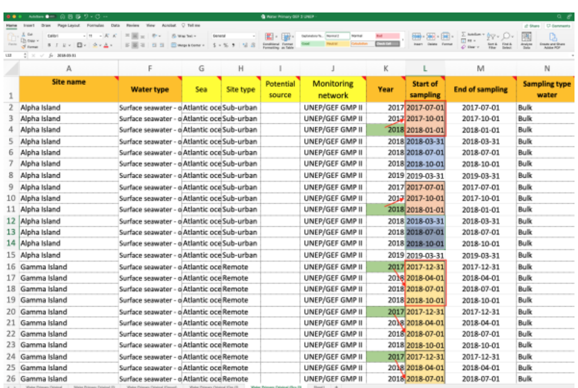
Example: The following Water database has three years of monitoring data, but some years and some sites have only one or two values, and to represent a full year for global comparisons at least three samples per year and site are needed. Then if you group by year, you will lose the 2017 and 2019 data.

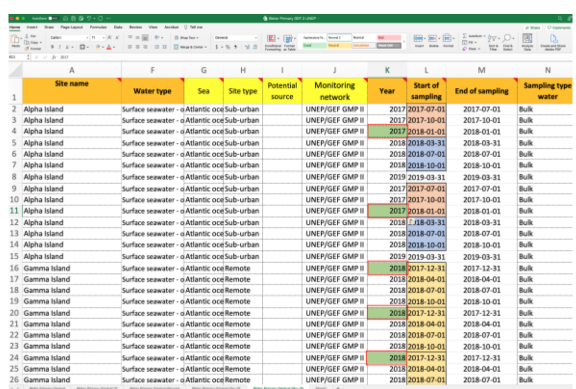


	A	F	G	H	I	J	K	L	M	N
1	Site name	Water type	Sea	Site type	Potential source	Monitoring network	Year	Start of sampling	End of sampling	Sampling type water
2	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2017	2017-07-01	2017-07-01	Bulk
3	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2017	2017-10-01	2017-10-01	Bulk
4	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-01-01	2018-01-01	Bulk
5	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-03-31	2018-03-31	Bulk
6	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-07-01	2018-07-01	Bulk
7	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-10-01	2018-10-01	Bulk
8	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2019	2019-03-31	2019-03-31	Bulk
9	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2017	2017-07-01	2017-07-01	Bulk
10	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2017	2017-10-01	2017-10-01	Bulk
11	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-01-01	2018-01-01	Bulk
12	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-03-31	2018-03-31	Bulk
13	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-07-01	2018-07-01	Bulk
14	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2018	2018-10-01	2018-10-01	Bulk
15	Alpha Island	Surface seawater - o	Atlantic oce	Sub-urban		UNEP/GEF GMP II	2019	2019-03-31	2019-03-31	Bulk
16	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2017	2017-12-31	2017-12-31	Bulk
17	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-04-01	2018-04-01	Bulk
18	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-07-01	2018-07-01	Bulk
19	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-10-01	2018-10-01	Bulk
20	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2017	2017-12-31	2017-12-31	Bulk
21	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-04-01	2018-04-01	Bulk
22	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-07-01	2018-07-01	Bulk
23	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-10-01	2018-10-01	Bulk
24	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2017	2017-12-31	2017-12-31	Bulk
25	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-04-01	2018-04-01	Bulk
26	Gamma Island	Surface seawater - o	Atlantic oce	Remote		UNEP/GEF GMP II	2018	2018-07-01	2018-07-01	Bulk

As can be seen in the Alpha Island site the monitoring in 2018 started on January 1 and in 2017 there was no monitoring in January nor in the period from November to December, so one could consider the first sampling of 2018 as the last of 2017 and group changing only the year 2018 for 2017. We would then have two years 2017 and 2018 with three samples each.

In the case of the Gamma site the monitoring of the last day of 2017 can be grouped with the 3 of 2018 to have a full year of monitoring, i.e. with 4 samples.





How you group the data for the aggregation is very important. The way the data is grouped prior to its aggregation will allow more values to be used when the completeness criterion is applied.

Excel tools like functions and formulas (see Annex 3), and Power Pivot; or statistical programs, will help you to aggregate the database. If you have a PC and Excel 2013 you can install power pivot; several tutorial videos for installing and using Power Pivot can be found at https://youtu.be/uDoCL6Vctsk (www.computertutoring.co.uk). Annex 4 will help you too to install Power Pivot.

The following procedures show the basic steps to perform data aggregation when using Excel functions and formulas. If you are not familiar with excel, please consult Annex 3 Excel Functions or Excel tutorials.

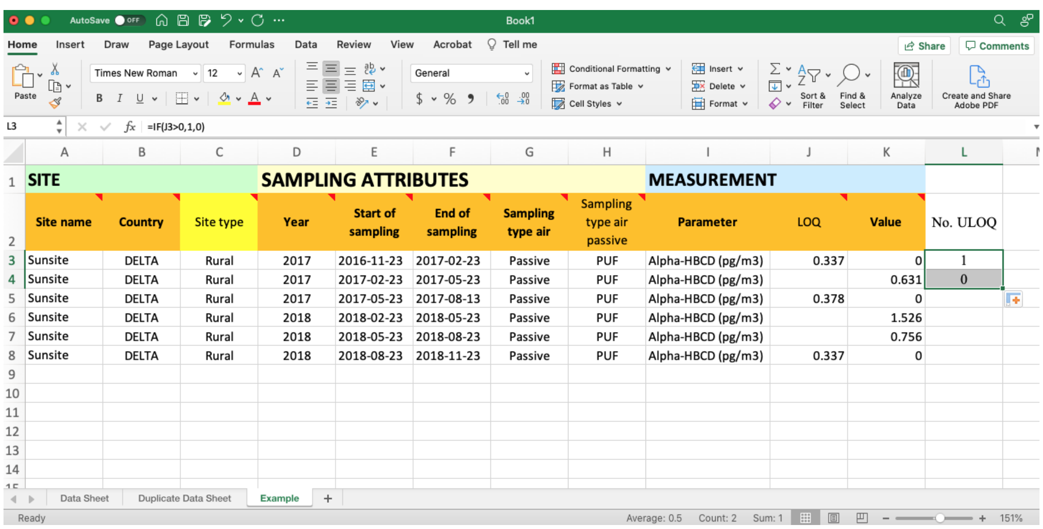
2.3 Procedures

2.3.1 Procedure to configurate an aggregated database from unaggregated data using Excel Functions (manual aggregation). Exercise 2.1

1. **Calculate LOQ Values:**

   a. Number of Values below the LOQ (No. ULOQ). To calculate the number of values ULOQ we add a new column, named No. ULOQ, to the original data sheet, that will allow us to count how many values under LOQ where registered. To do this, the following formula is used:

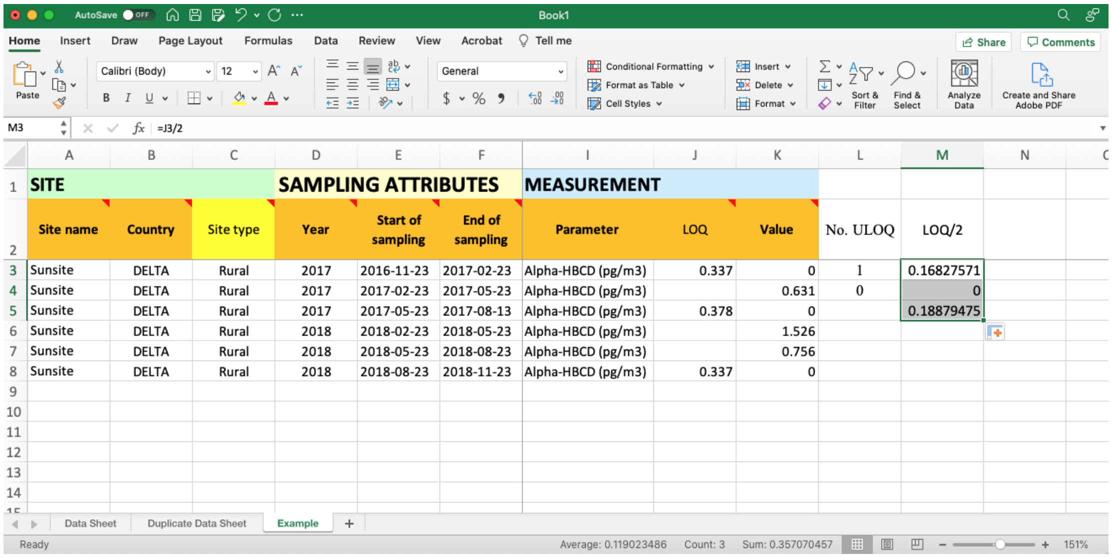
=IF(LOQ>0,1,0)



SITE			SAMPLING ATTRIBUTES					MEASUREMENT			
Site name	Country	Site type	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Parameter	LOQ	Value	No. ULOQ
Sunsite	DELTA	Rural	2017	2016-11-23	2017-02-23	Passive	PUF	Alpha-HBCD (pg/m3)	0.337	0	1
Sunsite	DELTA	Rural	2017	2017-02-23	2017-05-23	Passive	PUF	Alpha-HBCD (pg/m3)		0.631	0
Sunsite	DELTA	Rural	2017	2017-05-23	2017-08-13	Passive	PUF	Alpha-HBCD (pg/m3)	0.378	0	
Sunsite	DELTA	Rural	2018	2018-02-23	2018-05-23	Passive	PUF	Alpha-HBCD (pg/m3)		1.526	
Sunsite	DELTA	Rural	2018	2018-05-23	2018-08-23	Passive	PUF	Alpha-HBCD (pg/m3)		0.756	
Sunsite	DELTA	Rural	2018	2018-08-23	2018-11-23	Passive	PUF	Alpha-HBCD (pg/m3)	0.337	0	

   b. Calculate LOQ/2 values. Add a new column, named LOQ/2, divide LOQ by two and copy the formula downwards to all cells. The formula will look like this:

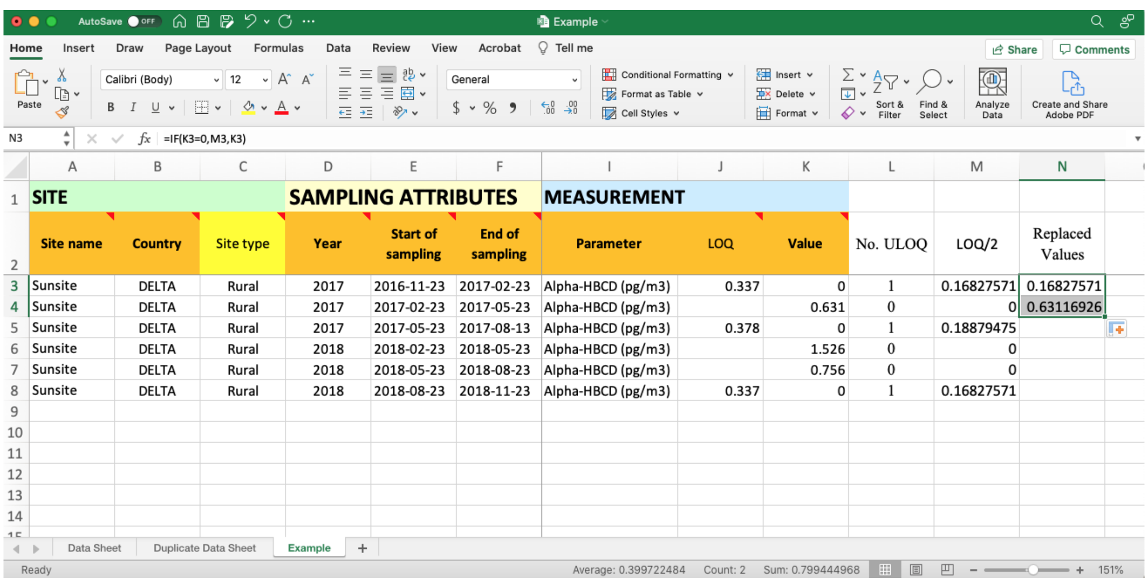
=LOQ/2



	SITE			SAMPLING ATTRIBUTES			MEASUREMENT				
	Site name	Country	Site type	Year	Start of sampling	End of sampling	Parameter	LOQ	Value	No. ULOQ	LOQ/2
3	Sunsite	DELTA	Rural	2017	2016-11-23	2017-02-23	Alpha-HBCD (pg/m3)	0.337	0	1	0.16827571
4	Sunsite	DELTA	Rural	2017	2017-02-23	2017-05-23	Alpha-HBCD (pg/m3)		0.631	0	0
5	Sunsite	DELTA	Rural	2017	2017-05-23	2017-08-13	Alpha-HBCD (pg/m3)	0.378	0		0.18879475
6	Sunsite	DELTA	Rural	2018	2018-02-23	2018-05-23	Alpha-HBCD (pg/m3)		1.526		
7	Sunsite	DELTA	Rural	2018	2018-05-23	2018-08-23	Alpha-HBCD (pg/m3)		0.756		
8	Sunsite	DELTA	Rural	2018	2018-08-23	2018-11-23	Alpha-HBCD (pg/m3)	0.337	0		

c. Calculate Values for aggregated template. For the calculation of the statistical parameters, and according to the Guidance (UNEP, 2021), the zero values below LOQ should be replaced by one half of the quantification limit prior their annual aggregation and the information of the portion of these values should be stored together with the aggregated values. In another column named Replaced Values, insert values for the computing of the statistical parameters. Zero values of the column named Value will be replaced by the LOQ/2 values. In the new column type the following formula:

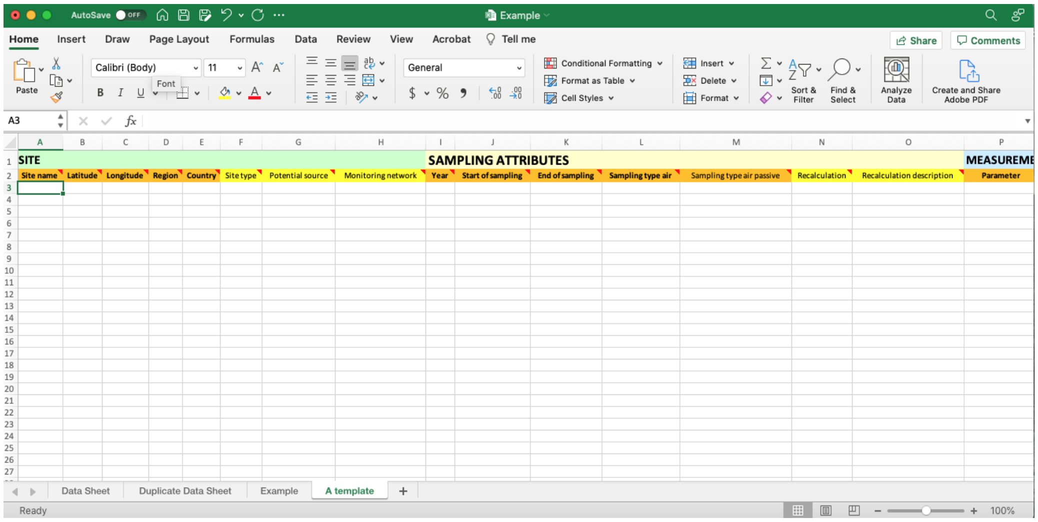
=IF(value=0, LOQ/2, value)



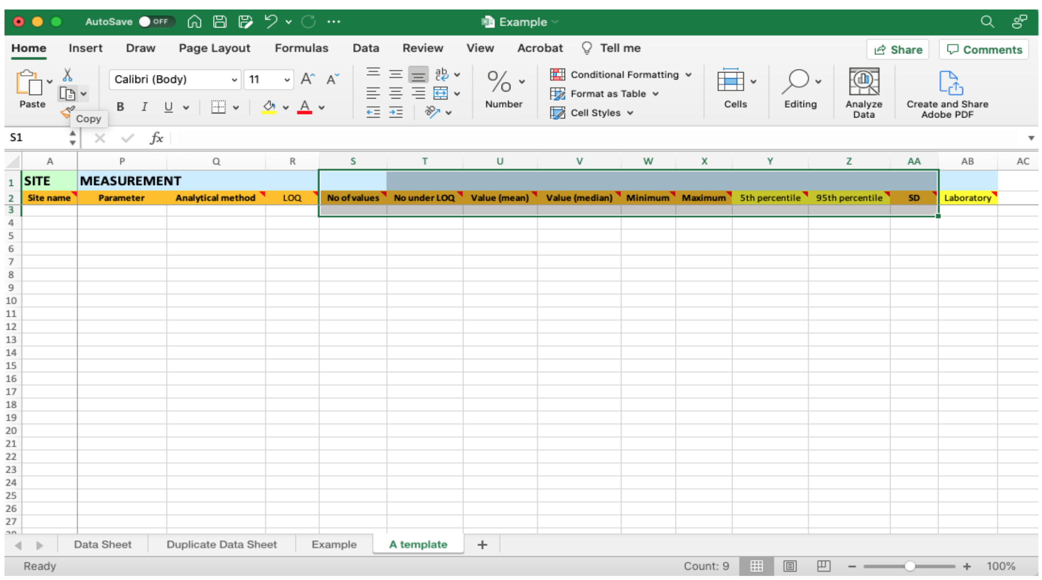
	SITE			SAMPLING ATTRIBUTES			MEASUREMENT					
	Site name	Country	Site type	Year	Start of sampling	End of sampling	Parameter	LOQ	Value	No. ULOQ	LOQ/2	Replaced Values
3	Sunsite	DELTA	Rural	2017	2016-11-23	2017-02-23	Alpha-HBCD (pg/m3)	0.337	0	1	0.16827571	0.16827571
4	Sunsite	DELTA	Rural	2017	2017-02-23	2017-05-23	Alpha-HBCD (pg/m3)		0.631	0	0	0.63116926
5	Sunsite	DELTA	Rural	2017	2017-05-23	2017-08-13	Alpha-HBCD (pg/m3)	0.378	0	1	0.18879475	
6	Sunsite	DELTA	Rural	2018	2018-02-23	2018-05-23	Alpha-HBCD (pg/m3)		1.526	0	0	
7	Sunsite	DELTA	Rural	2018	2018-05-23	2018-08-23	Alpha-HBCD (pg/m3)		0.756	0	0	
8	Sunsite	DELTA	Rural	2018	2018-08-23	2018-11-23	Alpha-HBCD (pg/m3)	0.337	0	1	0.16827571	

2. Compute Annual aggregation Parameters

a. Select the template that you will use to aggregate the data. In our case it is GMP DWH air aggregated template. You will find it in Annex 2. Copy and paste the data sheet of the file air aggregated template in your data file. Change the name to A template.

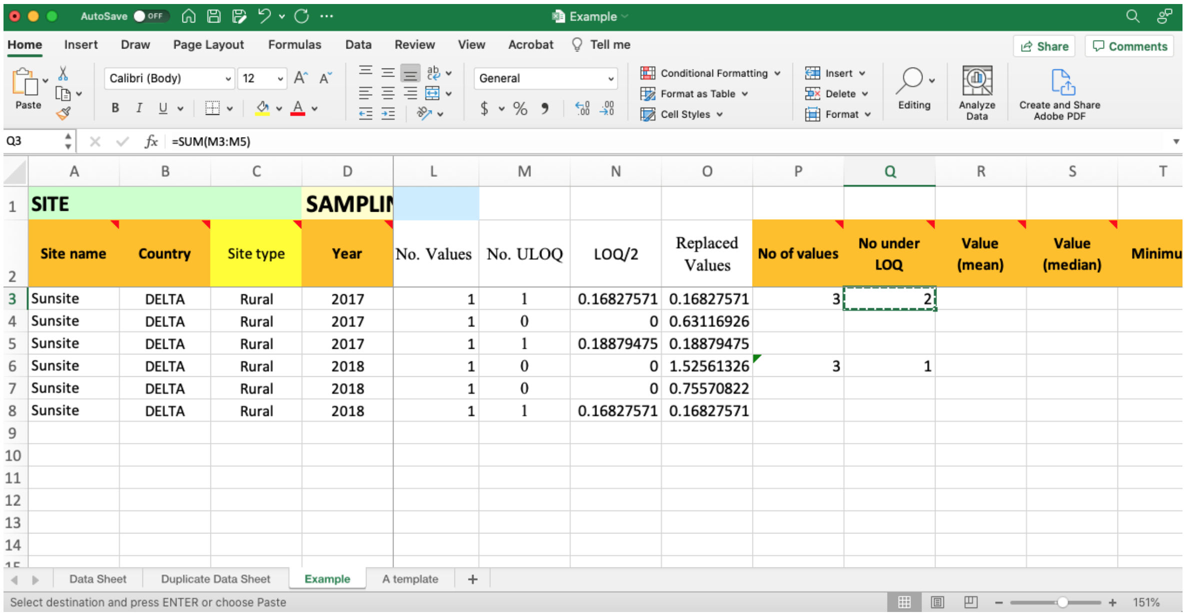


b. Copy and paste the headings from A template sheet to be calculated onto the sample sheet. Then register the number of records involved in calculating the statistical parameters for each compound per year. The number of records is determined as the number of primary values used to calculate the aggregation. Then, add the number of records below the LOQ.



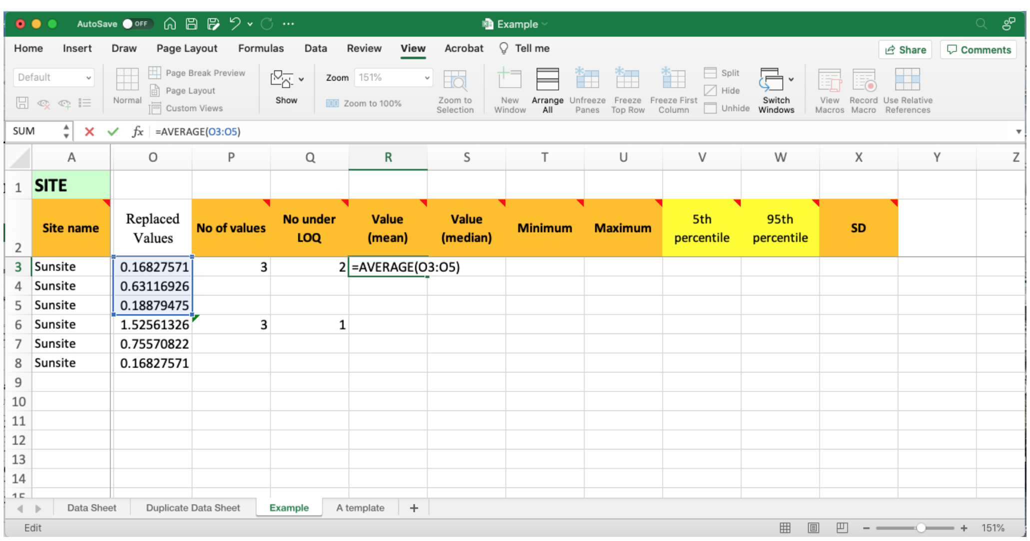
To add the records of No. of values and No. ULOQ, the following formula is used:

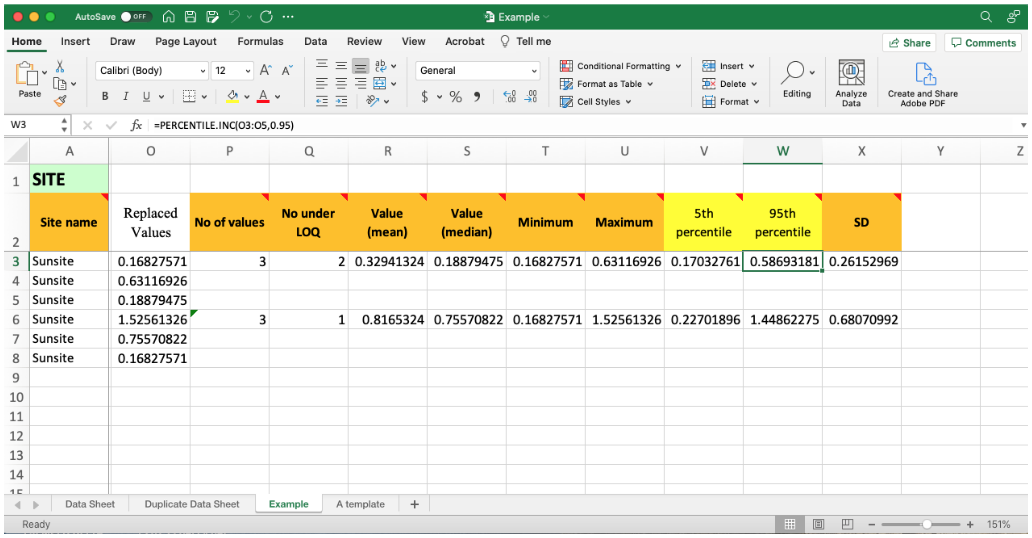
=SUM(Number1, (Number2), …..)



c. Calculation of statistical parameters by monitoring site, parameter and year using excel functions. The following functions could be used:

=AVERAGE(Number1, (Number2), ..)
=MEDIAN(Number1, (Number2), ..)
=MIN(Number1, (Number2), ..)
=MAX(Number1, (Number2), ..)
=PERCENTILE.INC(array,0.05 or 0.95)
=STDEV(Number1, (Number2), ..)



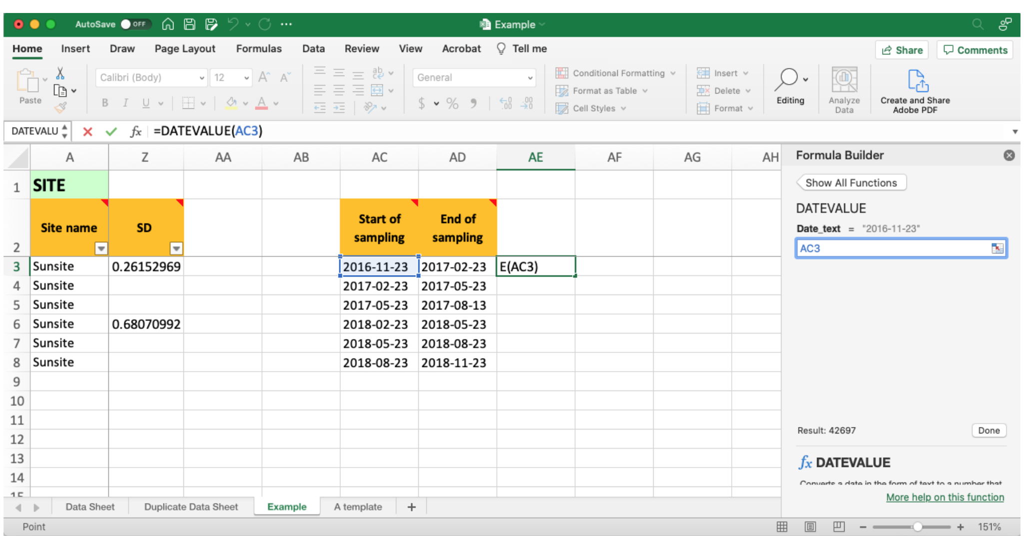


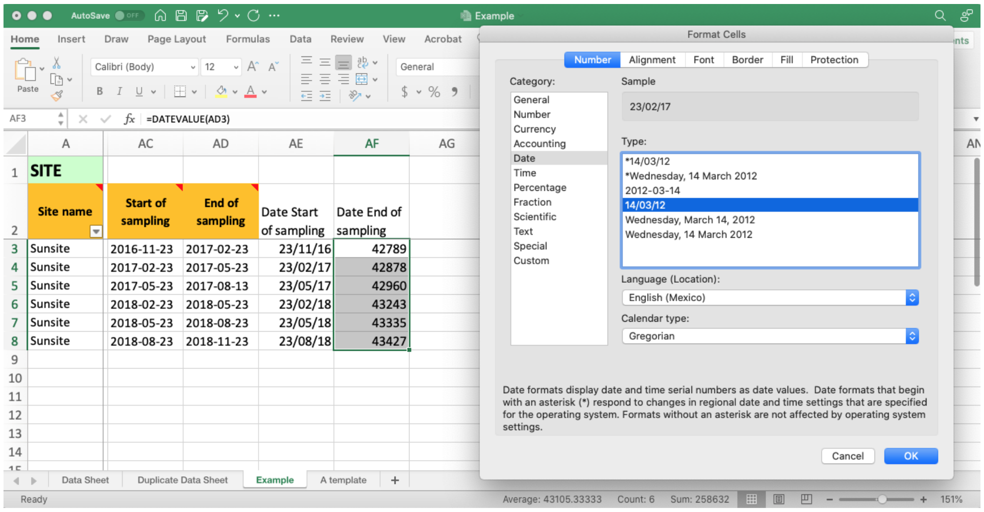
3. Start/end of sampling adjustments:

Start/end of the sampling in a particular year are determined as a start date of an initial sampling and an end date of a final sampling within the year. If the sampling period exceeds start/end of the year, the value of 1 January/31 December is used instead (GMP, DWH).

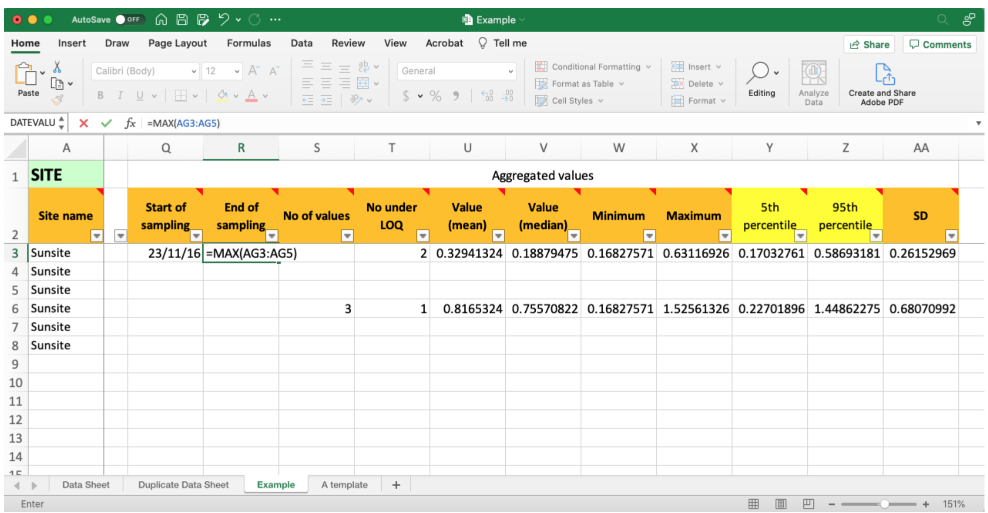
When data is aggregated, the sampling period must be adjusted. The start will be the oldest date of the sampling periods and the end the newest.

a. Review the format of the sampling periods by filtering the dates. They must be in a date format, if not, change the format by using the function Date Time and then select DATEVALUE. A number will appear. Change the format with format cells, click date and then choose the format dd/mm/yyyy.

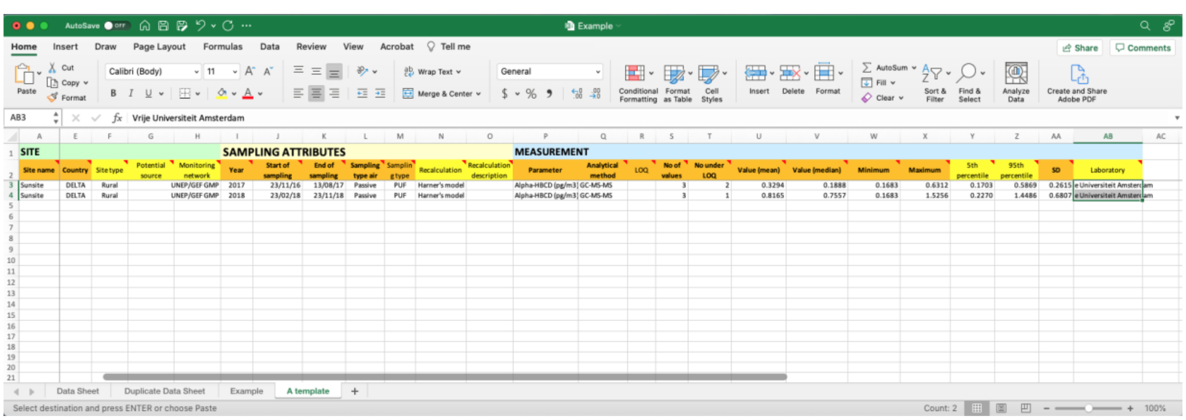




b. Include two more columns to your Example sheet and adjust the aggregated Start/end of sampling by means of the functions MIN and MAX.



Finally, the A template will be filled with the aggregated values and the characteristics of the monitoring sites of the un-aggregated data sheet.



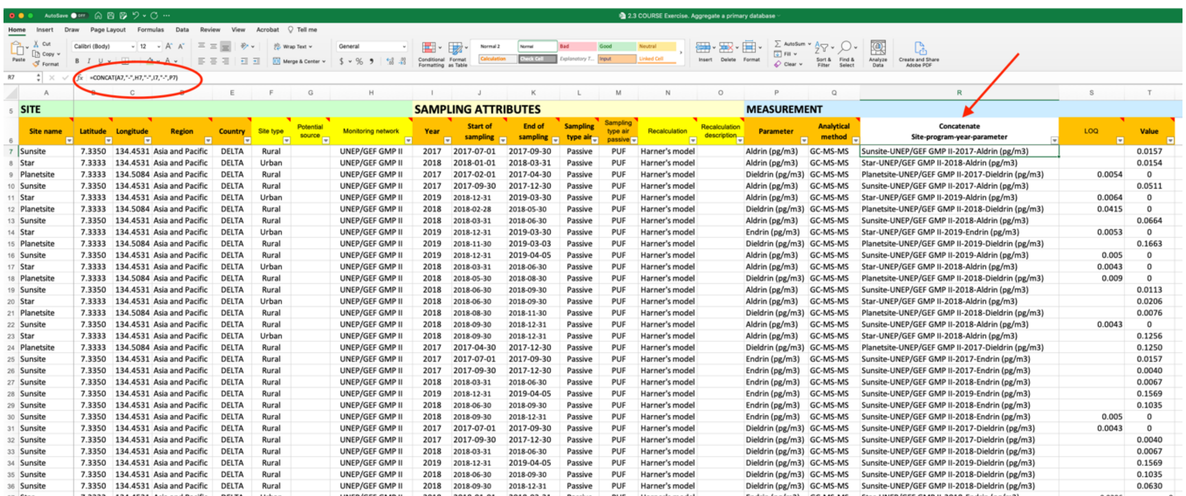
2.3.2 Procedure to configurate an aggregate database using Excel functions and formulas. Exercises 2.2 and 2.3

To aggregate a database using Excel functions and formulas, Annex 3 explains the functions we will use, and the formulas are presented below:

1. **Calculate LOQ Values using formulas:**

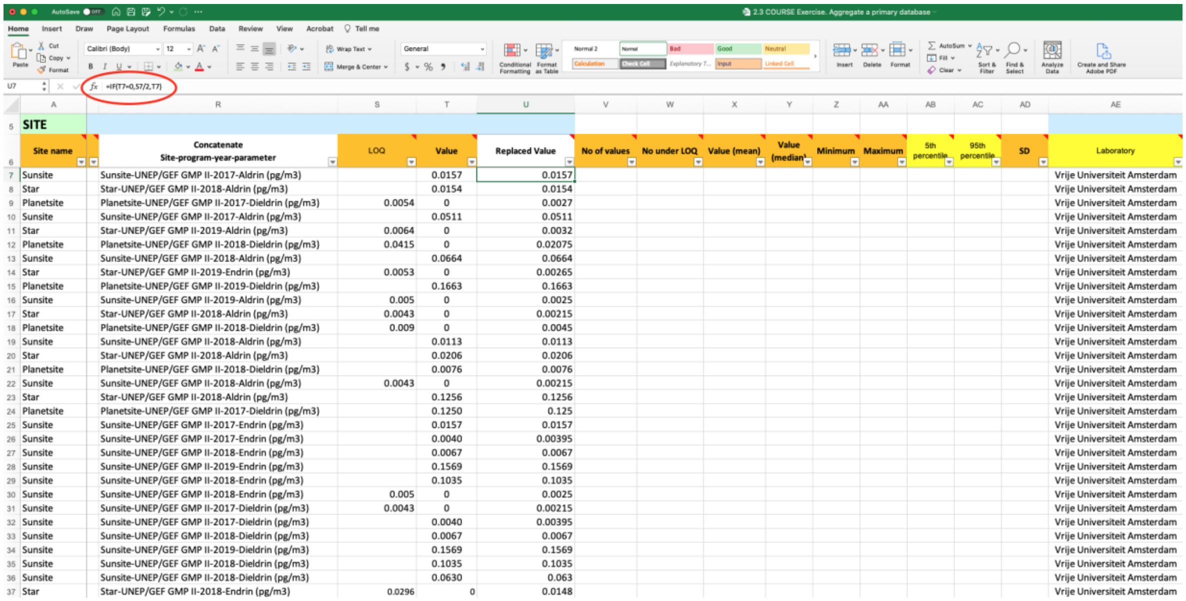
   a. Insert a column after Analytical method and concatenate all the parameters that should be considered for the aggregation of the values. In this case concatenate: Site, program, year and parameter. Use the following formula:

   = CONCAT (cell1,"-",cell2, "-",cell3 ...)



   b. Insert a column after the value column. Name it Replaced Value. In addition, insert 9 columns after the Replaced Value column and copy the header of the aggregated parameters template including those for the statistical parameters. Calculate the Replaced Value with the function IF:

   =IF(logical_test,(value_if_true),(value_if_false))



	Site name	Concatenate Site-program-year-parameter	LOQ	Value	Replaced Value	No of values	No under LOQ	Value (mean)	Value (median)	Minimum	Maximum	5th percentile	95th percentile	SD	Laboratory
7	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0157	0.0157										Vrije Universiteit Amsterdam
8	Star	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0154	0.0154										Vrije Universiteit Amsterdam
9	Planetsite	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0054	0	0.0027										Vrije Universiteit Amsterdam
10	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0511	0.0511										Vrije Universiteit Amsterdam
11	Star	Star-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.0064	0	0.0032										Vrije Universiteit Amsterdam
12	Planetsite	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0415	0	0.02075										Vrije Universiteit Amsterdam
13	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0664	0.0664										Vrije Universiteit Amsterdam
14	Star	Star-UNEP/GEF GMP II-2019-Endrin (pg/m3)	0.0053	0	0.00265										Vrije Universiteit Amsterdam
15	Planetsite	Planetsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1663	0.1663										Vrije Universiteit Amsterdam
16	Sunsite	Sunsite-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.005	0	0.0025										Vrije Universiteit Amsterdam
17	Star	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
18	Planetsite	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.009	0	0.0045										Vrije Universiteit Amsterdam
19	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0113	0.0113										Vrije Universiteit Amsterdam
20	Star	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0206	0.0206										Vrije Universiteit Amsterdam
21	Planetsite	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0076	0.0076										Vrije Universiteit Amsterdam
22	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
23	Star	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.1256	0.1256										Vrije Universiteit Amsterdam
24	Planetsite	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.1250	0.125										Vrije Universiteit Amsterdam
25	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0157	0.0157										Vrije Universiteit Amsterdam
26	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0040	0.00395										Vrije Universiteit Amsterdam
27	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0067	0.0067										Vrije Universiteit Amsterdam
28	Sunsite	Sunsite-UNEP/GEF GMP II-2019-Endrin (pg/m3)		0.1569	0.1569										Vrije Universiteit Amsterdam
29	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.1035	0.1035										Vrije Universiteit Amsterdam
30	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.005	0	0.0025										Vrije Universiteit Amsterdam
31	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
32	Sunsite	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.0040	0.00395										Vrije Universiteit Amsterdam
33	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0067	0.0067										Vrije Universiteit Amsterdam
34	Sunsite	Sunsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1569	0.1569										Vrije Universiteit Amsterdam
35	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.1035	0.1035										Vrije Universiteit Amsterdam
36	Sunsite	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0630	0.063										Vrije Universiteit Amsterdam
37	Star	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.0296	0	0.0148										Vrije Universiteit Amsterdam

c. To calculate the number of values and values under LOQ, use the following formulas:

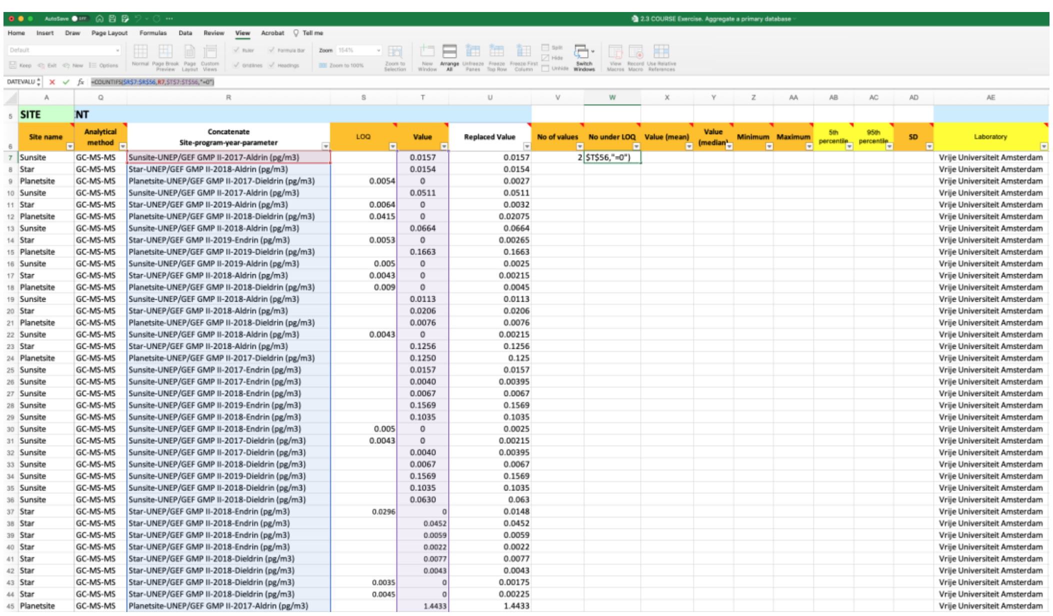
=COUNTIF(range, criteria)

and

=COUNTIFS(criteria_range1, criteria1,…)

Formulas adapted to the exercise were:

No of Values =COUNTIF($R$7:$R$56,R7)
No under LOQ=COUNTIFS($R$7:$R$56,R7,$T$7:$T$56,"=0")



	Site name	Analytical method	Concatenate Site-program-year-parameter	LOQ	Value	Replaced Value	No of values	No under LOQ	Value (mean)	Value (median)	Minimum	Maximum	5th percentile	95th percentile	SD	Laboratory
7	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0157	0.0157	2	$T$56,"=0")								Vrije Universiteit Amsterdam
8	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0154	0.0154										Vrije Universiteit Amsterdam
9	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0054	0	0.0027										Vrije Universiteit Amsterdam
10	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0511	0.0511										Vrije Universiteit Amsterdam
11	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.0064	0	0.0032										Vrije Universiteit Amsterdam
12	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0415	0	0.02075										Vrije Universiteit Amsterdam
13	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0664	0.0664										Vrije Universiteit Amsterdam
14	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2019-Endrin (pg/m3)	0.0053	0	0.00265										Vrije Universiteit Amsterdam
15	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1663	0.1663										Vrije Universiteit Amsterdam
16	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.005	0	0.0025										Vrije Universiteit Amsterdam
17	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
18	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.009	0	0.0045										Vrije Universiteit Amsterdam
19	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0113	0.0113										Vrije Universiteit Amsterdam
20	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0206	0.0206										Vrije Universiteit Amsterdam
21	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0076	0.0076										Vrije Universiteit Amsterdam
22	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
23	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.1256	0.1256										Vrije Universiteit Amsterdam
24	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.1250	0.125										Vrije Universiteit Amsterdam
25	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0157	0.0157										Vrije Universiteit Amsterdam
26	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0040	0.00395										Vrije Universiteit Amsterdam
27	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0067	0.0067										Vrije Universiteit Amsterdam
28	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Endrin (pg/m3)		0.1569	0.1569										Vrije Universiteit Amsterdam
29	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.1035	0.1035										Vrije Universiteit Amsterdam
30	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.005	0	0.0025										Vrije Universiteit Amsterdam
31	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0043	0	0.00215										Vrije Universiteit Amsterdam
32	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.0040	0.00395										Vrije Universiteit Amsterdam
33	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0067	0.0067										Vrije Universiteit Amsterdam
34	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1569	0.1569										Vrije Universiteit Amsterdam
35	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.1035	0.1035										Vrije Universiteit Amsterdam
36	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0630	0.063										Vrije Universiteit Amsterdam
37	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.0296	0	0.0148										Vrije Universiteit Amsterdam
38	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0452	0.0452										Vrije Universiteit Amsterdam
39	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0059	0.0059										Vrije Universiteit Amsterdam
40	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0022	0.0022										Vrije Universiteit Amsterdam
41	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0077	0.0077										Vrije Universiteit Amsterdam
42	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0043	0.0043										Vrije Universiteit Amsterdam
43	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0035	0	0.00175										Vrije Universiteit Amsterdam
44	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0045	0	0.00225										Vrije Universiteit Amsterdam
45	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		1.4433	1.4433										Vrije Universiteit Amsterdam

2. Compute Annual aggregation Parameters

a. Calculate the statistical parameters by monitoring site, program, parameter and year using the following formulas:

AVERAGE WITH IF= AVERAGEIF(range, criteria,(average_range))

MEDIAN WITH IF=MEDIAN(IF(logical_test, median_range))

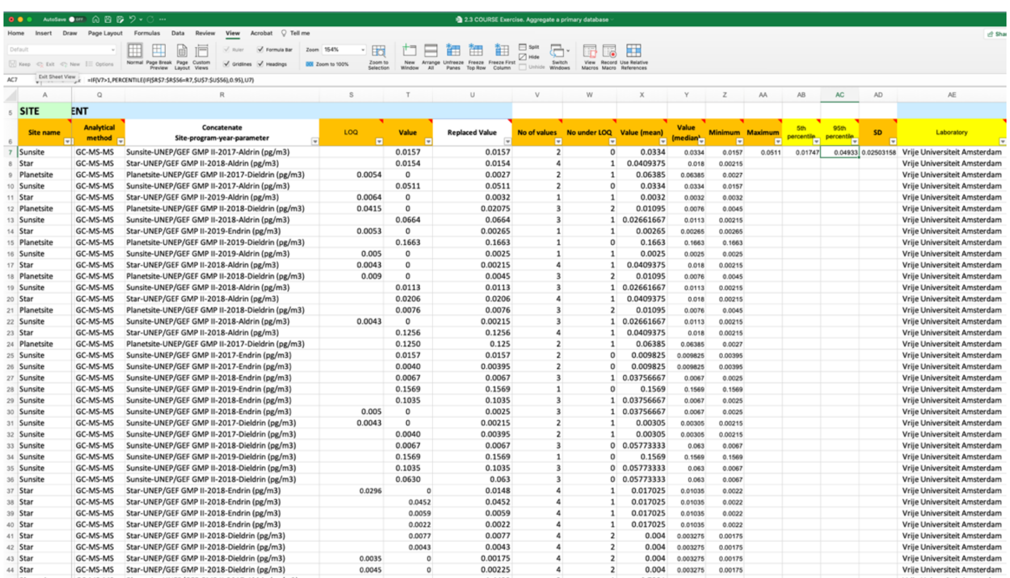
MAX OR MIN WITH IF =MAXIFS(max_range, criteria_range1, criteria1,…))

PERCENTILE WITH IF= IF(logical_test,PERCENTILE(IF logical_test,percentile_range),k),cell)

SD= IF(logical_test,STDEV(IF(logical_test,stdev_range)),cell)

b. Remember that the formulas should be adapted to each database using the concatenate column as ruler to calculate the statistical parameters. The formulas adapted to the exercise were:

Mean = AVERAGEIF($R$7:$R$56,R7,$U$7:$U$56)
Median =MEDIAN(IF(R7=$R$7:$R$56,$U$7:$U$56))
Minimum =MINIFS($U$7:$U$56,$R$7:$R$56,R7)
Maximum =MAXIFS($U$7:$U$56,$R$7:$R$56,R7)
5TH percentile = IF(V7>1,PERCENTILE(IF($R$7:$R$56=R7,$U$7:$U$56),0.05),U7)
95THpercentile = IF(V7>1,PERCENTILE(IF($R$7:$R$56=R7,$U$7:$U$56),0.95),U7)
SD= IF(V7>1,STDEV(IF(RR:RR6=R7,$UB$7:$U$56)),U7)

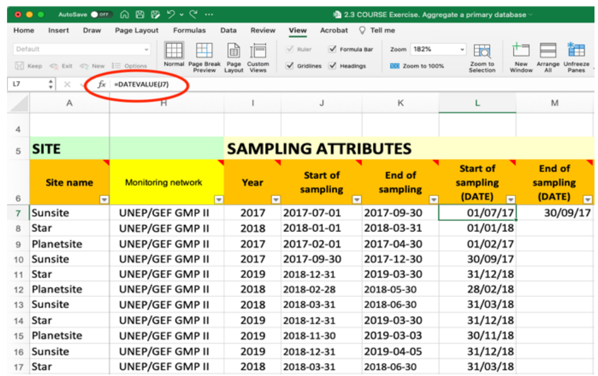


	Site name	Analytical method	Concatenate Site-program-year-parameter	LOQ	Value	Replaced Value	No of values	No under LOQ	Value (mean)	Value (median)	Minimum	Maximum	5th percentile	95th percentile	SD	Laboratory
7	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0157	0.0157	2	0	0.0334	0.0334	0.0157	0.0511	0.01747	0.04933	0.02503158	Vrije Universiteit Amsterdam
8	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0154	0.0154	4	1	0.0409375	0.018	0.00215					Vrije Universiteit Amsterdam
9	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0054	0	0.0027	2	1	0.06385	0.06385	0.0027					Vrije Universiteit Amsterdam
10	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		0.0511	0.0511	2	0	0.0334	0.0334	0.0157					Vrije Universiteit Amsterdam
11	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.0064	0	0.0032	1	1	0.0032	0.0032	0.0032					Vrije Universiteit Amsterdam
12	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0415	0	0.02075	3	2	0.01095	0.0076	0.0045					Vrije Universiteit Amsterdam
13	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0664	0.0664	3	1	0.02661667	0.0113	0.00215					Vrije Universiteit Amsterdam
14	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2019-Endrin (pg/m3)	0.0053	0	0.00265	1	1	0.00265	0.00265	0.00265					Vrije Universiteit Amsterdam
15	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1663	0.1663	1	0	0.1663	0.1663	0.1663					Vrije Universiteit Amsterdam
16	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Aldrin (pg/m3)	0.005	0	0.0025	1	1	0.0025	0.0025	0.0025					Vrije Universiteit Amsterdam
17	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215	4	1	0.0409375	0.018	0.00215					Vrije Universiteit Amsterdam
18	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.009	0	0.0045	3	2	0.01095	0.0076	0.0045					Vrije Universiteit Amsterdam
19	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0113	0.0113	3	1	0.02661667	0.0113	0.00215					Vrije Universiteit Amsterdam
20	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.0206	0.0206	4	1	0.0409375	0.018	0.00215					Vrije Universiteit Amsterdam
21	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0076	0.0076	3	2	0.01095	0.0076	0.0045					Vrije Universiteit Amsterdam
22	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Aldrin (pg/m3)	0.0043	0	0.00215	3	1	0.02661667	0.0113	0.00215					Vrije Universiteit Amsterdam
23	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Aldrin (pg/m3)		0.1256	0.1256	4	1	0.0409375	0.018	0.00215					Vrije Universiteit Amsterdam
24	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.1250	0.125	2	1	0.06385	0.06385	0.0027					Vrije Universiteit Amsterdam
25	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0157	0.0157	2	0	0.009825	0.009825	0.00395					Vrije Universiteit Amsterdam
26	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Endrin (pg/m3)		0.0040	0.00395	2	0	0.009825	0.009825	0.00395					Vrije Universiteit Amsterdam
27	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0067	0.0067	3	1	0.03756667	0.0067	0.0025					Vrije Universiteit Amsterdam
28	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Endrin (pg/m3)		0.1569	0.1569	1	0	0.1569	0.1569	0.1569					Vrije Universiteit Amsterdam
29	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.1035	0.1035	3	1	0.03756667	0.0067	0.0025					Vrije Universiteit Amsterdam
30	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.005	0	0.0025	3	1	0.03756667	0.0067	0.0025					Vrije Universiteit Amsterdam
31	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)	0.0043	0	0.00215	2	1	0.00305	0.00305	0.00215					Vrije Universiteit Amsterdam
32	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2017-Dieldrin (pg/m3)		0.0040	0.00395	2	1	0.00305	0.00305	0.00215					Vrije Universiteit Amsterdam
33	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0067	0.0067	3	0	0.05773333	0.063	0.0067					Vrije Universiteit Amsterdam
34	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2019-Dieldrin (pg/m3)		0.1569	0.1569	1	0	0.1569	0.1569	0.1569					Vrije Universiteit Amsterdam
35	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.1035	0.1035	3	0	0.05773333	0.063	0.0067					Vrije Universiteit Amsterdam
36	Sunsite	GC-MS-MS	Sunsite-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0630	0.063	3	0	0.05773333	0.063	0.0067					Vrije Universiteit Amsterdam
37	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)	0.0296	0	0.0148	4	1	0.017025	0.01035	0.0022					Vrije Universiteit Amsterdam
38	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0452	0.0452	4	1	0.017025	0.01035	0.0022					Vrije Universiteit Amsterdam
39	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0059	0.0059	4	1	0.017025	0.01035	0.0022					Vrije Universiteit Amsterdam
40	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Endrin (pg/m3)		0.0022	0.0022	4	1	0.017025	0.01035	0.0022					Vrije Universiteit Amsterdam
41	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0077	0.0077	4	2	0.004	0.003275	0.00175					Vrije Universiteit Amsterdam
42	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)		0.0043	0.0043	4	2	0.004	0.003275	0.00175					Vrije Universiteit Amsterdam
43	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0035	0	0.00175	4	2	0.004	0.003275	0.00175					Vrije Universiteit Amsterdam
44	Star	GC-MS-MS	Star-UNEP/GEF GMP II-2018-Dieldrin (pg/m3)	0.0045	0	0.00225	4	2	0.004	0.003275	0.00175					Vrije Universiteit Amsterdam
45	Planetsite	GC-MS-MS	Planetsite-UNEP/GEF GMP II-2017-Aldrin (pg/m3)		1.4433	1.4433	2	1	0.7221	0.7221	0.0009					Vrije Universiteit Amsterdam

3. **Start/end of sampling adjustments:**

    a. Verify the format of the dates. If necessary, transform it into date format using the formula DATEVALUE in an additional column.

=DATEVALUE(date_text)



2.3 COURSE Exercise. Aggregate a primary database

L7 | =DATEVALUE(J7)

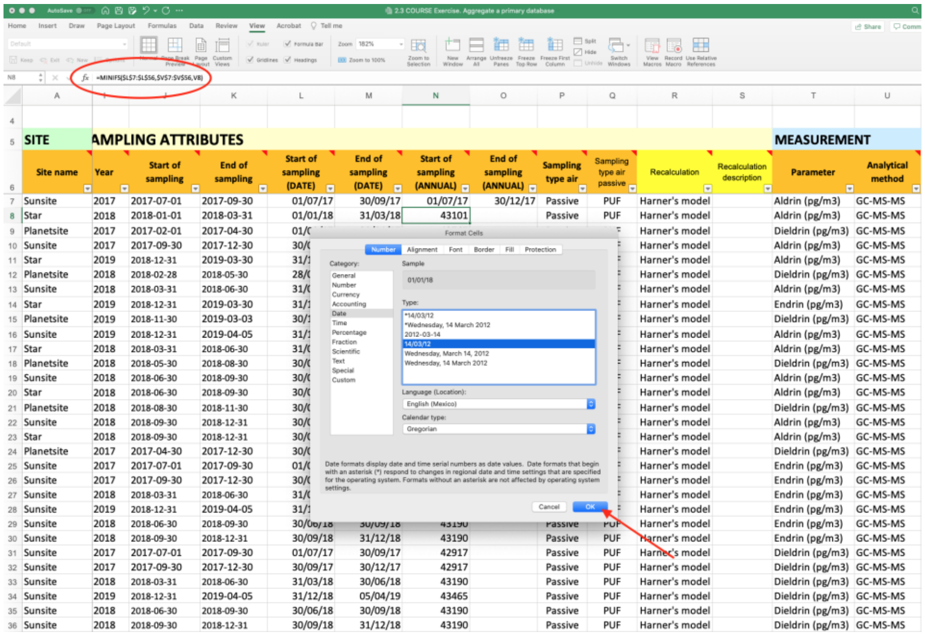
SITE		SAMPLING ATTRIBUTES				
Site name	Monitoring network	Year	Start of sampling	End of sampling	Start of sampling (DATE)	End of sampling (DATE)
Sunsite	UNEP/GEF GMP II	2017	2017-07-01	2017-09-30	01/07/17	30/09/17
Star	UNEP/GEF GMP II	2018	2018-01-01	2018-03-31	01/01/18	
Planetsite	UNEP/GEF GMP II	2017	2017-02-01	2017-04-30	01/02/17	
Sunsite	UNEP/GEF GMP II	2017	2017-09-30	2017-12-30	30/09/17	
Star	UNEP/GEF GMP II	2019	2018-12-31	2019-03-30	31/12/18	
Planetsite	UNEP/GEF GMP II	2018	2018-02-28	2018-05-30	28/02/18	
Sunsite	UNEP/GEF GMP II	2018	2018-03-31	2018-06-30	31/03/18	
Star	UNEP/GEF GMP II	2019	2018-12-31	2019-03-30	31/12/18	
Planetsite	UNEP/GEF GMP II	2019	2018-11-30	2019-03-03	30/11/18	
Sunsite	UNEP/GEF GMP II	2019	2018-12-31	2019-04-05	31/12/18	
Star	UNEP/GEF GMP II	2018	2018-03-31	2018-06-30	31/03/18	

    a. Add two more columns for the calculation of the start and end of sampling. Calculate the aggregate Start and End of sampling with the following formulas and give format to the values:

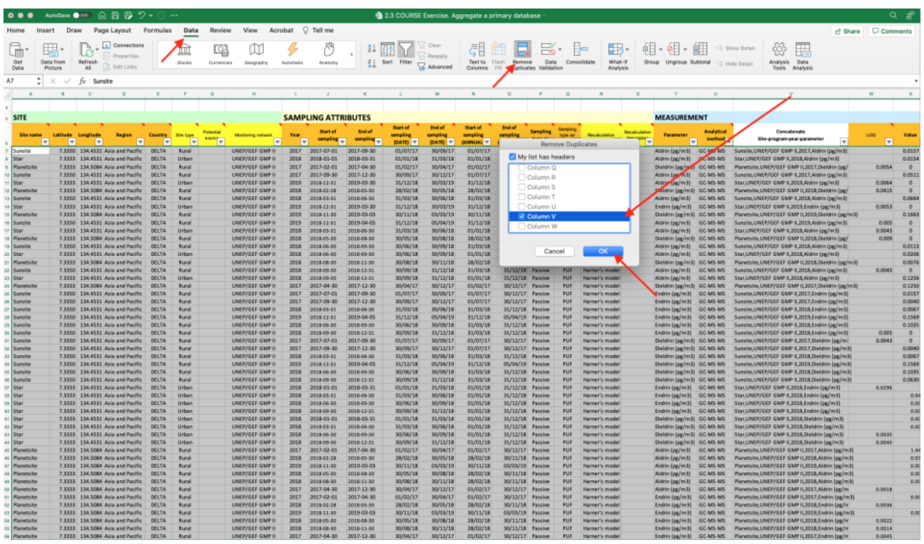
= MINIFS(min_range, criteria_range1, criteria1,…)
= MAXIFS(max_range, criteria_range1, criteria1,…)

Formulas adapted to this exercise were:

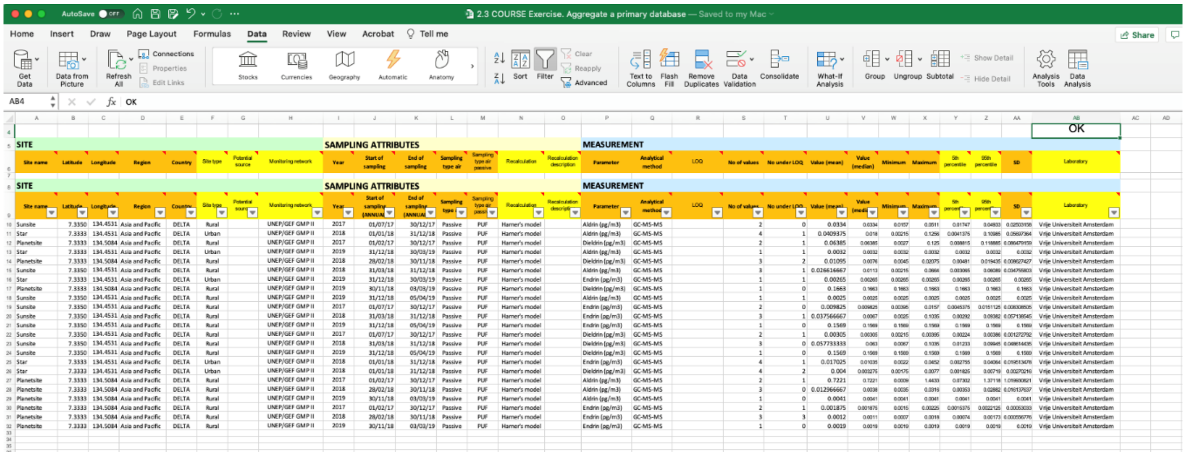
Start of Sampling (Annual) = MINIFS($L$7:$L$56,$V$7:$V$56,V7)
End of Sampling (Annual) = MAXIFS($M$7:$M$56,$V$7:$V$56,V7)



a. Duplicate this sheet. Copy and paste all the aggregated values in the new sheet. Remove duplicates by clicking in Remove duplicates from the Data tab. Select the concatenate column, for this exercise column V.



a. Remove the extra columns and clear the LOQ column. Review your database and template. Check that the aggregated data template is complete.

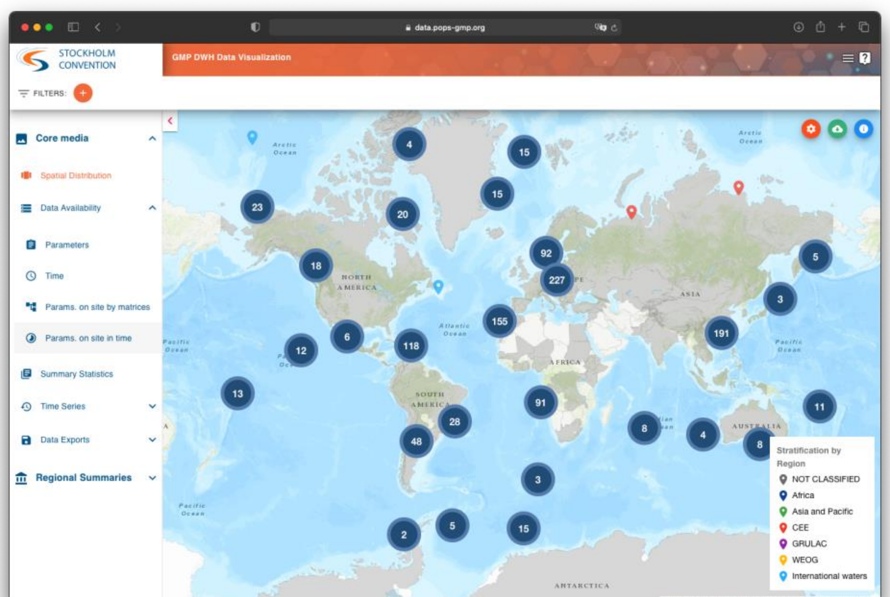


You have now the aggregated database.

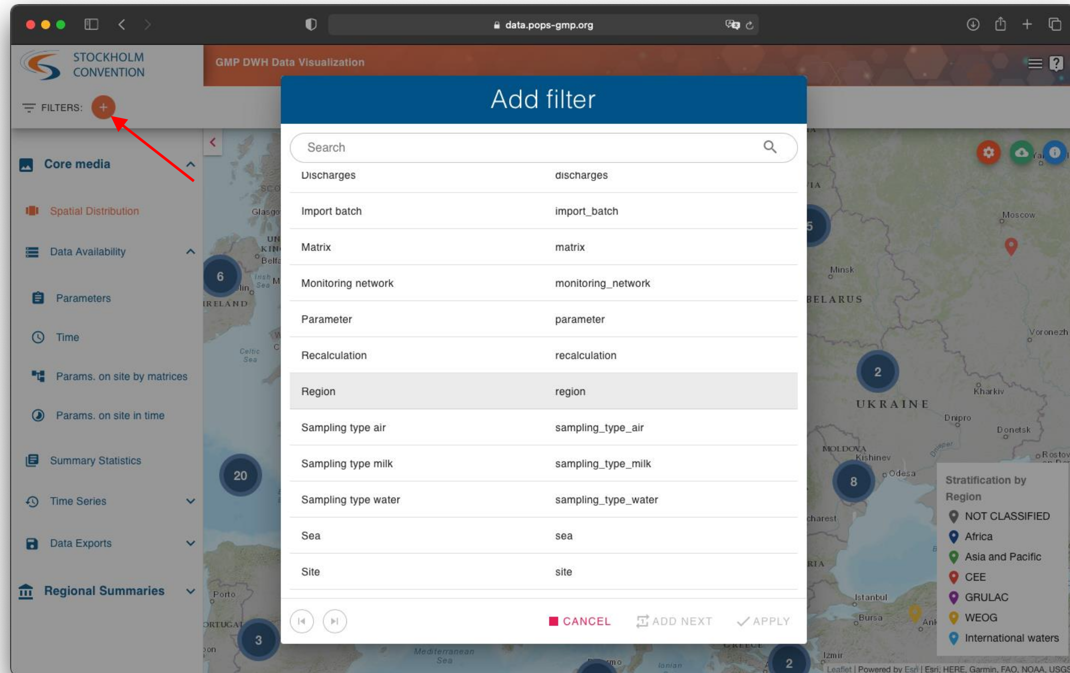
If the data is already uploaded in the DWH you could download the data in a CSV format and then transform it into an excel file. Note that all data that is available in the DWH will be aggregated data. The following section describes how to download a set of data to be analyzed in a spreadsheet.

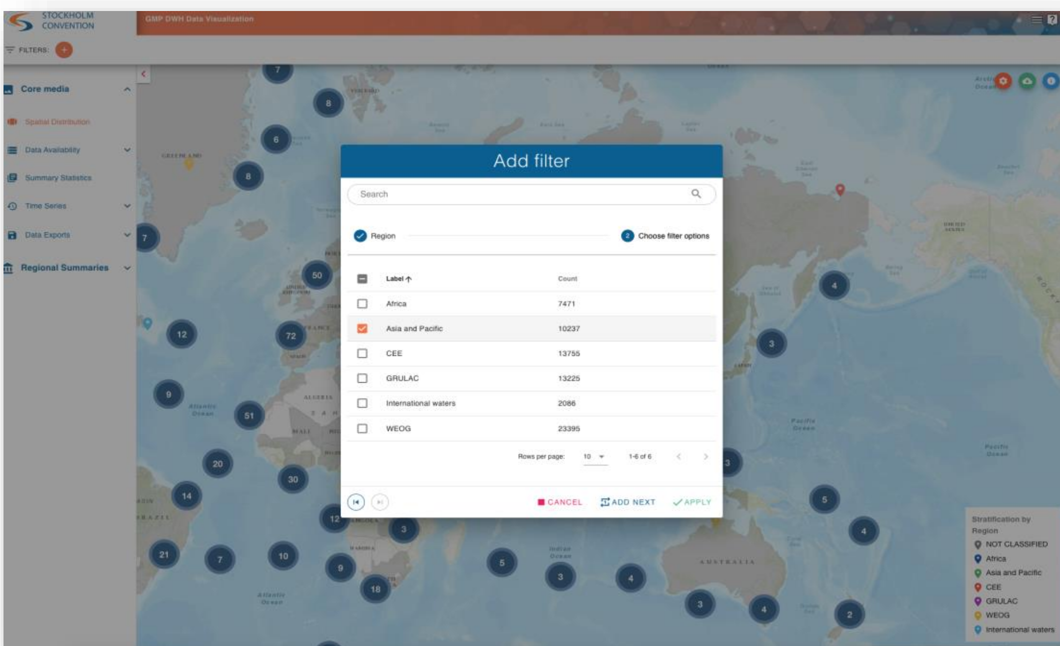
2.3.3 Procedure to download and configurate a Database from the DWH. Exercise 2.4

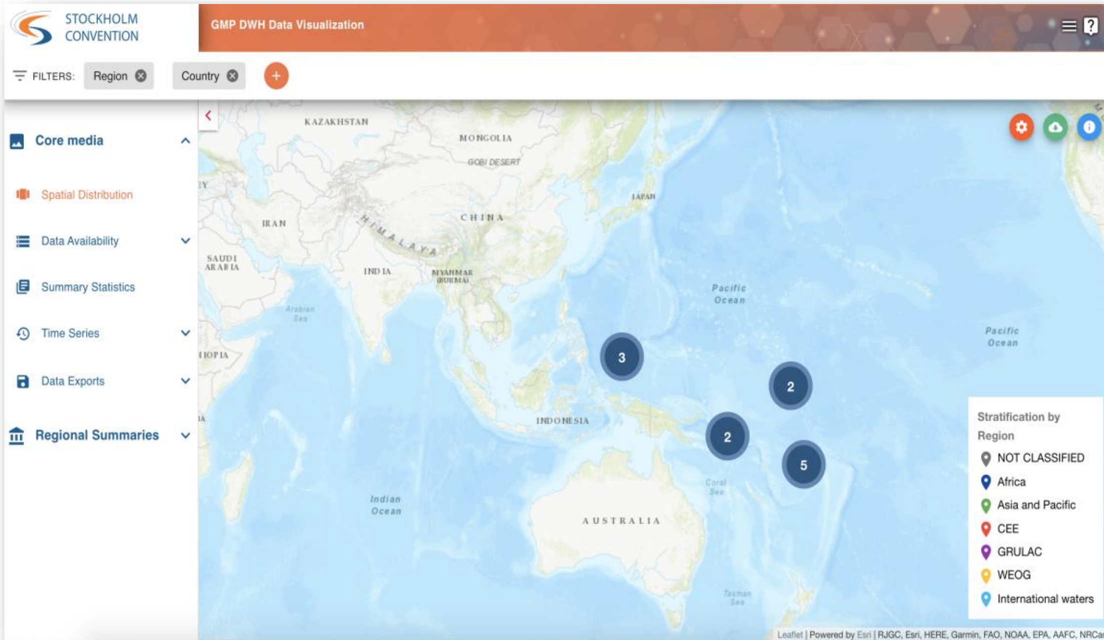
1. **Access the Data Warehouse and download the data selected (https://www.pops-gmp.org/index.php?pg=gmp-data-warehouse)**



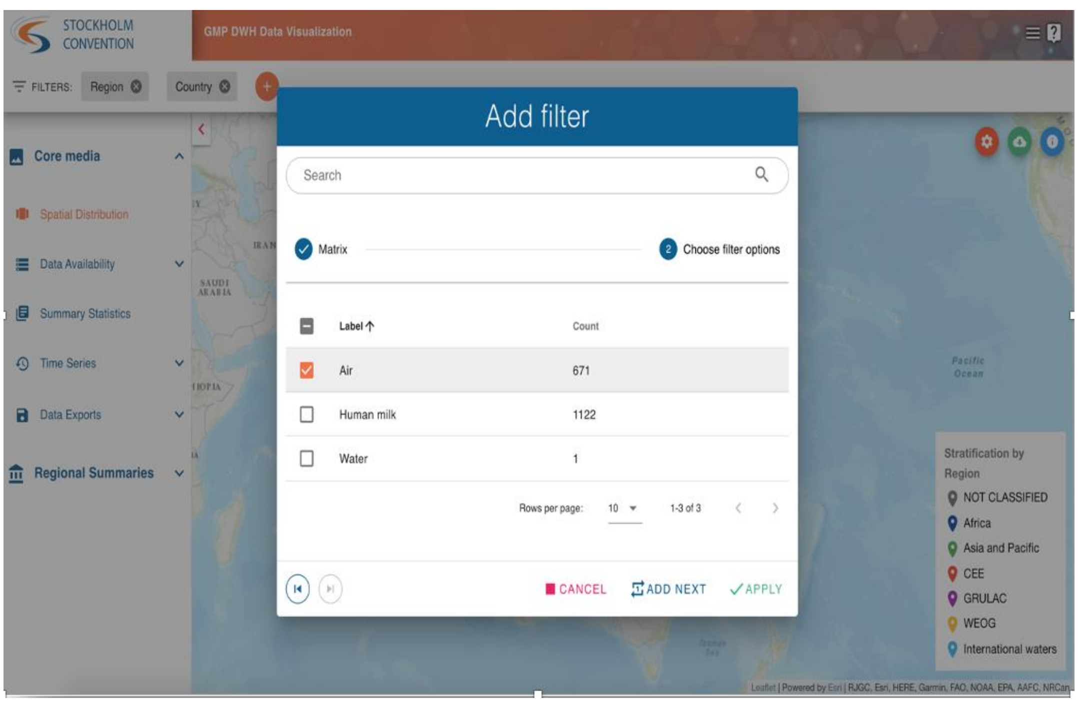
a. Click the orange dot near Filters and add a filter of the data you want to download or analyze. If you want to analyze the Air data of your country, first choose Region, then Country and then Matrix.

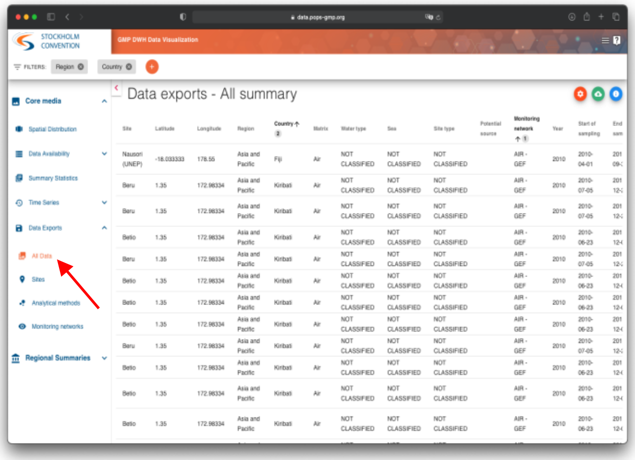




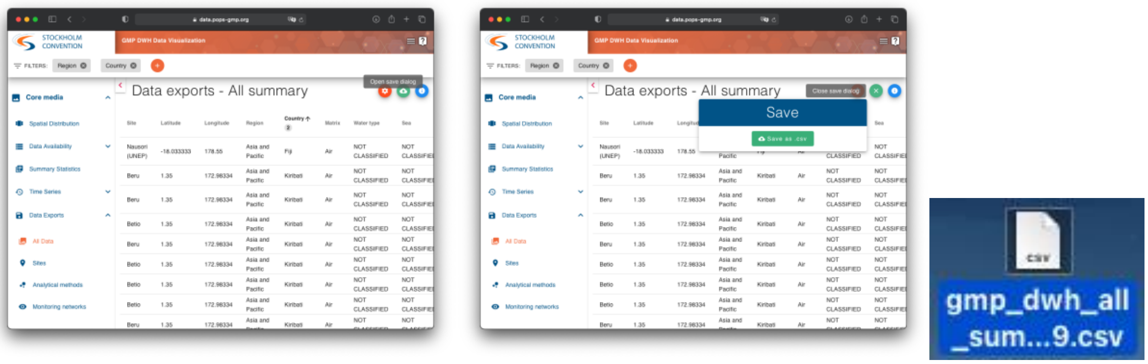


b. Select the Matrix you want to analyze and then "Data Exports", All Data.

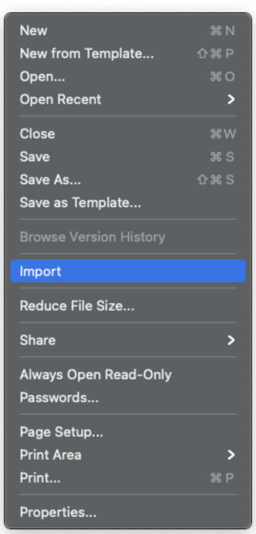


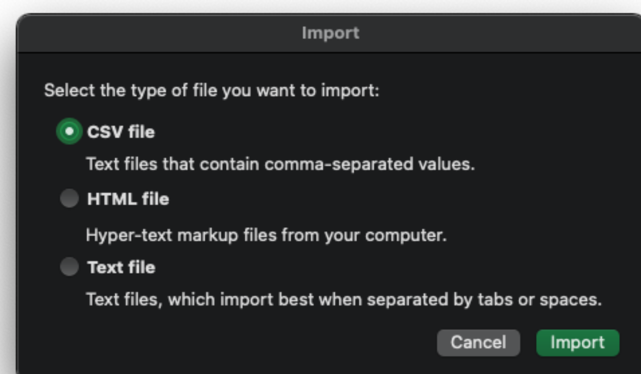


c. Click on the menu "Open save dialog"

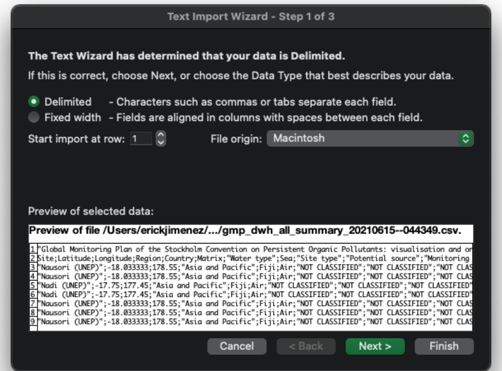


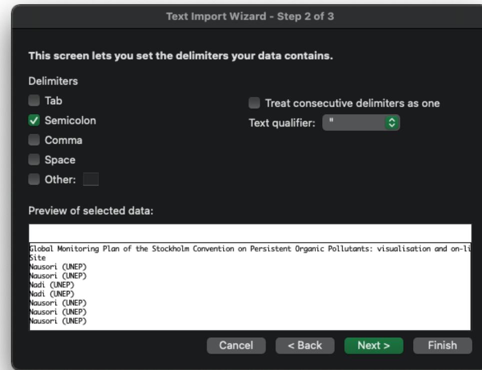
d. Open Excel and go to the Menu "File", then to the submenu "Import" and select the option "CSV file" and import.



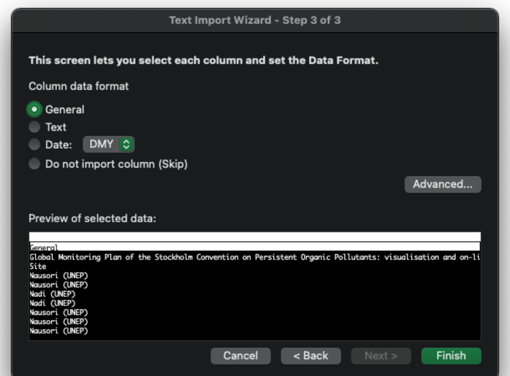


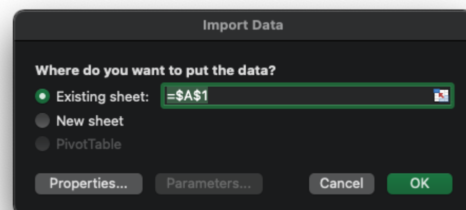
e. Select the option “delimited” and click Next. Then select the option semicolon.



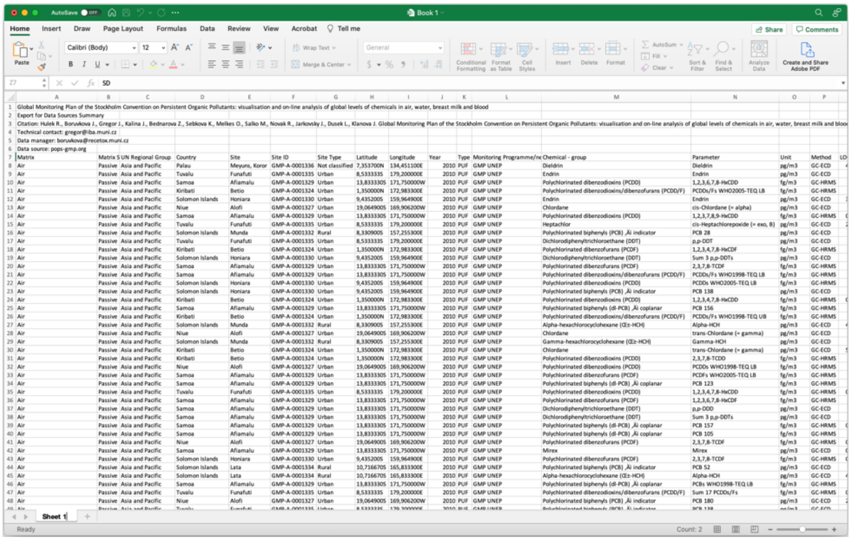


f. Select the option “General” for data format, click “Finish” and select the cell where you want to allocate your data.



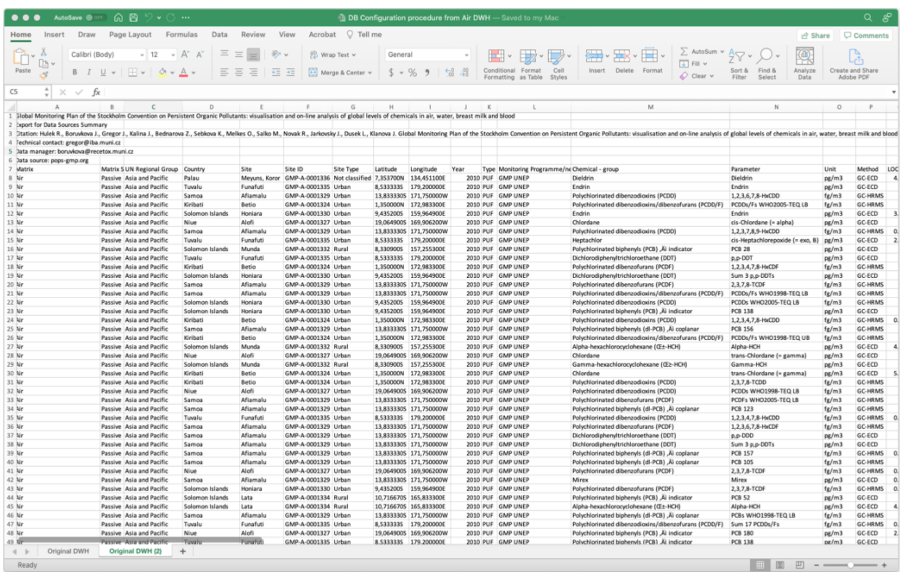


You have now downloaded the selected data from the DWH in a CSV file and have already transformed it into a file to be handled in Excel.



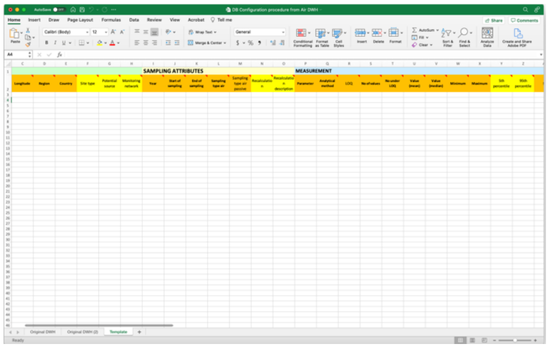
2. **Securing the data.**

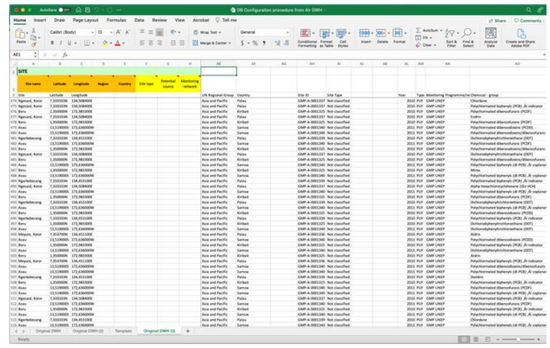
It is important to keep this data with no modifications. First, you will save the file with the name you like and identify as your POPs data for analysis; after that, you will rename the datasheet as "Original DWH" and will make a copy to do the preparation of the database before the analysis.



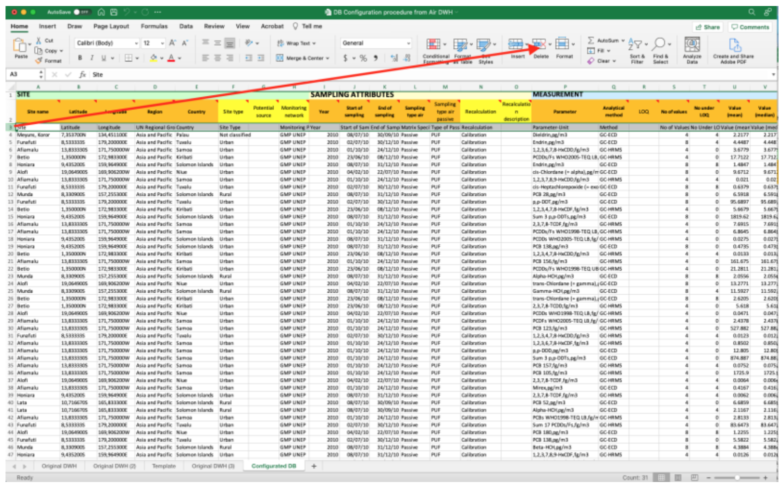
3. **Configurate the database.**

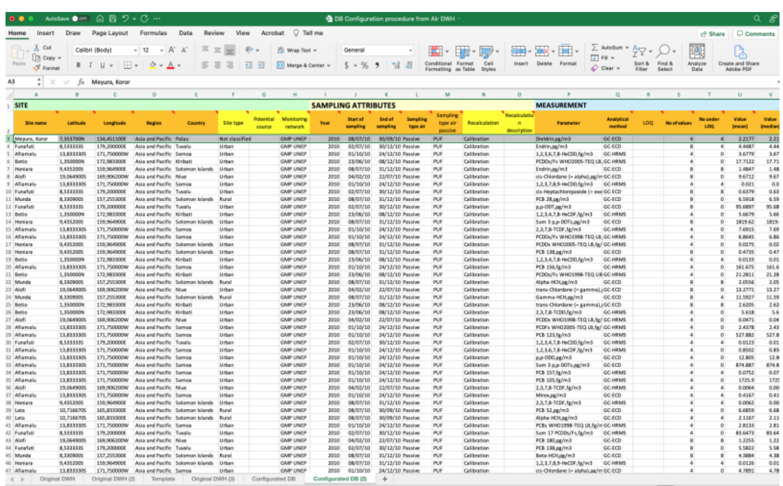
   a. You will need to add the corresponding template to the File and fill the template with the corresponding columns of the Original DWH (2). You can copy and paste the template header and data into a new sheet and sort all data columns into the corresponding header.





b. It is recommended to verify that the columns with the data are in the corresponding place in the header, and then delete row 3. You have now the DB configured.





Other specific global and regional monitoring programs have been sharing their POPs monitoring data with the regions by uploading their data in the DWH. When the regions download their monitoring data from the DWH, access to the data from these programs is also available and countries could benefit for other sources of information.

When data comes from a specific monitoring program, usually data handlers know exactly how the database is conformed. In this case database variables can be grouped categorizing them in additional columns to facilitate their evaluation, for instance, chemical substances are grouped by subgroups.

If the database is conformed from different sources of data, you must harmonize the data before you combine the different sources of data in your database, e.g. data un-aggregated and aggregated.

Modulo 3. DATA QUALITY ASSURANCE (PREPROCESS)

There are many definitions of data quality, but data is generally considered high quality if it is "fit for [its] intended uses in operations, decision making and planning" (Redman, 2013 and Fadahunsi, 2019). Moreover, data is deemed of high quality if it correctly represents the real-world construct to which it refers.

All data submitted for consideration under the GMP are evaluated and validated before its incorporation in the GMP DWH and the regional monitoring reports by the regional organization groups, and criteria for the evaluation of monitoring activities that could contribute with data to the Stockholm Convention Global Monitoring Plan are set out in Annex I to the Implementation of the Global Monitoring Plan for effectiveness evaluation as amended after the fourth meeting of the Conference of the Parties to the Stockholm Convention (UNEP, 2013).

Data quality assurance is the process of data profiling to discover inconsistencies and other anomalies in the data, as well as performing data cleansing/ flagging activities to improve the data quality. Data cleansing or data cleaning is the process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database.

The main goal of quality assurance (QA) is to set procedures and processes in place that will minimize risk and prevent any predictable defects from happening. In our case we need to detect bias in the concentration values which can result from different sampling techniques, protocols, different location of sampling sites and different classification of samples, among others.

Once the database is designed and data has been uploaded on the templates, it is important to set the criteria that will support the data quality objectives. Therefore, criteria that will assure the quality of the data depend on the monitoring objective, data quality objectives established at the design of the monitoring program and sampling protocols, among others.

The GMP Guidance (UNEP,2021) defines the monitoring objective, and qualitative and quantitative objectives for temporal studies:

“A qualitative objective for temporal studies could be stated as follows:

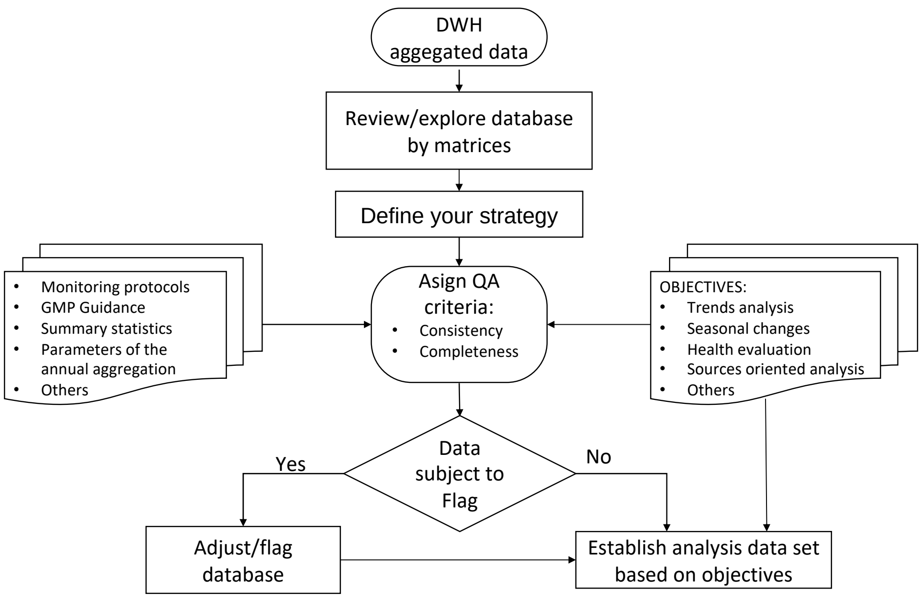
> To detect a decrease within a time period of 10 years with a statistical power of 80% at a significance level of 5%.

A quantitative objective for temporal studies could be stated as follows:

> To detect a 50 % decrease within a time period of 10 years with a statistical power of 80 % at a significance level of 5 %. (A 50 % decrease within a time period of 10 years corresponds to an annual decrease of about 7 %).”

GMP Guidance, monitoring protocols, SOP, statistic parameters and other parameters like number of values, numbers of values below LOQ, among others will give the information needed to set the QA criteria. The following Figure 4 provides the flow of processes to identify criteria that will be applied for assessing the database. For annually aggregated data comparisons usually two main attributes of the data must be confirmed: consistency and completeness.

Figure 4. Flow of data quality assurance



Consistency. It refers to the conformity in the characteristics or application of something. In the case of POPs monitoring, it could be related to period, site location, sampling protocol and country among others. In other words, it supports the comparability of the different samples, especially from the point of view of the type of site, matrix, sampling method, time span and sampling frequency.

Completeness. In the data quality framework, it refers to the degree to which all data in a data set is available.

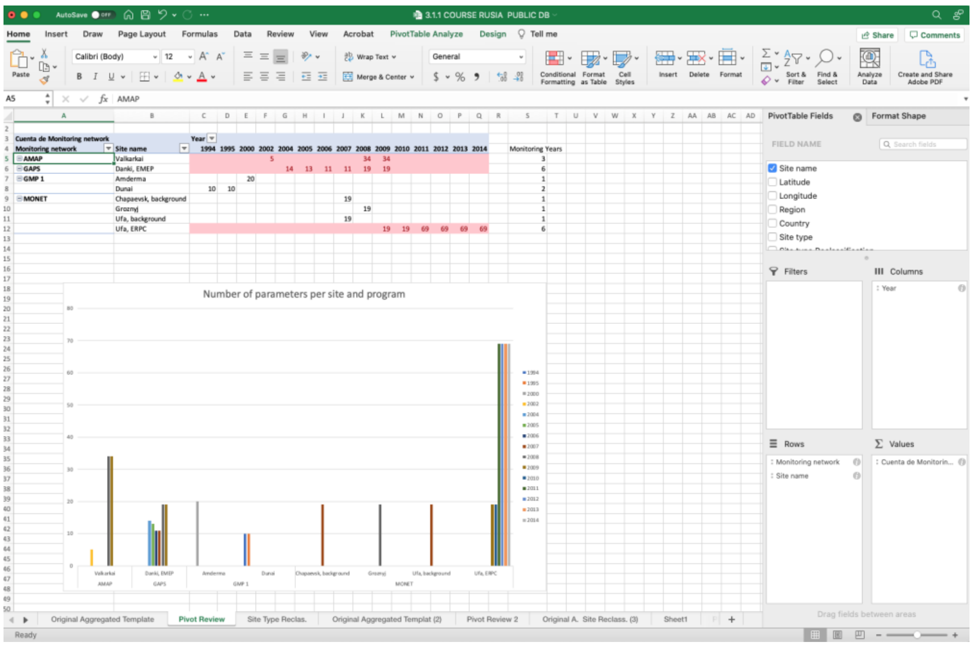
The three main steps recommended for the treatment of the data are:

3.1 Review of the database (EXPLORATION)

Once you have your database in an aggregated template per matrix, it is important to start recognizing and understanding your database in order to establish the strategy that you have to follow. If various monitoring programs deliver data in your region, you can separate the sampling programs in different datasheets. Pivot tables will help you to review each matrix per monitoring program.

A description of the monitoring programs, participating countries, sites, and parameters analyzed, among others, can be made generating summary tables and indicators to easily visualize the data of each program. It is recommended to apply filters, used pivot tables (see Annex 5) or any other tool to build multiple figures to better understand your database. Figure 5 shows an example of the application of a pivot table to generate a summary table and chart and a procedure on how to build a summary table and indicators is presented in section 3.4.

Figure 5. Pivot table and Chart of Russia Public Air DB



Summary tables of the air, water and human milk aggregated data of the six Pacific Islands are presented below. Data were downloaded from the DWH.

Table 1. Summary table of aggregated air matrix data for six Pacific Islands

Country	Site name	Monitoring network	Year				
			2010	2011	2017	2018	2019
Kiribati	Beru	AIR - GEF	58				
	Betio	AIR - GEF	58				
	Bonriki airport	AIR - GEF			72	45	
Niue	Alofi	AIR - GEF	58		33		
Samoa	Afiamalu Area	AIR - GEF				71	
	Apia	AIR - GEF	75				
	Asau, Savaii	AIR - GEF		75			
Solomon Islands	Honiara	AIR - GEF	58		72	45	
	Lata	AIR - GEF	26				
	Munda	AIR - GEF	26				
Tuvalu	Funafuti	AIR - GEF	58			72	
Vanuatu	Port Vila	AIR - GEF				72	45

Table 2. Summary table of aggregated water matrix data for six Pacific Islands

Country	Site name	Monitoring network	Year		
			2017	2018	2019
Kiribati	**Kiribati Bonriki**	UNEP/GEF GMP II	3	3	3
Niue	**Niue Alofi**	UNEP/GEF GMP II	3		
Samoa	**Samoa Vaisigano River**	UNEP/GEF GMP II	3	3	3
Solomon Islands	**Solomon Islands Mataniko River**	UNEP/GEF GMP II	3	3	
Tuvalu	**Tuvalu Fongafale islet**	UNEP/GEF GMP II	3	3	
Vanuatu	**Vanuatu Mele Bay**	UNEP/GEF GMP II	3	3	3

Table 3. Summary table of aggregated human milk matrix data for six Pacific Islands

Country	Monitoring network	Year					
		2006	2007	2011	2017	2018	2019
Kiribati	GMP 1	35					
	MILK - WHO	95		87		108	
	WHO		78				
Niue	MILK - WHO			84	99		3
Samoa	MILK - WHO			87			108
Solomon Islands	MILK - WHO			84			108
Tuvalu	MILK - WHO			97			
Vanuatu	MILK - WHO					108	

3.2 Define a strategy

When knowledge of the database provides enough information, you can choose the strategy for the approach you want to follow. First proceed to categorize the variables in the database. They can be grouped by monitoring program, country, type of site and compound group, among others. Then select the variables that you need to achieve your objective.

Therefore, the strategy consists of grouping and selecting the variables that will help you achieve your objective: monitoring programs, countries, type of sites and compound groups among others, according to the objective.

You can now proceed to assure the quality of the data which you are going to use and flag the other data. For example, the summary table of aggregated human milk matrix data for six Pacific Islands, Table 3, shows data from three programs, but if the objective is to compare POPs concentrations from the six islands, only the MILK-WHO program should be worked with.

3.3 Assign quality assurance criteria

Following the objectives for the GMP, the criteria established in the GMP Guidance and SOPs among others, we proceed to assign and verify the consistency and completeness criteria to the data that will be used to achieve the objective, for this case, changes in levels over time and spatial or/and temporal trends among others.

Once the strategy has been chosen, it is recommended to separate each monitoring program, including its sites and parameters measured, in different sheets. Since consistency and completeness criteria may be different for each program, each monitoring program must be verified according to its specific characteristics.

3.3.1 Confirm consistency.

As was mentioned, it refers to the conformity in the characteristics or application of something and supports the comparability of the different samples. Therefore, trends should be evaluated between data with same sampling protocols, sampling technics, type of site, matrix, time span and sampling frequency among others, in order to avoid bias. Comparisons between different programs can be carried out if data were previously evaluated in mirror sites and the corresponding statistical tests were carried out.

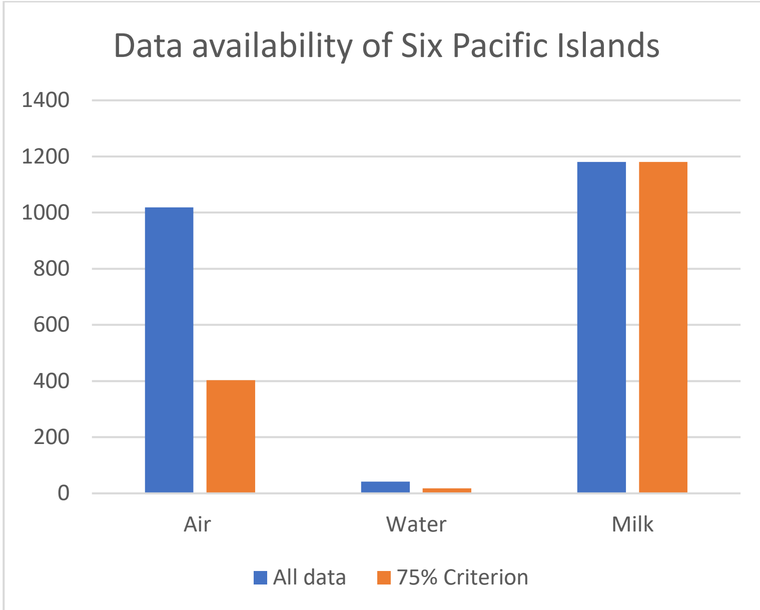
In the case of air/water samples is very important to verify if the sites that measured for several years under the same monitoring program and protocol, were in the same or almost the same place. Prevalence of sites will refer to sites that maintain their location through years of monitoring. A procedure to verify the consistency of the sites including its prevalence is available in section 3.4

3.3.2. Completeness of data

The GMP Guidance (UNEP; 2021) recommends the use of annually aggregated data for spatial and temporal comparisons and quantification of time-related trends, to avoid bias related to seasonal changes.

For air matrix the criterion of 75% of sampling days per sampling year is recommended to validate the sampling years of each monitoring site and program. In the case of passive PUF monitoring, it needs to verify that each year of sampling was represented by at least 3 samples and exposed each for almost three months (around 270 days in total) and in the case of XAD sampling, it needs to verify that the samplers were exposed for at least 275 days to represent each sampling year. Figure 11 shows the reduction of the available data when the 75% criterion of completeness was applied to the six Pacific Islands data. The procedure to verify the completeness of the aggregated data is available in section 3.4

Figure 11. Amount of data available of six Pacific Islands and data available when the 75% criterion is applied (DWH data).



For active air sampling, the GMP Guidance recommends "one or more active high-volume air sampling stations per region which can provide episodic or cumulative sampling (for 1 to 2 days every week or continuously over periods of 1 to 2 weeks)" (UNEP; 2021). Thus, the completeness criterion should be established considering the recommendation of the GMP Guidance.

For water matrix, sampling is recommended in the GMP Guidance at a selected site 4 times a year (same site and with the same method) (UNEP; 2021); thus, the completeness criterion will be 3 out of 4 samples taken in a calendar year.

For biotic samples the GMP is using human milk and human maternal blood as the two equal core matrices for comparable biological monitoring. The WHO guidelines (WHO, 2007) and amended UNEP guidelines (UNEP, 2017a) require samples from 50 individuals. The protocol also makes provision for a country to stratify the participants such that it represents the presumed exposure profile of each country. This stratification will need to be the same for subsequent rounds, so that changes/trends can be followed. If a country has a population greater than 50 million it should include at least one additional participant per one million population over 50 million. Countries with populations well over 50 million (or with sufficient resources) are encouraged to prepare a second pooled sample (or more) if feasible. The power of the survey can be increased by the inclusion of more than 50 individual samples (UNEP; 2021).

Databases of these biotic matrices are already aggregated. Therefore, completeness criterion for biotic matrices could be established if information is available on the calculation of the aggregated values.

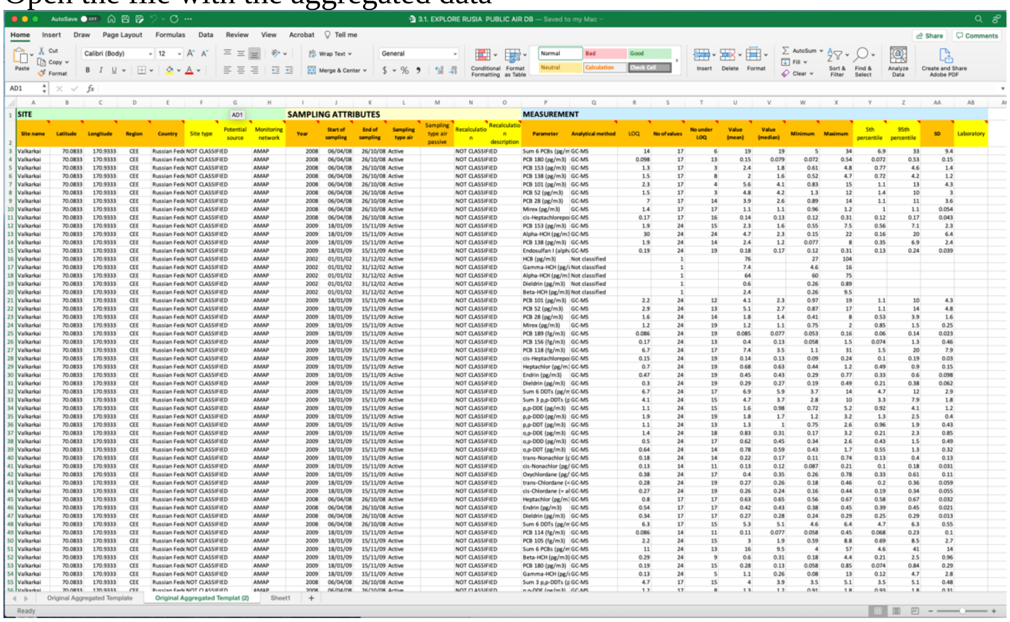
3.4 Procedures

The following procedures shows how to build a summary table and indicators, how to confirm the consistency of the sites, and verify the completeness of the data.

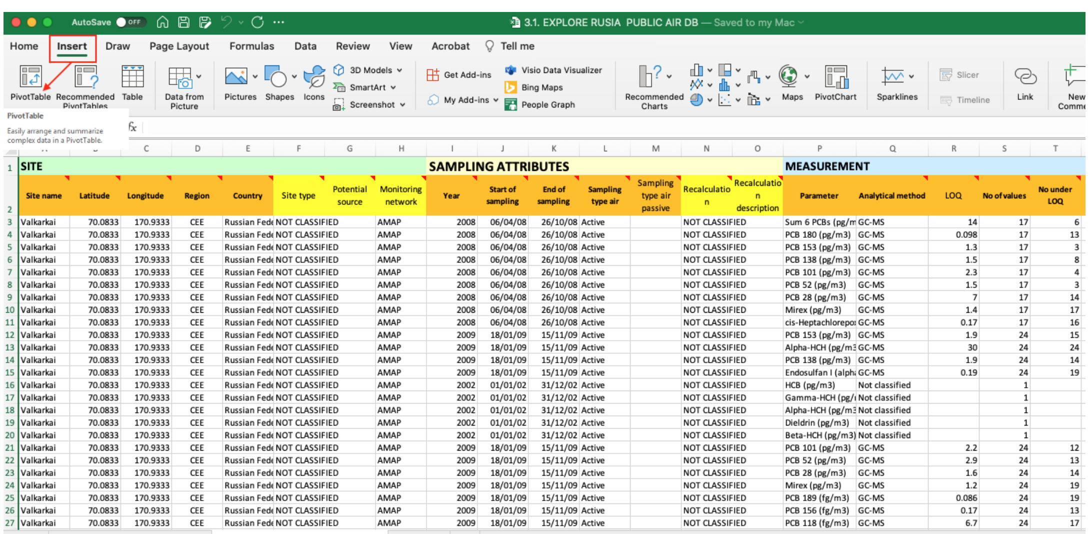
3.4.1 Procedure to generate the summary table and indicators: values per site, per year, and per program. Exercise 3.1.

To explore the database, it is suggested to use the Excel pivot tables method. To do so, the following steps are recommended:

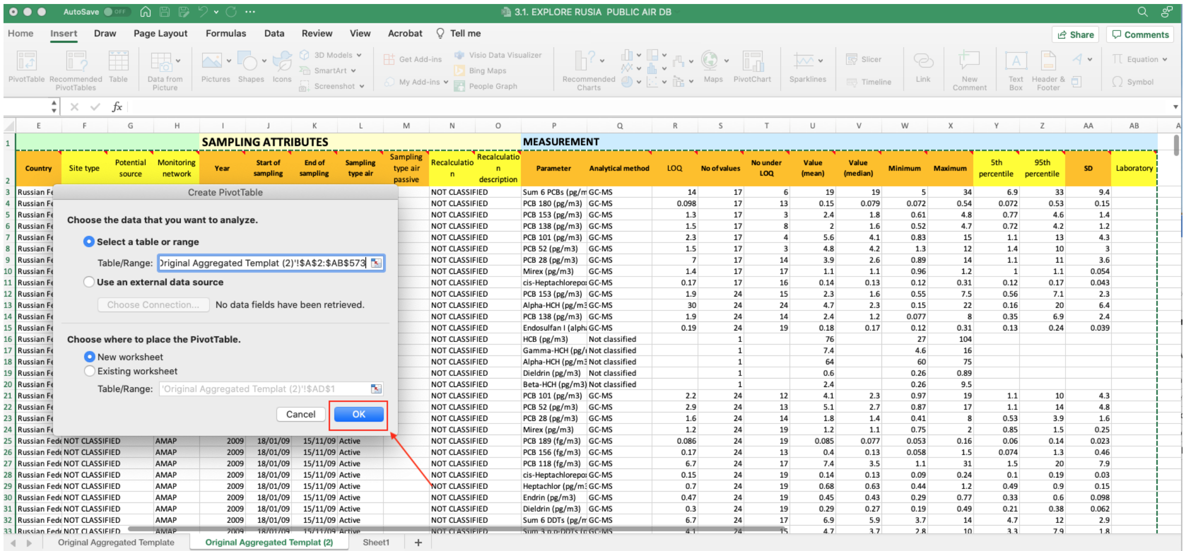
a) Open the file with the aggregated data



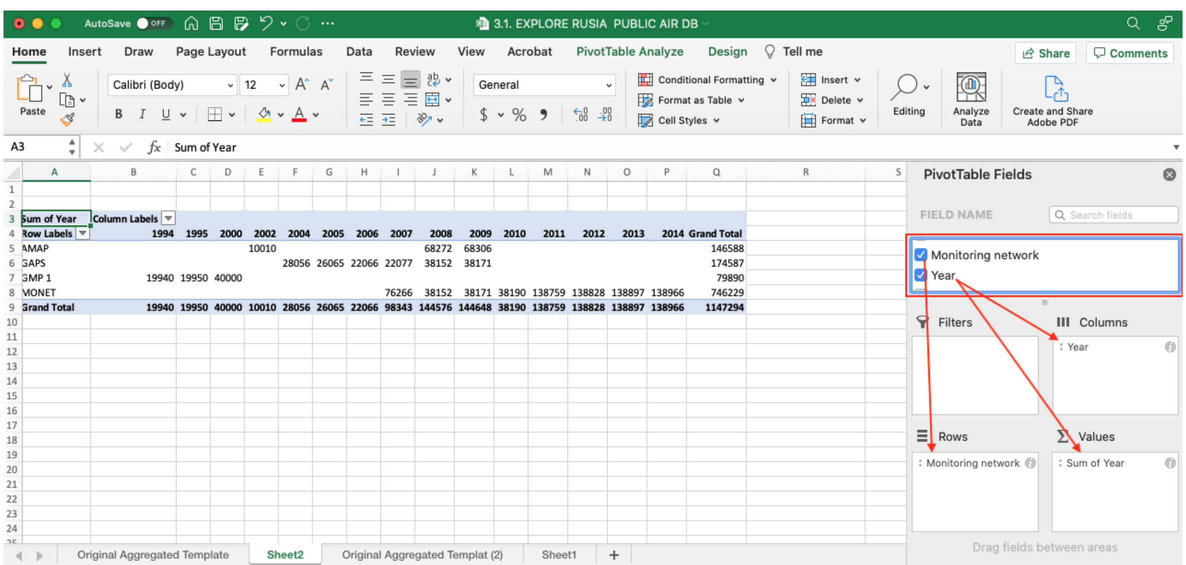
b) In the insert menu click on pivot table.



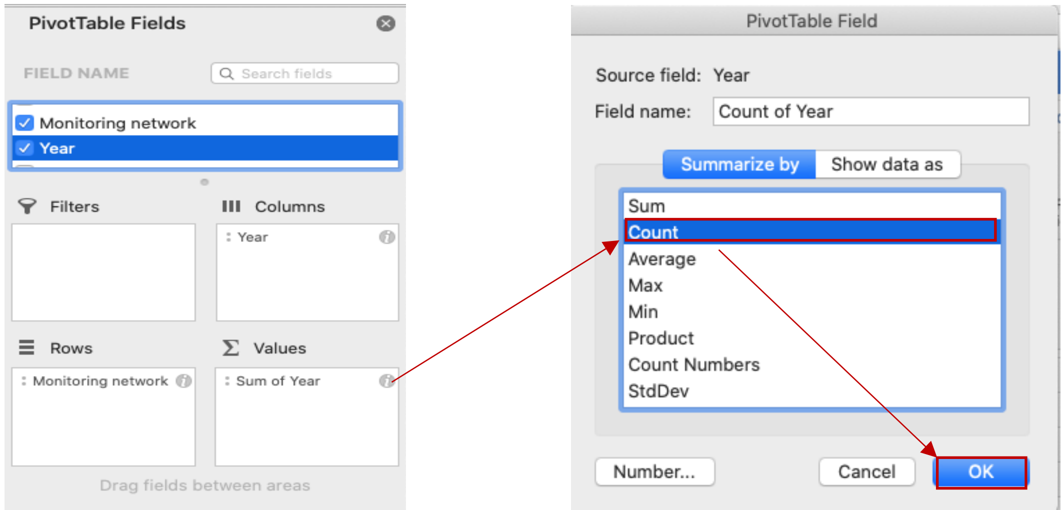
c) When you click on pivot table, the window for creating the pivot table appears. At this point you must select the range and a new sheet to work with and then click on the OK button.



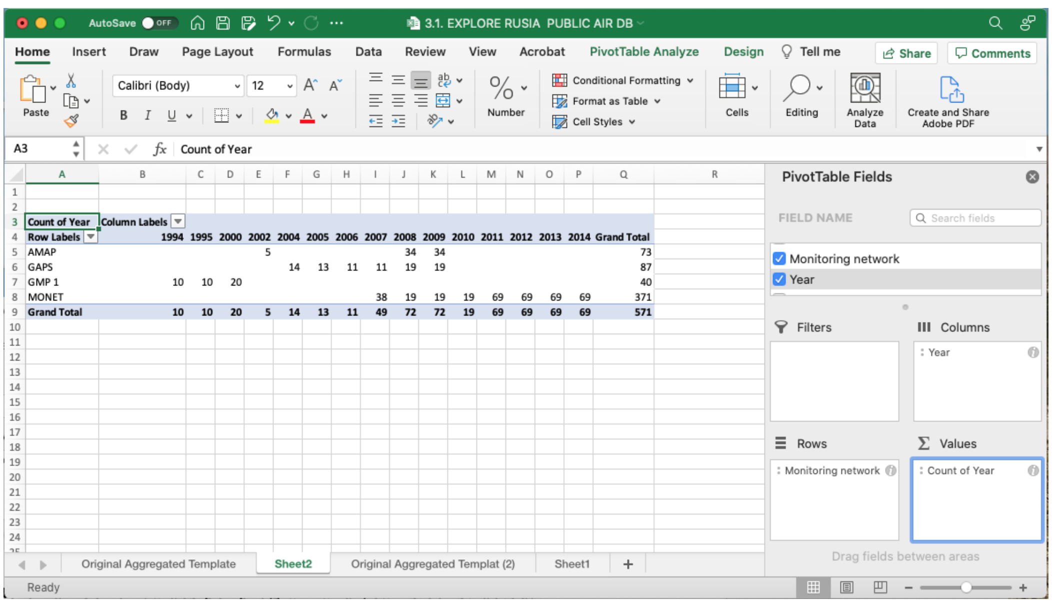
d) When generating the pivot table, select the elements to generate the desired query. In this case, the table is generated with the number of values per program per year. To do so, drag the "Monitoring network" field in the row box, the "Year" field in the column box and the "Year" field in the values box.



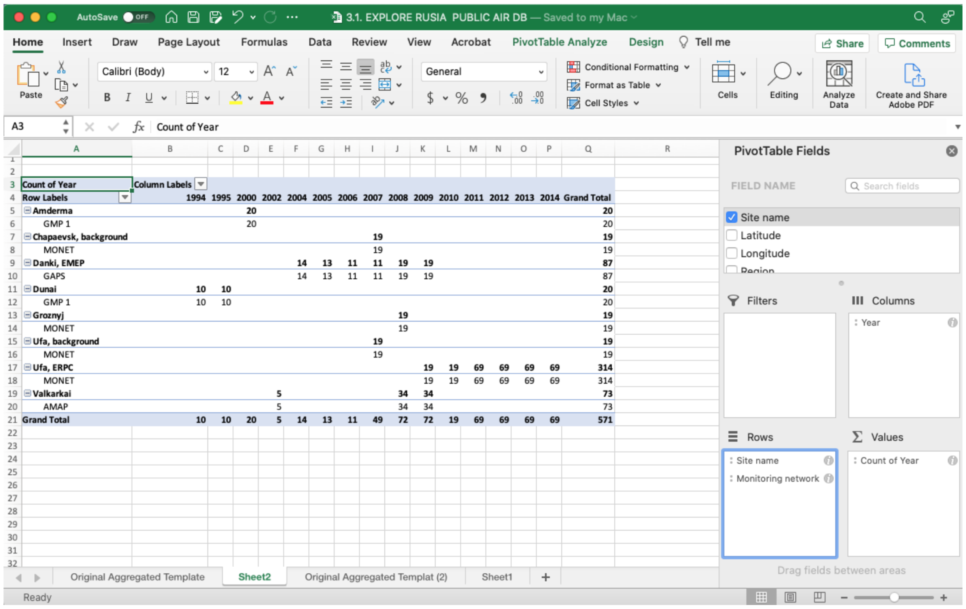
e) To finish displaying the number of data, the sum function must be changed to count in the value box by clicking on the "Sum of Year" and then on "Value field configuration". Select Count and OK.



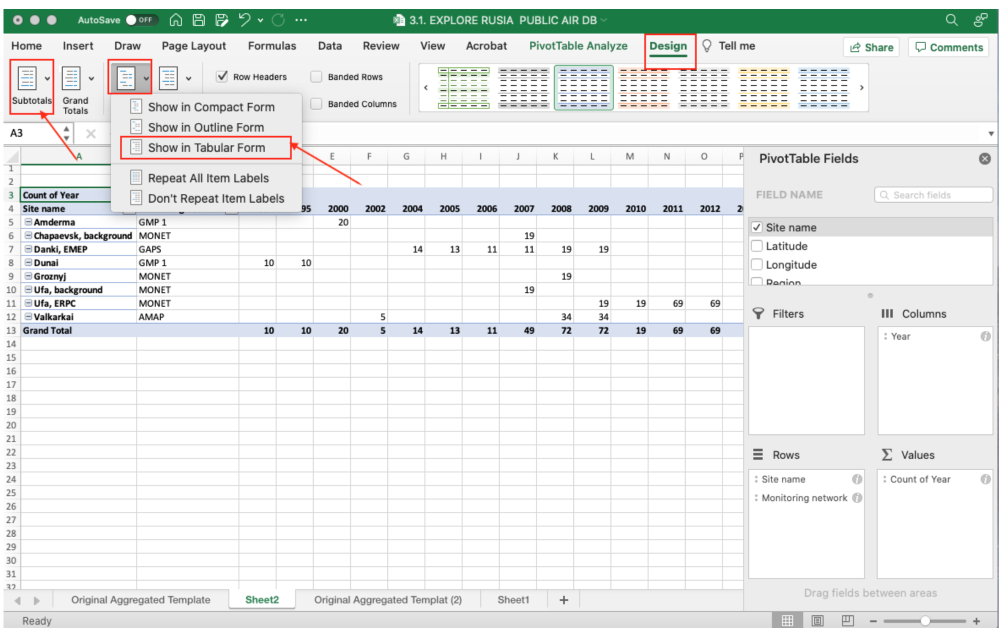
f) This is how the table number of values per program and year is constructed.



g) To make the table of number of values per site per year and per program in the table rows, drag the "Site" field before the "Monitoring network" field.



h) Go to the design tab and in Subtotals click on Don't show Subtotals and in Report Layout click in Show in Tabular Form

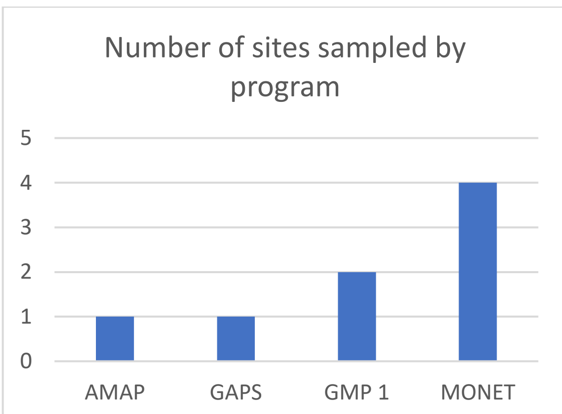


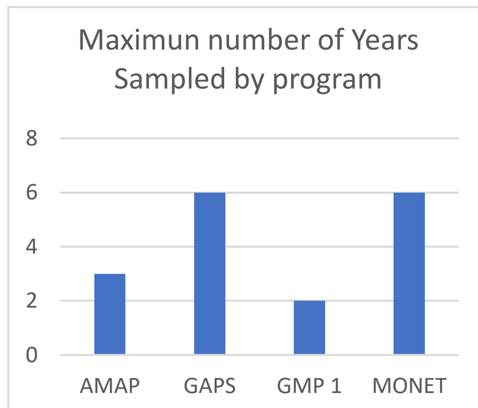
i) The table can be copied and pasted into any other document. It summarizes the number of values by site, monitoring program and year of measurement. It also allows to identify those sites where several years have been monitored, sites where several programs have been applied and years where several sites have been monitored simultaneously.

Monitoring network	Site name	YEAR														
		1994	1995	2000	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AMAP	Valkarkai				5					34	34					
GAPS	Danki, EMEP					14	13	11	11	19	19					
GMP 1	Amderma			20												
GMP 1	Dunai	10	10													
MONET	Chapaevsk, background								19							
MONET	Groznyj									19						
MONET	Ufa, background								19							
MONET	Ufa, ERPC										19	19	69	69	69	69

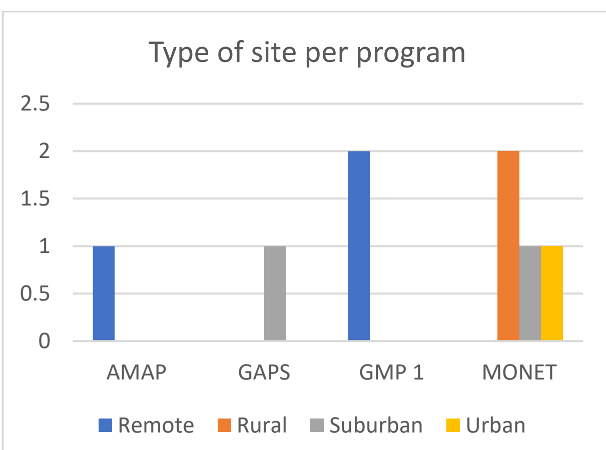
More attributes can be added to the pivot table such as: type of sampling, types of sites, among others, and graphs can be built to visualize the information. As an example, figures 6 to 9 are presented below.

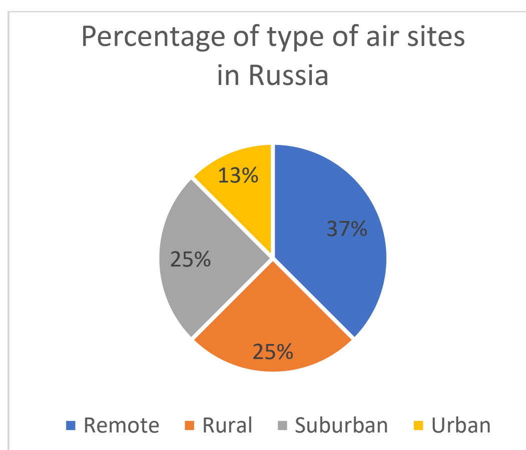
Figures 6 and 7. Characteristics of the monitoring programs of Russia Public Air DB





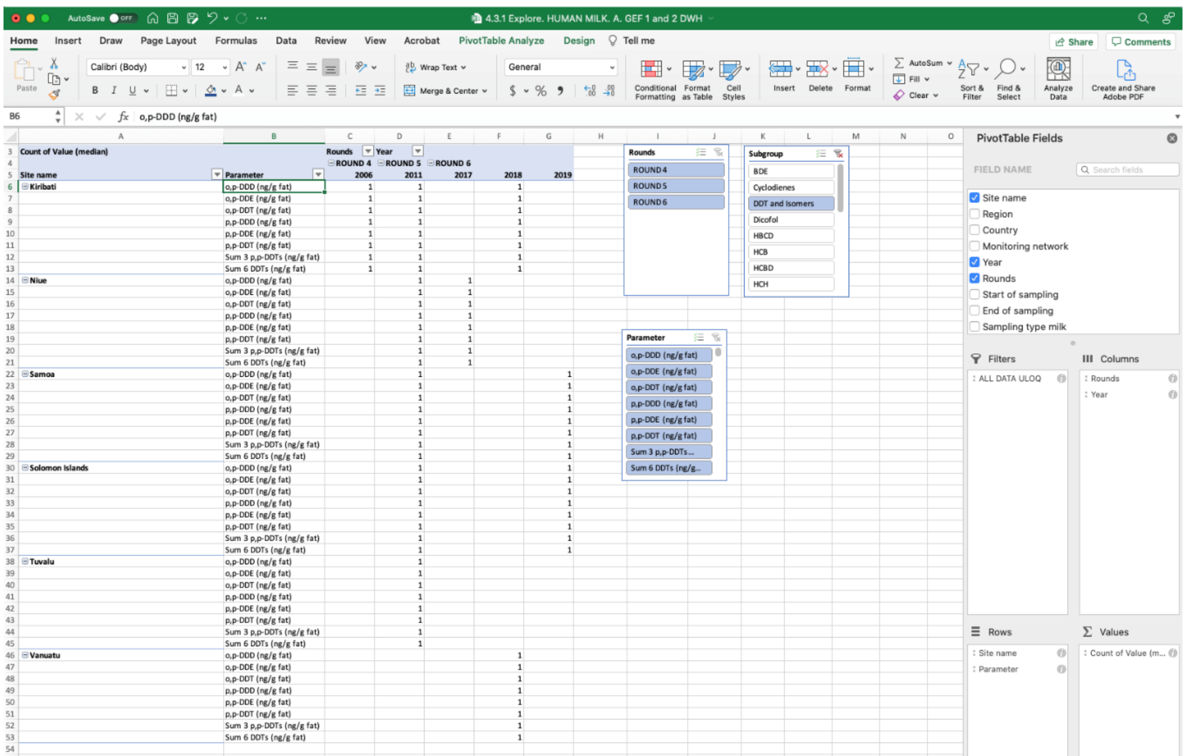
Figures 8 and 9. Characteristics monitoring sites of Russia Public Air DB





Also, in the process of reviewing and organizing the database it must be verified whether there are duplicate or triplicate records, data under the limit of quantification or outliers, among others. “Furthermore, the detection and possible elimination of erroneous extreme values would also noticeably improve the power” of the statistical analysis (UNEP, 2021). Summary tables of parameters per site or country must be develop using pivot tables.

Figure 10. Summary pivot table of the parameters of the human milk matrix aggregated database for six Pacific Islands



3.4.2 Procedure to confirm the consistency of the sites. Exercises 3.2 and 3.3

To confirm the consistency of the monitoring sites from one campaign to another, it will be necessary to first verify the prevalence of their setting by locating them geographically.

a) **Geographical location of the Sites.** The geographical location of the air/water sampling sites is extracted from the Pacific Islands database for this example and can be taken to an Open-Source Geographic Information System (GIS) licensed under GPL (General Public License) called QGIS, or to Google Maps, to facilitate the verification of the location of the sites. With any of these programs, you can review the location of the sampling sites to validate their geographic locations and consistency across records, monitoring years or between monitoring campaigns. The steps to locate sites are:

a. Identify site name and coordinates, latitude and longitude, of your database.
b. Open a new excel file. Type site name, latitude and longitude in three different columns; it is recommended to separate the sites per program or monitoring campaign.
c. Copy and paste sites names and coordinates.
d. Repeat this step for as many sites as there are.

As an example, suppose we have two files Aggregated GEF 1 Air (data from 2010-2012) and Aggregated GEF 2 Air (data from 2016-2018):

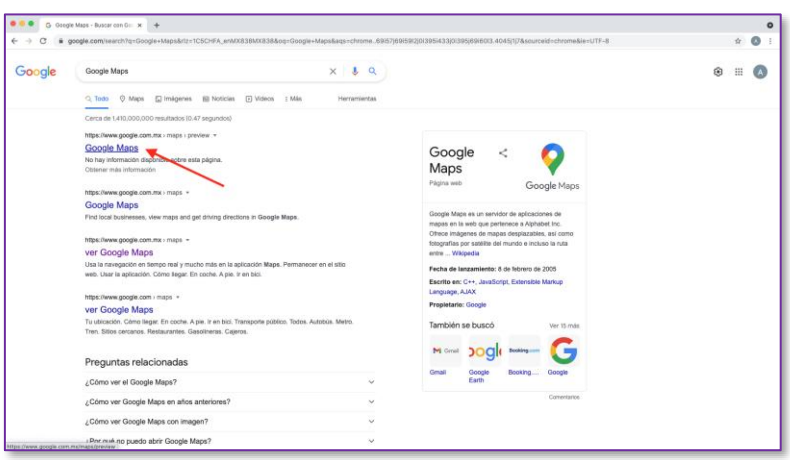
e. Follow the steps a to d and save your file as “Coordinates GEF 1 Air” Pacific Islands.

f. Repeat the steps a to d and save your file as “Coordinates GEF 2 Air”.

Site name GEF 1	Latitude	Longitude
Alofi	-19.0649	-169.9062
Apia	-13.833333	-171.75
Asau, Savaii	-13.519	-172.636
Beru	1.35	172.98334
Betio	1.35	172.98334
Funafuti	-8.533333	179.2
Honiara	-9.4352	159.9649
Lata	-10.716667	165.83333
Munda	-8.3309	157.2553

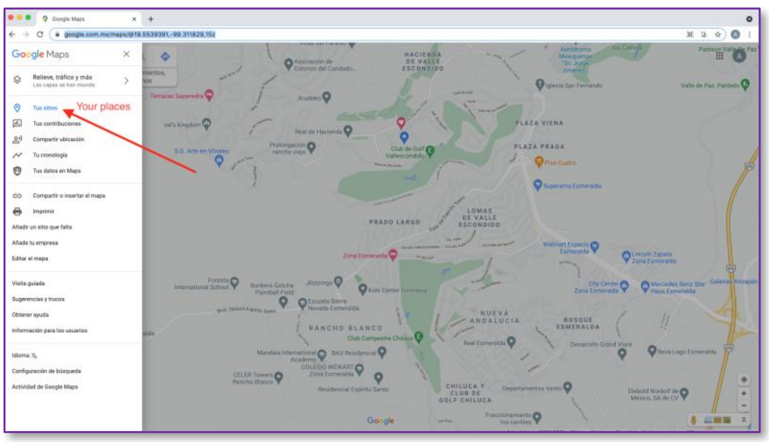
Site name GEF 2	Latitude	Longitude
Afiamalu Area	-13.910042	-171.79085
Alofi	-19.076944	-169.92583
Bonriki airport	1.379341	173.145018
Funafuti	-8.525327	179.196647
Port Vila	-17.72416667	168.3380833
Vavaya Ridge, Honaira	-9.43494	159.95435

g. Go to Google Maps or https://www.google.com/maps/about/mymaps/

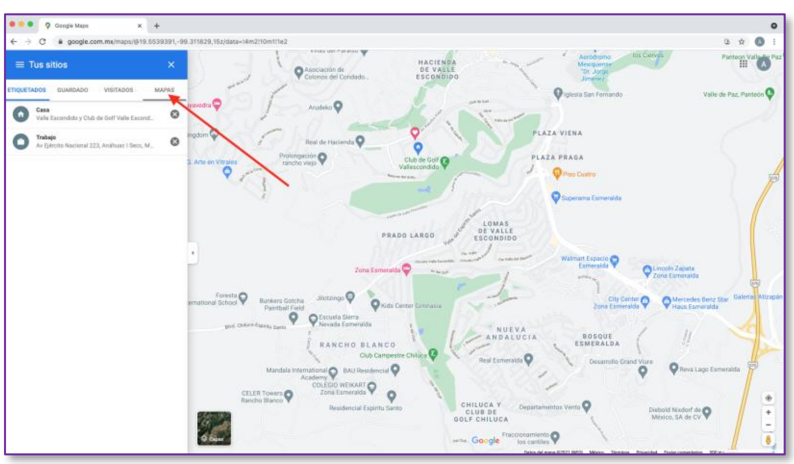


h. Click on Menu.

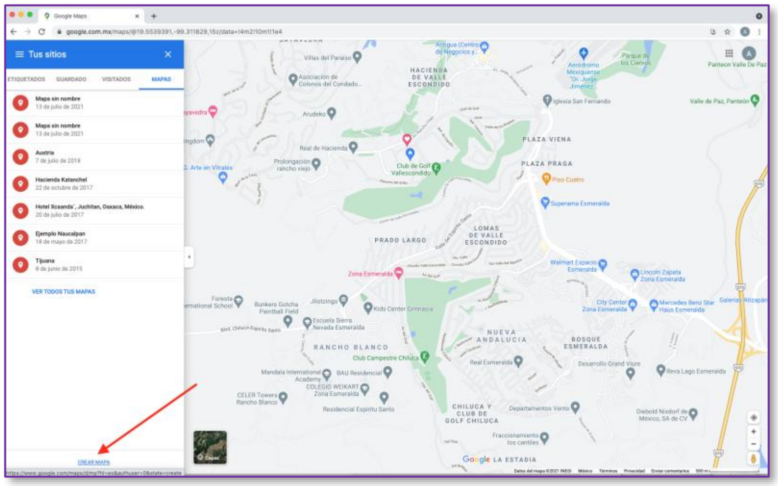
i. Click on your places



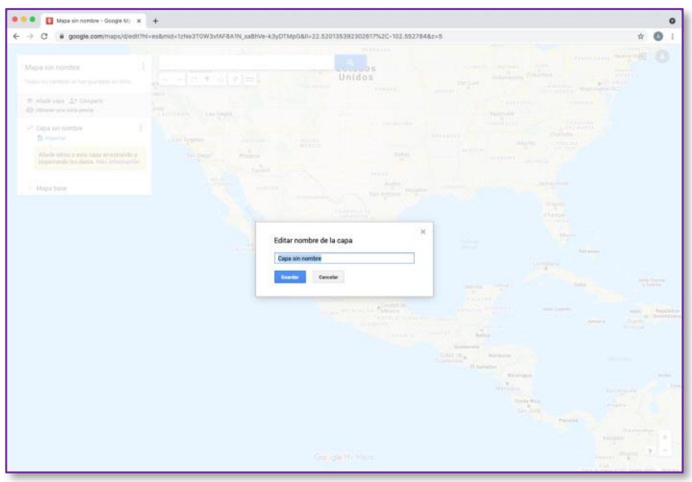
j. Click on maps

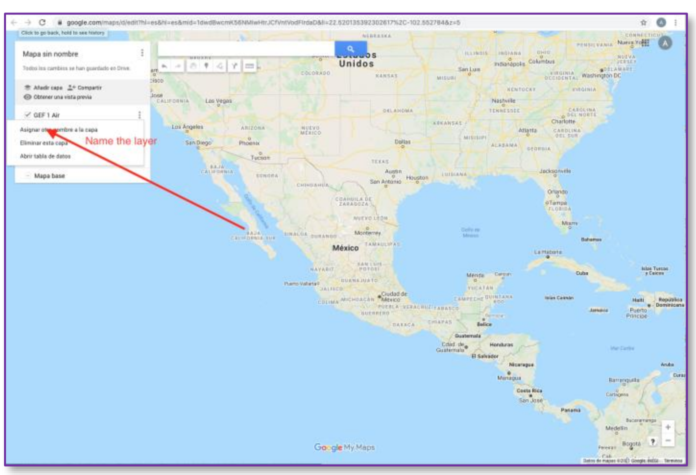


k. Click on create a map

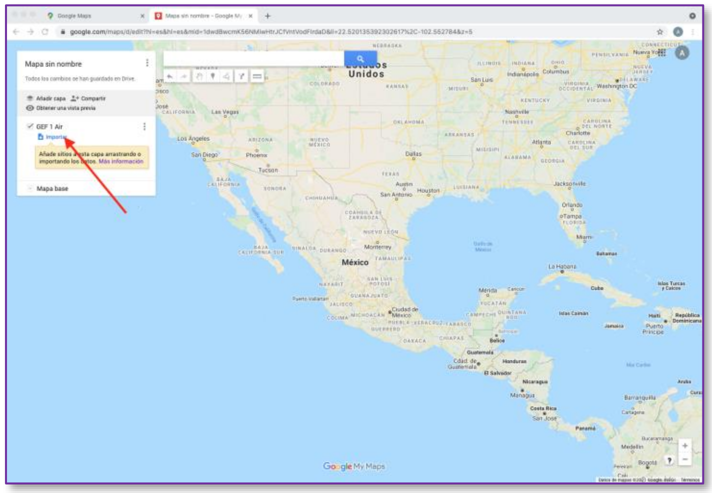


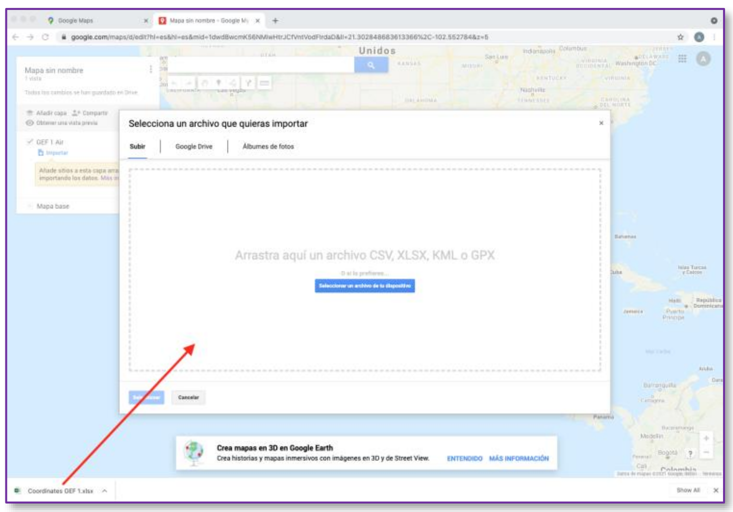
l. Name the layer. Choose a name and save it.



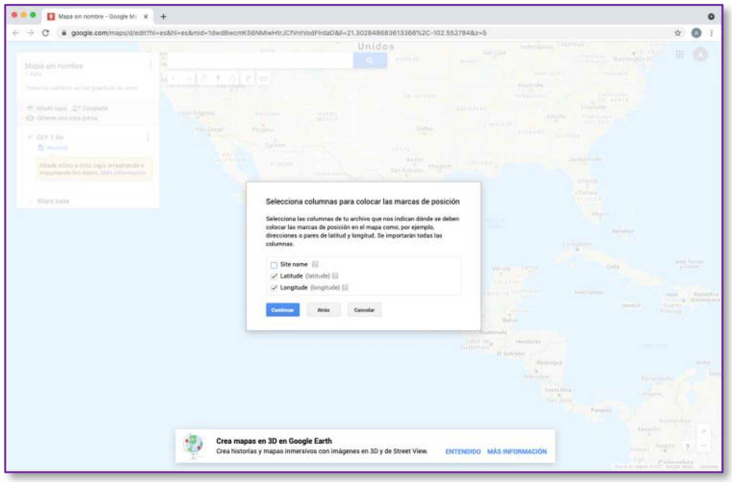


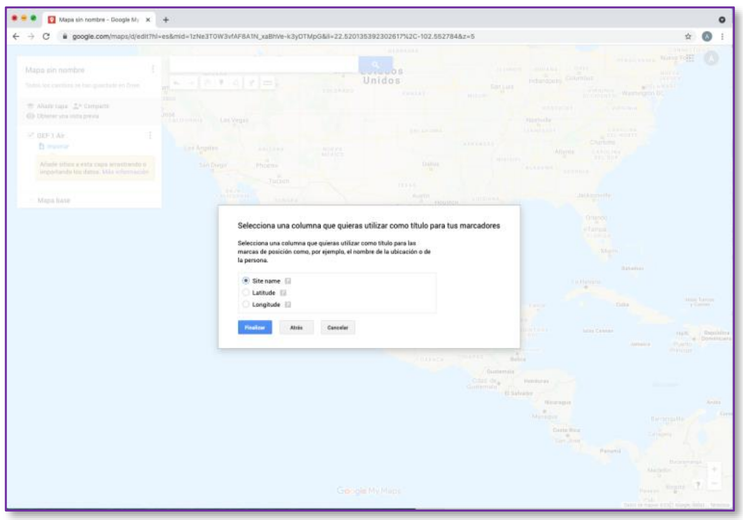
m. Click on import and drag or import your file

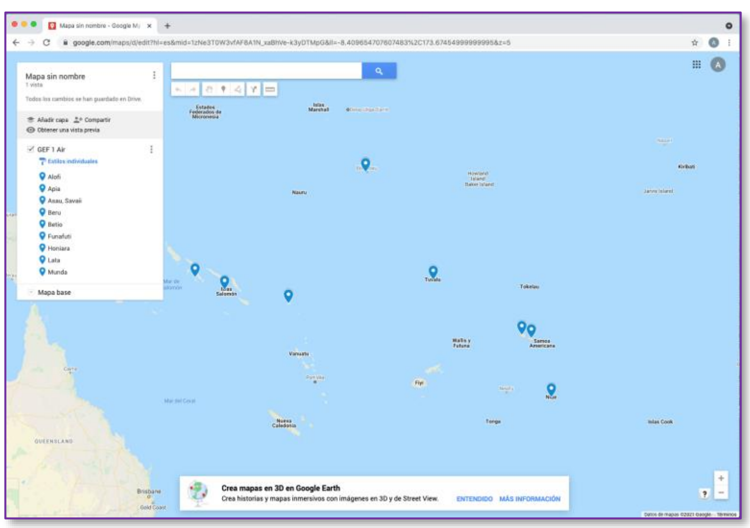




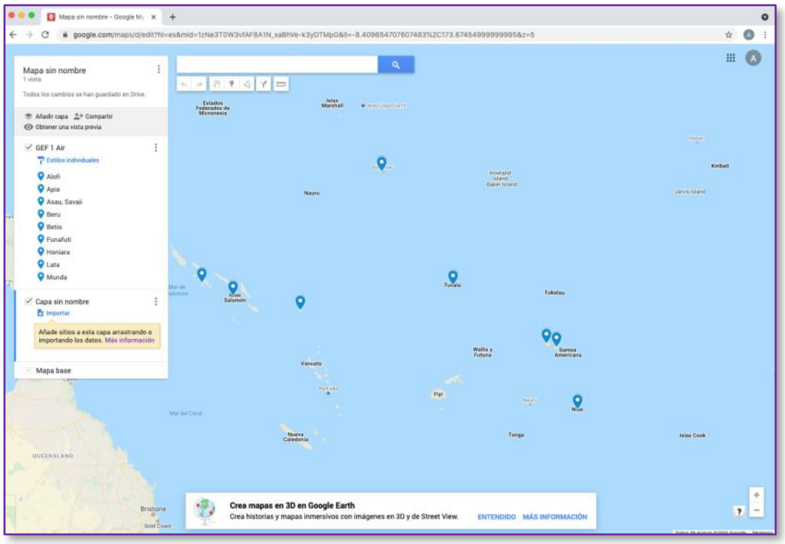
n. Click on site then continue. Then select site again and finalize.

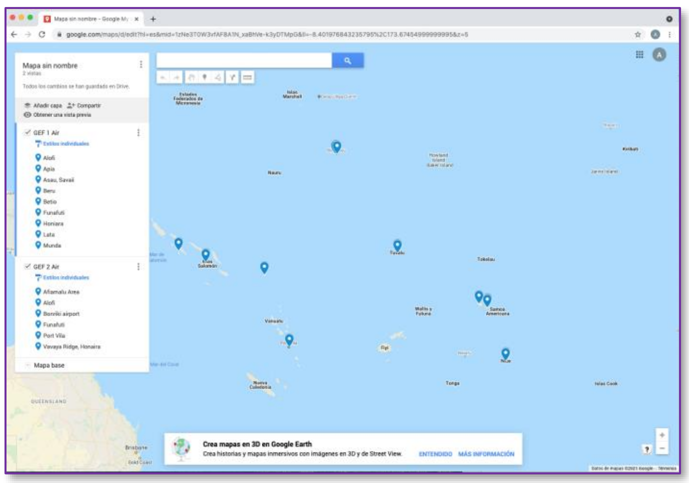




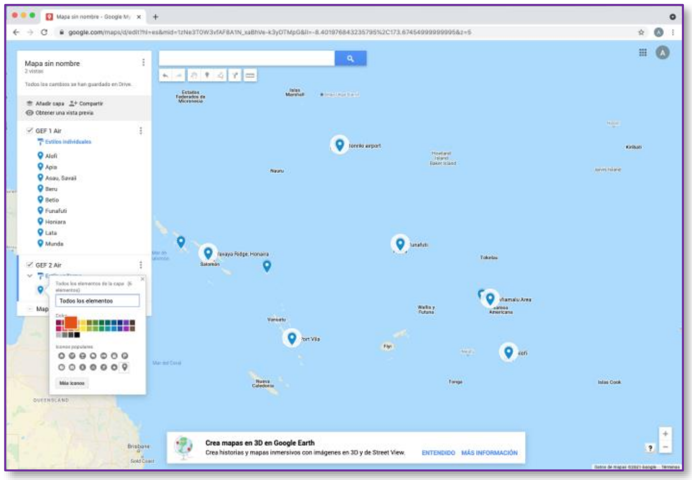


o. To add the GEF 2 Air sites, click on add layer and repeat the steps above, but instead of adding Coordinates GEF 1 Air file, add Coordinates GEF 2 Air file.

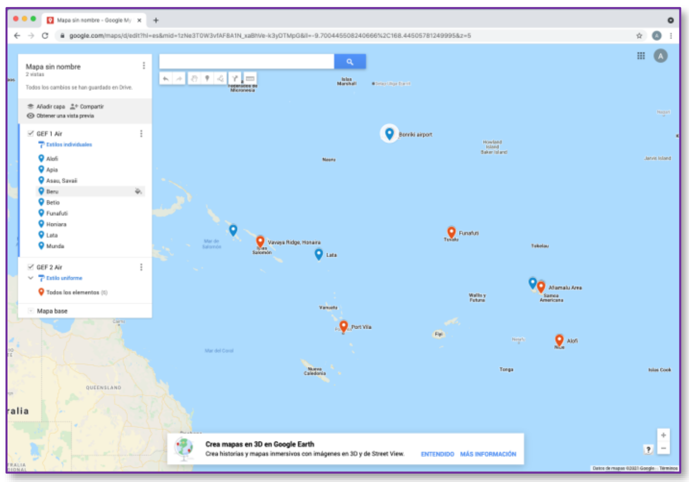




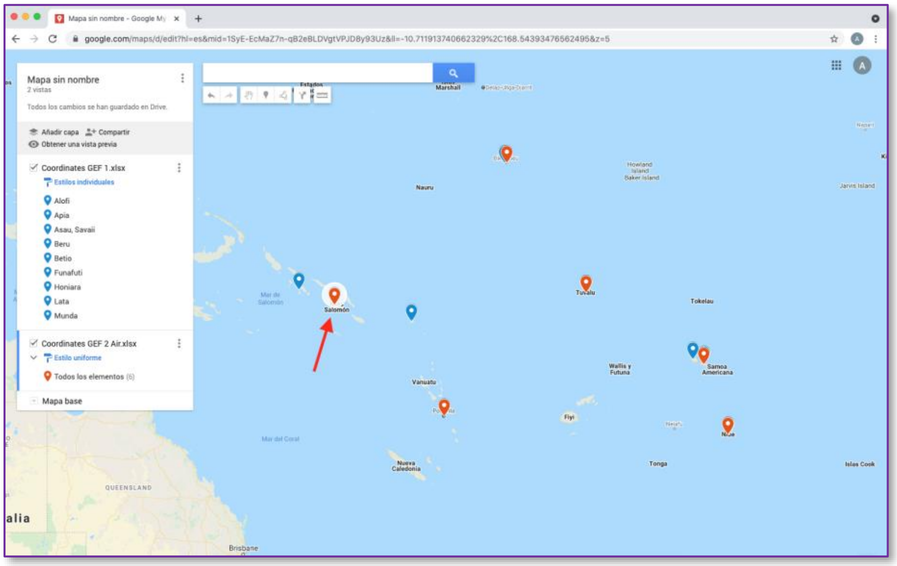
p. Change colors of GEF 2 sites by clicking on uniform style and on the bucket Icon. Select a color.



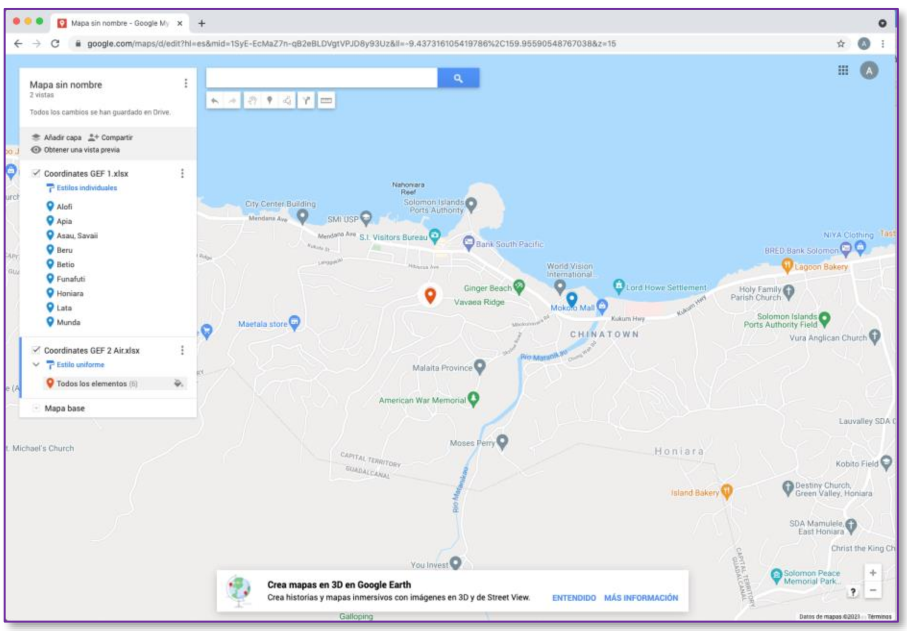
q. Your map will look like this:

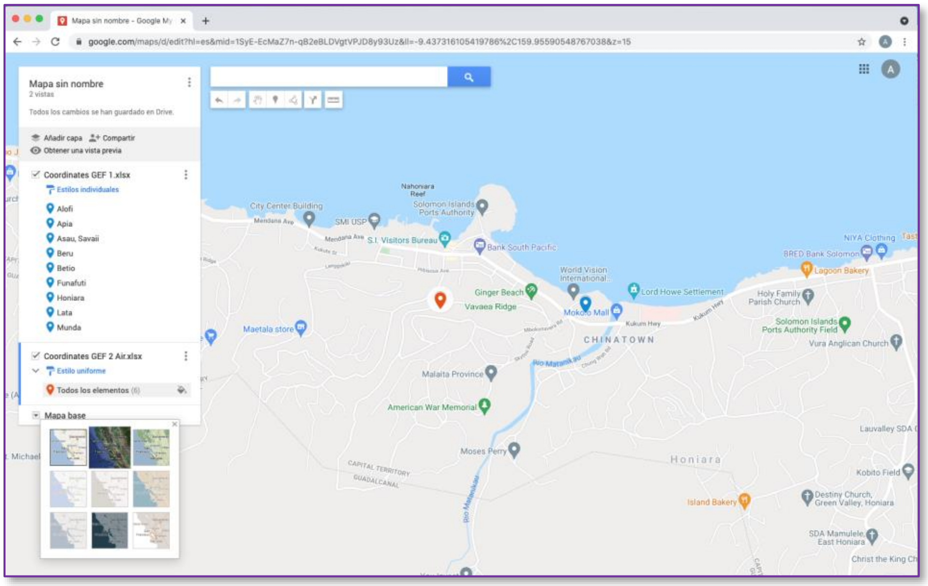


b) Review of site classification. Air sampling sites according to the criteria established in the previous GMP Guidance were classified as remote, rural, suburban, urban, and agricultural. The 2021 amendment to the GMP Guidance (UNEP; 2021) recommends that sites be classified as: Remote, Rural, Suburban and Urban. It should be noted that some sites in the GMP DWH database are reported as unclassified. For the classification of the sites, the population density is considered as follows: urban > 200,000 inhabitants within a radius of 10 km; suburban between 20,000 and 200,000 inhabitants within a radius of 10 km; rural between 2,000 and 20,000 inhabitants in a radius of 10 km; remote relatively uninhabited (<2,000 inhabitants within a 10 km radius). Site information and classification is important for comparing data within a region and between regions. For instance, if Salomon Islands is selected and the procedure is followed:

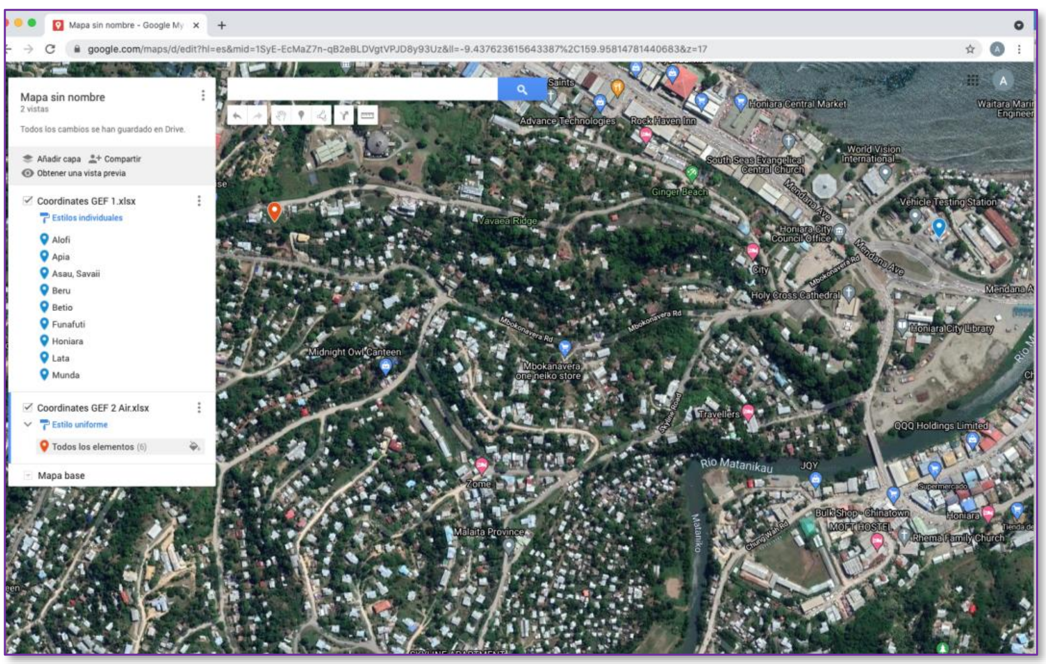


r. Approach or get closer to the island to see the two sites clearly. Then click on Base Map and choose a map with information on sites location.





s. Review the monitoring sites and their surroundings and potential emissions sources. Verify their classification, GEF 1 site was labeled NC and GEF 2 as Urban.



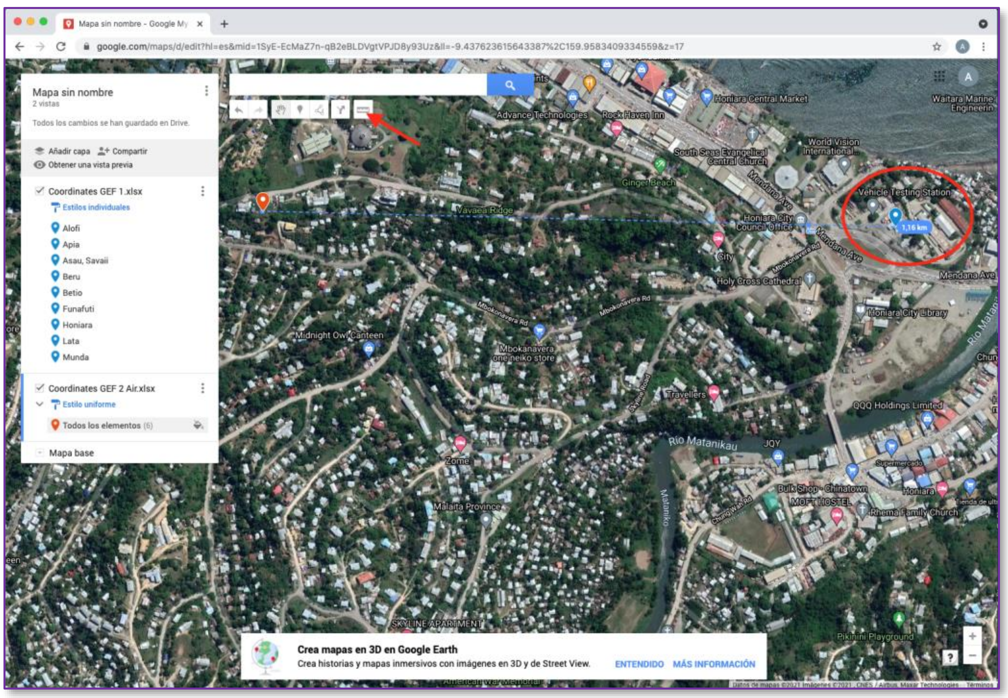
Both sites are Urban, but GEF 1 site is located very near to the Vehicle Testing Station.

c) **Prevalence of the sites.** After verifying the geographical location of the sites and their classification, the sites that have been located within a radius of 10 km of distance will be considered as prevalent sites and the measurements that have been made in these sites over the years will be considered as part of the same time series.

For UNEP/GEF GMP projects, many monitoring sites did not maintain their geographic location from one monitoring campaign to another (2010-2011 to 2016-2018), so those sites that are less than 10 kilometers away, located in the same country and with the same classification, are selected.

When there are sites with the same name but with different coordinates, or sites with different names and located within a radius of 10 kilometers of one another, a query must be made to the countries to verify their prevalence. From the results of the consultation, you should decide if the site could be considered as prevalent in order to compare their concentrations from one monitoring period to the other. Continuing with the Salomon Islands' example:

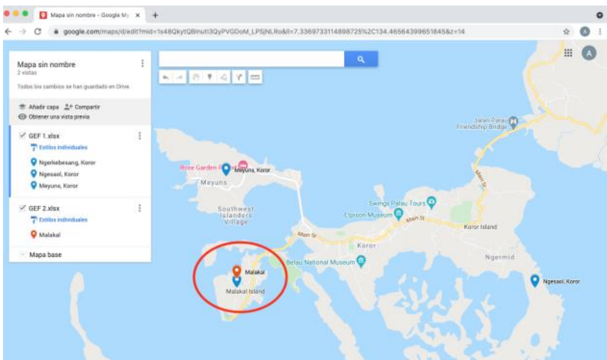
t. Measure the distance between the sampling sites. Click on the ruler icon, then on a site and afterwards on the other site.

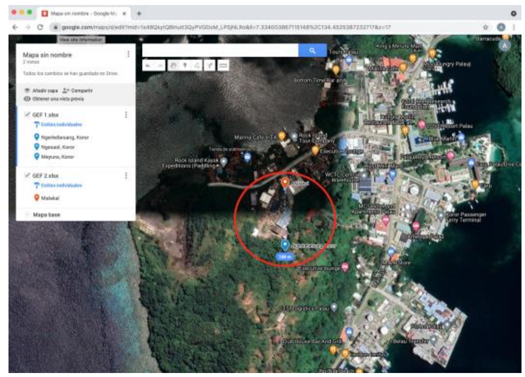


The sites meet the prevalence criterion because they are 1.16 Km apart. Comparisons could be made considering that GEF 1 site is possibly being affected by the proximity of the Vehicle Testing Station, but it is recommended to first inquire with the country if there are no errors in the sites' location or their geographical coordinates.

d) Harmonization of sites. The purpose of harmonizing the sites is to be able to apply tools or programs that facilitate data analysis. Different criteria can be established to harmonize the sites. In our case, after having carried out the evaluation of the prevalence of the sites, the sites with older data, known as GEF 1 Air in the example, need to be harmonized by adjusting the coordinates and names of those sites, to the coordinates and names of the 2016-2018 campaign sites, known as GEF 2 Air in the example, Figure 10.

Figure 10. Example of harmonization of sites. Palau Island. Sites Ngerkebesang, Koror GEF 1 and Malakal GEF 2 are considered prevalent.





	SITE						SAMPLING ATTRIBUTES				
Data Source	Site name	Latitude	Longitude	Region	Country	Site type	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive
GEF 1	Ngerkebesang, Koror	7.3333	134.4531	Asia and Pacific	Palau	NC	2010	08/07/10	30/12/10	Passive	PUF
GEF 1	Ngesaol, Koror	7.3333	134.5084	Asia and Pacific	Palau	NC	2010	08/07/10	30/09/10	Passive	PUF
GEF 1	Meyuns, Koror	7.3537	134.4511	Asia and Pacific	Palau	NC	2010	08/07/10	30/09/10	Passive	PUF
GEF 2	Malakal	7.3350	134.4531	Asia and Pacific	Palau	Rural	2017	23/11/16	13/08/17	Passive	PUF
GEF 2	Malakal	7.3350	134.4531	Asia and Pacific	Palau	Rural	2018	23/02/18	23/11/18	Passive	PUF

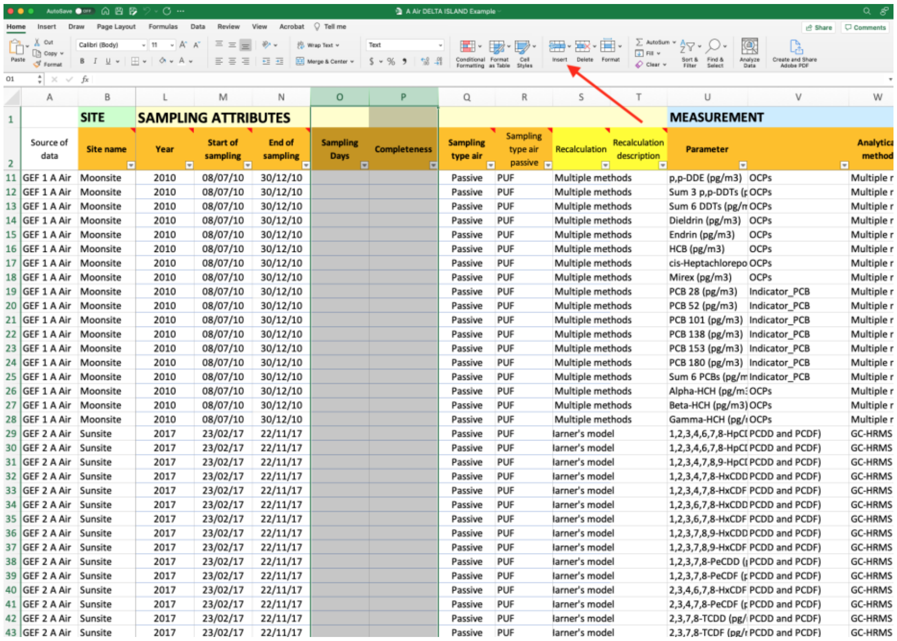
HARMONIZATION OF SITES

	SITE						SAMPLING ATTRIBUTES				
Data Source	Site name	Latitude	Longitude	Region	Country	Site type	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive
GEF 1	Malakal	7.3350	134.4531	Asia and Pacific	Palau	Rural	2010	08/07/10	30/12/10	Passive	PUF
GEF 1	Ngesaol, Koror	7.3333	134.5084	Asia and Pacific	Palau	NC	2010	08/07/10	30/09/10	Passive	PUF
GEF 1	Meyuns, Koror	7.3537	134.4511	Asia and Pacific	Palau	NC	2010	08/07/10	30/09/10	Passive	PUF
GEF 2	Malakal	7.3350	134.4531	Asia and Pacific	Palau	Rural	2017	23/11/16	13/08/17	Passive	PUF
GEF 2	Malakal	7.3350	134.4531	Asia and Pacific	Palau	Rural	2018	23/02/18	23/11/18	Passive	PUF

For human milk/blood matrix, it should be verified whether the countries followed the same protocol in different monitoring programs. If metadata don't give any clues, it is recommended to consult with the countries or with UNEP. Time series will be composed of the repeated participation of a country in the biannual rounds of milk/blood surveys.

3.4.3 Procedure to verify the completeness of the aggregated data. Exercise 3.4.

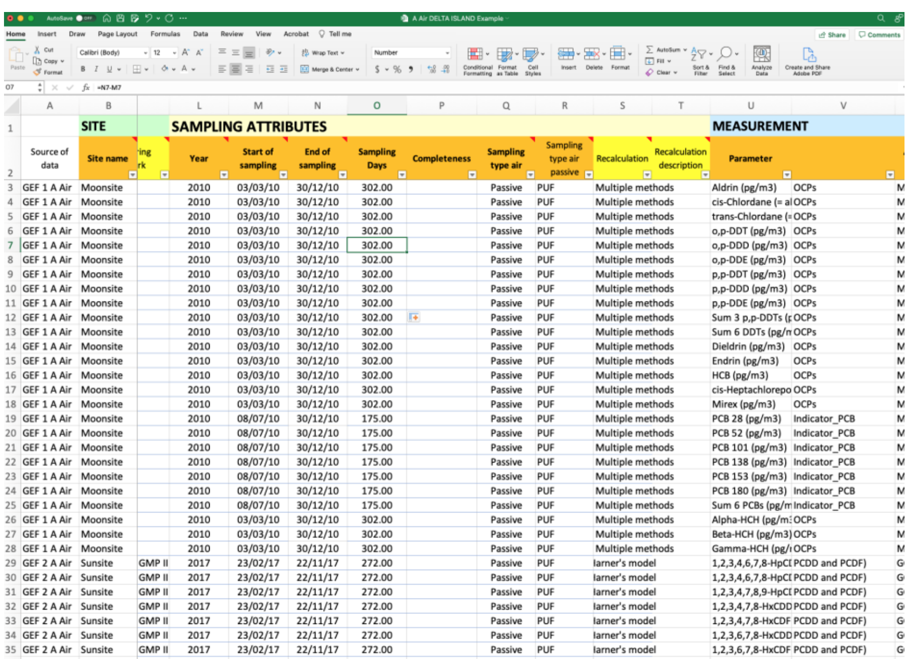
a) Open your aggregated data base (which includes GEF 1 and GEF 2 Aggregated Air data) and insert two columns after the End of sampling column. Name one Sampling Days and the other Completeness.



b) Verify that the "Start and End of Sampling" columns are in date format. If not use the Excel function =DATEVALUE(cell). Next, calculate the Sampling Days with the following formula:

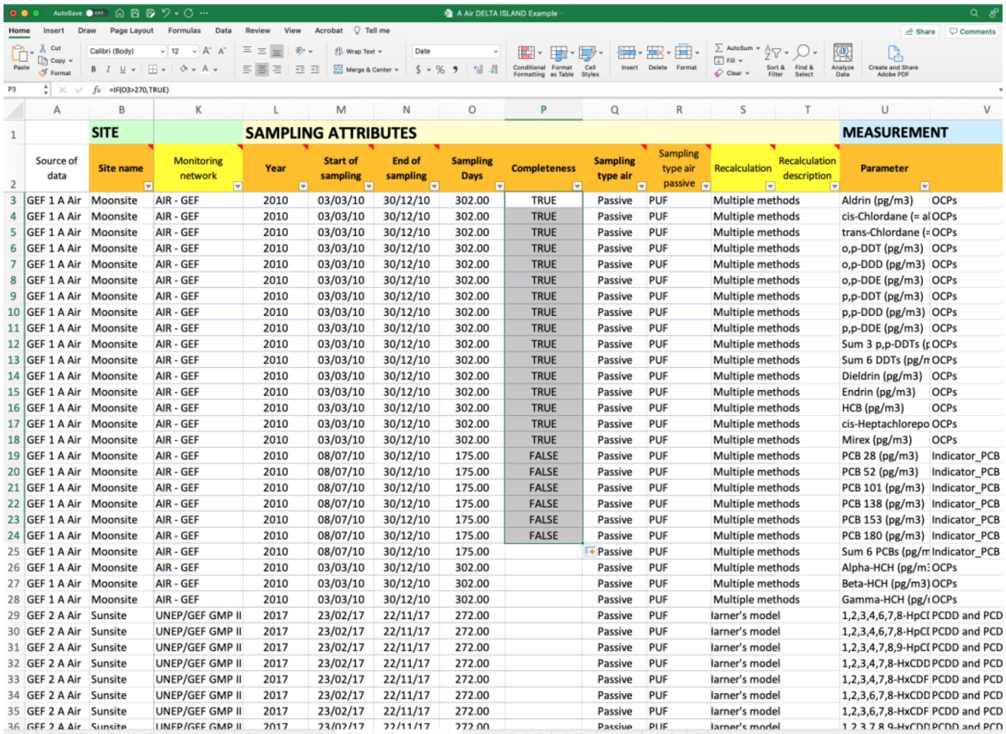
= End of Sampling - Start of Sampling (=cell N-M)

Or you can use the Excel function: =DAYS(N,M)



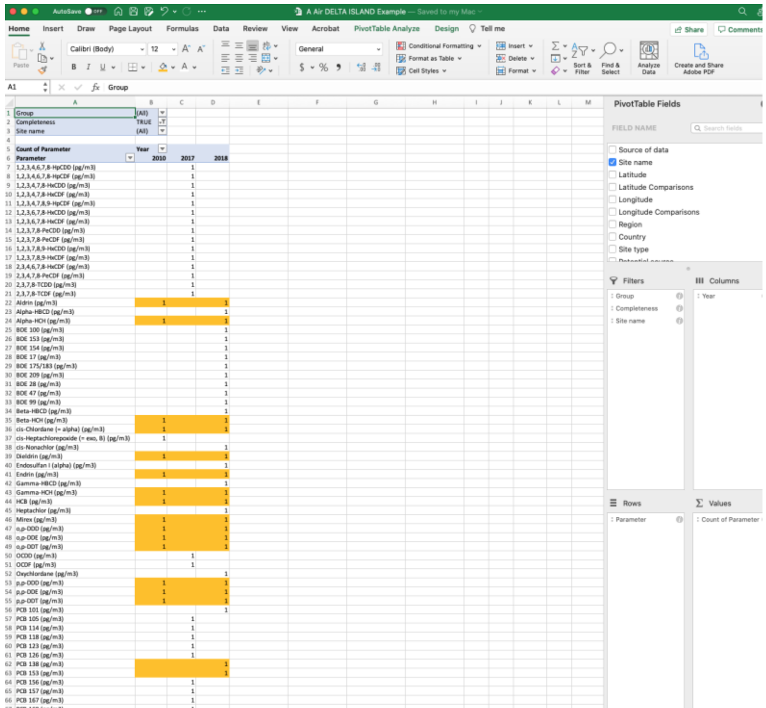
c) Evaluate the completeness of the aggregated data. You can use the following formula for passive air samples.

=IF(Sampling Days > 270, TRUE)



	A	B	K	L	M	N	O	P	Q	R	S	T	U	V
1		SITE		SAMPLING ATTRIBUTES									MEASUREMENT	
2	Source of data	Site name	Monitoring network	Year	Start of sampling	End of sampling	Sampling Days	Completeness	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	
3	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Aldrin (pg/m3)	OCPs
4	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		cis-Chlordane (= al	OCPs
5	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		trans-Chlordane (=	OCPs
6	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		o,p-DDT (pg/m3)	OCPs
7	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		o,p-DDD (pg/m3)	OCPs
8	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		o,p-DDE (pg/m3)	OCPs
9	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		p,p-DDT (pg/m3)	OCPs
10	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		p,p-DDD (pg/m3)	OCPs
11	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		p,p-DDE (pg/m3)	OCPs
12	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Sum 3 p,p-DDTs (p	OCPs
13	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Sum 6 DDTs (pg/m	OCPs
14	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Dieldrin (pg/m3)	OCPs
15	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Endrin (pg/m3)	OCPs
16	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		HCB (pg/m3)	OCPs
17	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		cis-Heptachlorepo	OCPs
18	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00	TRUE	Passive	PUF	Multiple methods		Mirex (pg/m3)	OCPs
19	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 28 (pg/m3)	Indicator_PCB
20	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 52 (pg/m3)	Indicator_PCB
21	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 101 (pg/m3)	Indicator_PCB
22	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 138 (pg/m3)	Indicator_PCB
23	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 153 (pg/m3)	Indicator_PCB
24	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00	FALSE	Passive	PUF	Multiple methods		PCB 180 (pg/m3)	Indicator_PCB
25	GEF 1 A Air	Moonsite	AIR - GEF	2010	08/07/10	30/12/10	175.00		Passive	PUF	Multiple methods		Sum 6 PCBs (pg/m	Indicator_PCB
26	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00		Passive	PUF	Multiple methods		Alpha-HCH (pg/m3	OCPs
27	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00		Passive	PUF	Multiple methods		Beta-HCH (pg/m3)	OCPs
28	GEF 1 A Air	Moonsite	AIR - GEF	2010	03/03/10	30/12/10	302.00		Passive	PUF	Multiple methods		Gamma-HCH (pg/	OCPs
29	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,4,6,7,8-HpCI	PCDD and PCD
30	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,4,6,7,8-HpCI	PCDD and PCD
31	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,4,7,8,9-HpCI	PCDD and PCD
32	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,4,7,8-HxCDD	PCDD and PCD
33	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,4,7,8-HxCDF	PCDD and PCD
34	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,6,7,8-HxCDD	PCDD and PCD
35	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,6,7,8-HxCDF	PCDD and PCD
36	GEF 2 A Air	Sunsite	UNEP/GEF GMP II	2017	23/02/17	22/11/17	272.00		Passive	PUF	larner's model		1,2,3,7,8,9-HxCDD	PCDD and PCD

Data availability for site comparisons could be verified by filtering the data or inserting a pivot table. If the two sites are prevalent, changes in concentration can be evaluated for the parameters shaded in yellow. Your table will look like this:



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POPS DATA
HANDLING GUIDANCE

ANNEXES

POPS DATA HANDLING GUIDANCE
LATIN AMERICA AND THE CARIBBEAN

ANNEXES

ANNEX 1. GUIDANCE FOR THE CONVERSION OF DATA

Guidance for the Conversion of Data on POPs from mass/PUF to mass/m^3 using Tom Harner´s model and the Stockholm Convention Data Warehouse template

INTRODUCTION

Article 16 of the Stockholm Convention requested the Conference of the Parties (COP) to evaluate the effectiveness of the Convention every four years after its entering into force. In order to facilitate such evaluation, the Conference of the Parties developed a Global Monitoring Plan (GMP). Ambient air is an important matrix for the effectiveness evaluation of the Convention because it has a very short response time to changes in atmospheric emissions and is a relatively well-mixed environmental medium and includes both chemicals in gaseous form as well as chemicals partitioned onto particles (UNEP, GMP guidance 2019).

The objective of the ambient air sampling networks under the Stockholm Convention Global Monitoring Plan (GMP) is to obtain representative data for assessing baselines and changes over time and space and the regional and global transport of Persistent Organic Pollutants (POPs). Passive sampling provides continuous, cumulative passive (diffusive) sampling for integration periods ranging from a few months (generally 3 months) to 1 year.

Passive air sampling using Polyurethane Foam (PUF) disk sampler is the most widely used air sampler and method under the GMP and also in research studies to investigate the levels and long-range transport of POPs and priority chemicals in air like other Semi-volatile Organic Compounds. This is also the method used in the two rounds of UNEP/GEF POPs GMP projects. In the analysis of Polyurethane Foam Disk (PUF) samples collected during passive air sampling, data is expressed in mass concentration by PUF (Cpuf mass/PUF disk).

This guidance aims to support converting the data on POPs expressed in mass concentration by PUF (Cpuf mass/PUF disk) of compound to mass concentration in air (Cair mass/m^3) using samplers with PUF disks (Shoeib and Harner, 2002; Pozo et al., 2006, 2009) in order to report data in a uniformized unit of measure to the Stockholm Convention Data Warehouse Template.

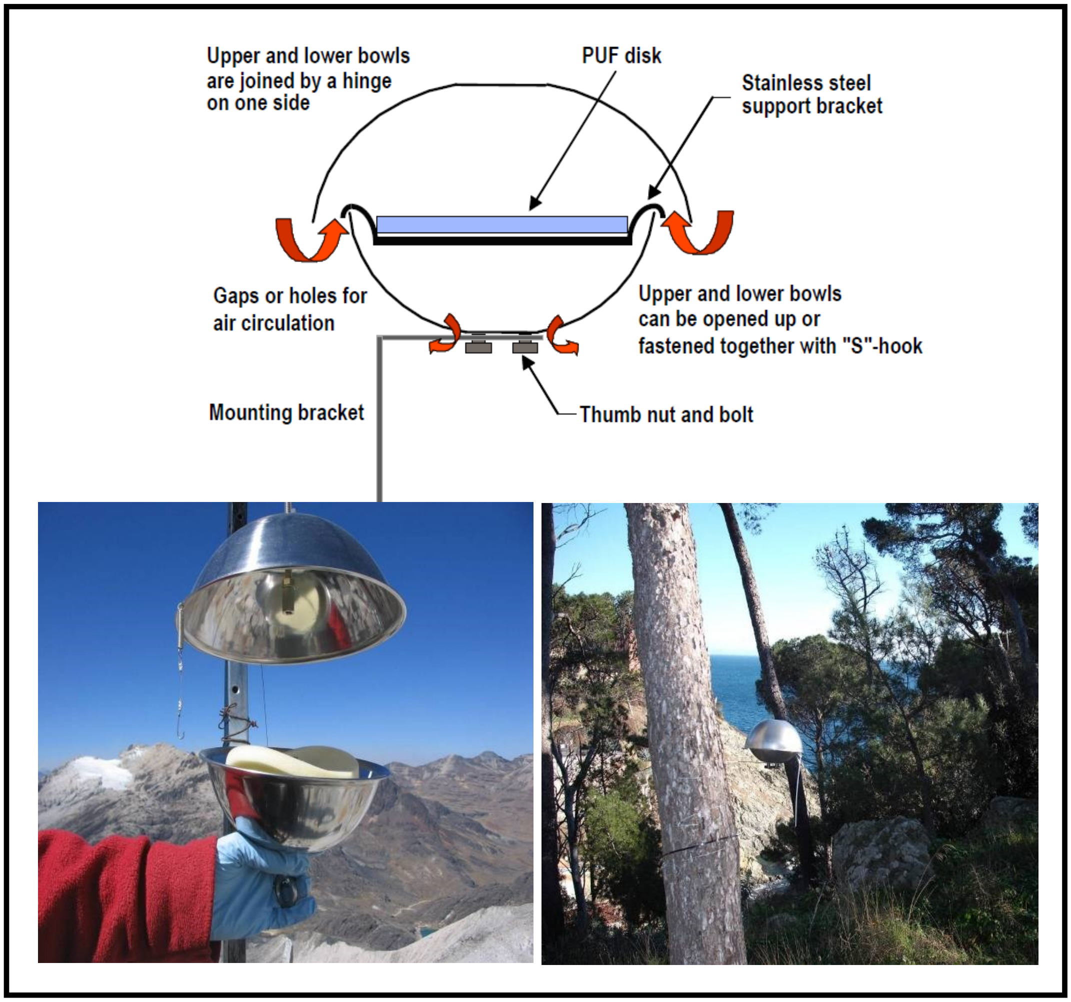
PASSIVE AIR SAMPLING (PAS)

The use of passive air samplers (PAS) as the main method for the collection of atmospheric POPs have several advantages, for example, they are cost-effective systems, simple to use, can be easily transported and do not require an external power source of electricity. On the other hand, one of the drawbacks is that the data produced is semiquantitative and there are different models for the calculation of the sample volume collected.

The most widely method used for deriving the effective sampled volume is the model developed by Tom Harner from Environment Canada (Tom Harner’s model), which uses a mathematical algorithm that takes into account the physical-chemical properties of the substances as the specific properties of the

PUFs, all these parameters are unique for each of the substances subject of study. All are collected in a formula. This formula can be well managed in an excel spreadsheets and from this point it is enough to know some basic particular parameters (i.e. the length sampling deployment time in days, the average temperature during the sampling, and the concentration in mass/PUF) of the sampling to convert to mass/m^3.

Figure 1. Schematic representation of the PAS and photos of PAS installed and PUF deployed.



Photos: ©Victor Estellano.

PAS is based on free flow of analyte molecules (POPs) from the sampled medium, in this case air, to a collecting medium (PUF disk), as a result of a difference in chemical potentials of the analyte between the two media (Górecki and Namiesnik, 2002).

The uptake of POPs by PUF disks and other materials has been widely studied and described in several studies (e.g. Shoeib and Harner, 2002; Pozo et al., 2004; Chaemfa et al., 2008) and was shown to be air-side controlled and thus a function of the air-side mass transfer coefficient (MTC). During outdoor deployment, a low-wind environment is preserved by housing samplers in protective chambers (Figure 1). Such samplers therefore allow for simultaneous and continuous sampling over long periods. Sampling rates for PUF-disk are typically on the order of ~4 m^3/day (Pozo et al., 2006, 2009; Harner et al., 2014) as so a 3-month deployment provides an equivalent sample air volume of approximately 270-360 m^3, which is sufficient for the detection of most of the POPs.

Approach to Equilibrium and Equilibrium sampling: It is imperative to account for approach to equilibrium that may occur for the more volatile POPs (e.g. HCB, Pentachlorobenzene, HCBD) (Harner et al., 2004; Gouin et al., 2005; Pozo et al., 2006). Approach to equilibrium results in a gradual reduction in the sampling rate until the net rate goes to zero at equilibrium. In some ways, this is not a disadvantage and does not vary with windspeed. Using PUF disk as equilibrium samplers can result in improved accuracy of derived air concentrations. However, if approach to equilibrium is achieved too quickly e.g. hours to a few days (e.g. HCBD and Pentachlorobenzene) then this is not ideal since the resulting concentration in air will only reflect ambient concentrations during the last few hours or days of deployment. This would not be a concern however, for chemicals with relatively constant ambient air concentrations over period of weeks to months, which is typical of volatile POPs (e.g. HCB) at background sites (UNEP, GMP guidance 2019).

Calculation of concentration of POPs using Tom Harner's model

The calculations of the concentrations using this model use a template in an excel file (Harner, 2020). The template is regularly updated.

Before using the template, however, is important to harmonize the data to be ready to include in the template.

(a) It is important to pay care attention on the unites provided with the data from the lab mass/disk, it can be given on nanogram (ng/disk), picogram (pg/disk) or even femtogram (fg/disk).
Note: ng= 10^{-9}; pg= 10^{-12}; and fg= 10^{-15}.
(b) To filter and to put together the results provided by the lab of the same groups of POPs e.g. Polychlorinated biphenyl (PCB Congeners); Polybrominated diphenyl ethers (PBDE Congeners); Organochlorine Pesticides (OCP Compound); Polyfluorinated Compounds (PFCs); Dioxins and Furans (PCCD_F Congener).
Note: Dioxin-like PCB are normally analysed together with the Dioxane and Furans, but the calculation is done in the same group of marker PCB.

How to use Tom Harner's template

There are different work spreadsheets in the template. The spreadsheet "Air Volume (m3) & Concentration" is the one used for the calculation. The other spreadsheets are references and notes of general information regarding the sources of literature used for preparing the template and the model for the groups of compounds included.

In a general manner the spreadsheet of the template "Air Volume (m3) & Concentration" is divided in two main parts: INPUT and OUTPUT (Figure 2).

Figure 2. Image of the template, with the first section of the spreadsheet with the general information.

PUF/SIP Disk Effective Air Volume Calculation for Target Chemicals	
Updated:	06-Apr-20 (refer to Corrections and Revisions tab)
Version	2020_v2.2
Questions & Suggestions?	tom.harner@Canada.ca amandeep.saini2@canada.ca

How to apply this tab : Enter site-specific values into the tables directly below "INPUT" (green headers, yellow columns); the site-specific air volume (m3) results will be shown in the first set of tables directly below "OUTPUT" for the following compounds using PUF/SIP disks; To obtain site-specific air concentrations (ng/m3) for numerous sites over an extended period, enter deployment time, average temperature, and sampling rate in tables to the right of the arrows.

INPUT:

Sampling Period		Default Value
Deployment Time (days)	90	
Average Temperature (°C)	25	
Effective Gas-phase Sampling Rate, R_S (m^3/day)	4	4
(Use default R or enter site-specific value from depuration compound results)		

Characteristics of Passive Sampling Media (PSM)		Default Values		
		GAPS	MONET	CSIC (Spain)
Volume of PSM (m^3)	2.10E-04	2.10E-04	2.64E-04	2.08E-04
Effective film thickness, D_{film} (m)	5.67E-03	5.67E-03	6.25E-03	1.35E-02
Density (g/m^3)	2.10E+04	2.10E+04	3.00E+04	2.65E+04
Surface Area (m^2)	3.70E-02	3.70E-02	4.23E-02	4.24E-02
Mass of PUF (g)	4.40E+00	4.40E+00	7.92E+00	5.50E+00
(Enter default values for PUF type under				

OUTPUT:

Air-side MTC, k_A (m/day) and (cm/s)	108	0.13

INPUT:

Before starting to use the template carefully read the instruction on "*How to apply this tab"* (Figure 2). For the calculations the required parameters that need to be included for the two parts highlighted in green (Figure 2) are:

Sampling period:

1. Deployment time in days during the whole period of sampling.
2. Average temperature during that period.
3. Sampling Rate R we use the default value of 4 m^3/day.

Characteristics of Passive sampling Media (PSM):

Here the default values of the type of PSM are used.

4. Type of sampler used.
5. Type of absorbent used.
6. Mass value of the substance/PUF disk

The sampling rate becomes a constant value which is the same for the same type of disk. In the case of the GAPS network and CSIC PUF the value is ‘4 m^3/day’ (Point 3). Other parameters are provided by sampling team, and the mass/disk is provided by the lab (Points 4, 5 and 6).

OUTPUT:

This section is divided also in two main parts (Figure 3). To the Left of the Arrow includes all the values, from scientific literature, used by the model to calculate the concentration. And for the calculation we don’t need to do any manipulation on this section.

Note: *If needed a compound that was not included in the original file can be added to the left of the arrow. However, to do this is important to have a good knowledge of how the model works and what values are needed, then would be better to do it in consultation with a specialist (e.g. Tom Harner).*

Figure 3. Division of the OUTPUT section in two part to the left and to the right of the arrow.

OUTPUT:

Air-side MTC, k_a (m/day) and (cm/s)	108	0.13

Polychlorinated Biphenyl (PCBs) - PUF Disks						
PCB Congener	RRT *	log K_{oa}	K'_{PUF-A} (no dimension)	V_{air} (m^3)	Φ	$V_{air, True}$ (m^3)
1	0.2668	6.16	1.2E+05	24	0.00	24
3	0.2960	6.57	2.1E+05	45	0.00	45
4/10	0.3114	6.79	3.0E+05	62	0.00	62
7	0.3291	7.04	4.3E+05	88	0.00	88
6	0.3362	7.14	5.0E+05	101	0.00	101
8/5	0.3406	7.21	5.4E+05	109	0.00	109
19	0.3538	7.39	7.1E+05	136	0.00	136
18	0.3690	7.61	9.8E+05	170	0.00	170
17	0.3704	7.63	1.0E+06	173	0.00	173
24/27	0.3761	7.71	1.1E+06	186	0.00	186
16/32	0.3787	7.75	1.2E+06	191	0.00	191
26	0.3933	7.95	1.6E+06	222	0.00	222

temperature and deployment times for each sample. The templates sample analysis). The template can be expanded as needed.

PCBs (PUF)	Peri		
Site Code	Name of the Country		
Sample ID	Sample ID		
Deployment Time (days)	90		
Average Temp. (°C)	25		
Sampling Rate (m3/day)	4		
Air Volume/Concentrations	V_{air} (m^3)	Cpuf (ng/disk	Cair (ng/m³
1	24	0	0
3	45	0	0
4/10	62	0	0
7	88	0	0
6	101	0	0
8/5	109	0	0
19	136	0	0
18	170	0	0
17	173	0	0
24/27	186	0	0
16/32	191	0	0
26	222	0	0

To the right of the arrow (Figure 3 and 4) is the section where we include the values in mass/PUF (e.g. ng/disk) to calculate the concentration in air.
If we go down throughout the spreadsheet the same logic follows for all the groups of compounds included in the template i.e. PCB, PBDE, OCPs, PFC, etc.

Note: *The template includes more groups and, in each group, more compounds or congeners than the once monitored under the UNEP/GEF GMP projects. For example, for the PBDEs the template includes 13 Congeners (Figure 4), however only 8 are regularly monitored and included in the SC Data Warehouse (DWH). For avoiding confusion the* ***entire row*** *of the PBDEs that are not necessary for the reporting of compounds under GMP and the SC DWH (e.g. BDE-66, -77, -85, -126, and -156) can be deleted, but remember to delete the* ***entire row*** *(to the left and to the right of the arrow).*

Figure 4. Section of the spreadsheet on the right of the arrow used for calculating the concentration in air of the specific’s groups of POPs.

PBDEs (PUF)	Period 1			Period 2		
Site Code						
Sample ID						
Deployment Time (days)	90			90		
Average Temp. (°C)	25			15		
Sampling Rate (m3/day)	4			4		
Air Volume/Concentrations	V_{air} (m^3)	(ng/disk)	Cair (ng/m³)	V_{air} (m^3)	(ng/disk)	Cair (ng/m³)
17	335	0	0	347	0	0
28	341	0	0	350	0	0
47	356	0	0	358	0	0
66	357	0	0	359	0	0
77	357	0	0	359	0	0
100	358	0	0	359	0	0
99	359	0	0	359	0	0
85	359	0	0	360	0	0

In this section we can include the information needed for the calculation of the POPs (Figure 5).

Following the example of PBDEs in the figure 5, below Period 1 we have included the following information:

(a) DR Congo (Site code)
(b) COD-9 (2017-III) (Sample ID)
(c) 92 (Deployment time of the passive sampler in days)
(d) 25.5 (average temperature of the sampling period in °C)
(e) 4 (default value for the sampling rate in m^3/day)

Figure 5. Example of spreadsheet including the values for the calculation of the 8 PBDEs + BDE-209.

PBDEs (PUF)	Period 1		
Site Code	DR Congo		
Sample ID	COD-9 (2017-III)		
Deployment Time (days)	92		
Average Temp. (°C)	25.5		
Sampling Rate (m3/day)	4		
Air Volume/Concentrations	V_{air} (m^3)	(ng/disk)	Cair (ng/m^3)
17	256	0.31	0.00121104
28	259	0.59	0.002279698
47	265	1.1	0.004143477
100	267	0.25	0.000937634
99	267	0.31	0.001161805
154	267	0.57	0.002133301
153	267	0.45	0.001684441
183	267	1.1	0.004116657
209	368	5.3	0.014402174
	In blue <LOQ or LOQ		

Note: *In contrast to figure 4 in figure 5 we can note that the entire row of all the PBDEs (BDE-66, -77, -85, -126, and -156) that are not included in the SC DWH were deleted, and also that BDE-209 was added. The case of BDE-209 is a special because is entirely particle-associated so will never equilibrate in PUF. The model used for calculating the Vair (m^3) is simply using the value of R (m^3/day), in this case 4, multiplied by the days deployed, in this case 92, so in the example the Vair (m^3) = 368 m^3. This congener is not included in the original template but can be added.*

Subsequently we can include in the column (ng/disk) the values obtained by the laboratory during the analyses that normally are in ng/sample = ng/disk, however is important to double check the units because sometime can be in a different unit and would need to be transformed.

Finally, we obtain the concentration in air Cair (ng/m^3).

In the example, the values highlighted using the “blue aqua” colour, are the values of the Limit of Quantifications (‹LOQ). In case the values were below the limits of detection (‹LOD) or quantification (‹LOQ), to adapt to the format required under the DWH we always use the values of LOQ (for a definition of LOD and LOQ see the note below).

The concentrations of dioxin-like POPs are, in general, much lower than the other POPs (for instance, instead of pg/m^3 are in fg/m^3). For that reason, how dioxin-like POPs are calculated is a special case and needs to follow a different approach. The UNEP/GEF GMP1 and GMP2 projects have included in the same site two independent PUF disks, and these two PUF were combined to make a single sample extract. In the case that the concentration was too low and two PUF were not enough for the amylases, the extract of others subsequent periods was added to be combine all together. In many cases the PUF disks of the whole year were combined and analyses as a single sample of 8 PUFs (Figure 6).

During the calculation if more than one PUF was used for the analyses, the results were divided by the number of PUF included. In the example of figure 6, the values of dioxins in column B are of 2 PUF from the same period, in the case of column E are 4 PUF and 4 periods and in column F are 4 PUF but only two periods (Figure 6) (the periods can be recognized by the season code). For the calculation of the sampling period (days) and the Average temperature (°C), if two period or more were included the average deployment time and temperature was used.

Figure 6. Example of calculation of dioxin-like POPs.

	A	B	C	D	E	F
1	Sampling Period (d)	89	92	91	92	90
2	Average T (ºC)	26.2	25.5	25.8	25.4	26.1
3	**Region**	Africa	Africa	Africa	Africa	Africa
4	Sample from samplers	5+7	5+7	5+7	5+5+5+5	5+7+5+7
5	Sampling year	2017	2017	2017	2018	2019
6	Season code	II	III	IV	I+II+III+IV	I+II
7	Sample ID	COD (2017-II)	COD (2017-III)	COD (2017-IV)	COD (2018-I+II+III+IV)	COD (2019-I+II)
8	Unit	pg/2 PUF	pg/2 PUF	pg/2 PUF	pg/4 PUF	pg/4 PUF
9	2378-Cl_4DD	5.6	4.8	4.5	6.1	7.2
10	12378-Cl_5DD	11.4	11.5	10.0	13.9	18.7
11	123478-Cl_6DD	5.9	4.1	4.2	6.9	9.9
12	123678-Cl_6DD	16.2	16.7	11.0	17.2	23.7
13	123789-Cl_6DD	11.7	9.6	3.4	11.4	19.0
14	1234678-Cl_7DD	137.6	125.8	75.9	136.1	198.8
15	Cl_8DD	758.4	832.6	608.7	1149.4	1543.4

Notes:

- *LOD is the lowest quantity of a substance that can be distinguished from the absence of that substance (a blank value) with a stated confidence level (generally 99%) and is defined as 3 * standard deviation of the blank. the LOD can change from instruments and laboratories.*
- *LOQ is defined as 10 * standard deviation of the blank, or ~3 times the LOD.*

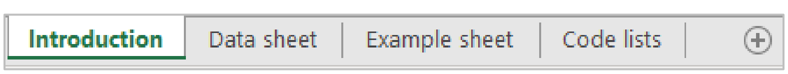
DATA WAREHOUSE (DWH)

The DWH supports the GMP of the Stockholm Convention on the data collection and handling along with data analysis and visualization and assists the regional organization groups (ROG) and the global coordination group (GCG) in producing the regional and global monitoring reports. It constitutes a publicly available repository of valuable information that can serve as a useful resource for policy makers and researchers worldwide. Almost all data from the GMP first and second phases is stored in the Data Warehouse (DWH).

The DWH was developed by the Stockholm Convention Regional Centre in the Czech Republic through the Research Centre for Toxic Compounds in the Environment and the Institute of Biostatistics and Analyses, Masaryk University, Brno, Czech Republic, under the guidance of the GMP Global Coordination Group, and based on Chapter 6 of the Guidance on the Global Monitoring Plan for Persistent Organic Pollutants relevant to data handling (UNEP/POPS/COP.6/INF/31).

The Reporting spreadsheet of the DWH is an excel file, that include four spreadsheets (Figure 7).

Figure 7. Reporting file of the DWH with the four spreadsheets.



The first spreadsheet is the introduction where it is explained how the file is conceived and how the information should be included in the other spreadsheets.

a) Data sheet is the table into which the reported data should be filled.
b) Example sheet is an example of a table with filled data indicating which fields are required and which are not mandatory.
c) Code lists for items with defined inputs. The data should be included into the Data sheet as defined in the code lists.

Data sheet

Data sheet is divided in three different classes or section of the DWH template: a) SITE, b) SAMPLING ATTRIBUTES and c) MEASURMENT (Figures 8).

Figure 8. Sections of the spreadsheet of the Data Sheet took from the Example sheet, showing how the data should be filled.

A	B	C	D	E	F	G	H
SITE							
Required field	*Required field*	*Required field*	*Required field*	*Required field*			
Text	*Numeric*	*Numeric*	*Codelist*	*Codelist*	*Codelist*	*Codelist*	*Codelist*
Site name	**Latitude**	**Longitude**	**Region**	**Country**	Site type	Potential source	Monitoring network
Kosetice	49.58335	15.08334	CEE	Czech Republic		Agricultural	
Kosetice	49.58335	15.08334	CEE	Czech Republic	Rural		

I	J	K	L	M	N	O
SAMPLING ATTRIBUTES						
Required field	*Required field*	*Required field*	*Required field*	*Required field for passive sampling*		
Integer	*text YYYY-MM-DD*	*text YYYY-MM-DD*	*Codelist*	*Codelist*	*Codelist*	*Text*
Year	**Start of sampling**	**End of sampling**	**Sampling type air**	Sampling type air passive	Recalculation	Recalculation description
2010	2010-01-01	2010-01-02	Active			
2010	2010-01-01	2010-03-31	Passive	PUF	Harner's model	

P	Q	R	S	T
MEASUREMENT				
Required field	*Required field*	*Required field if Value = 0*	*Required field*	
Codelist	*Codelist*	*Numeric*	*Numeric*	*Text*
Parameter	**Analytical method**	LOQ	**Value**	Laboratory
PCB 153 (pg/m3)	GC-MS	0.5	0	RECETOX
o,p-DDE (pg/m3)	GC-MS		4.12	

IMPORTANT NOTE 1: *No ambient air collected using a passive air sampler can be reported in concentration without the required use of a model. Current models may be useful, but there is no scientific consensus on this approach. One of the most used models is the Tom Harner´s model.*

IMPORTANT NOTE 2: *Many laboratories that work in the field of POPs work according to upper-bound criteria, others on the contrary prefer to work according to lower-bound criteria. In other words, this refers to using the LOQ as concentration data for those cases where the substance is below the LOD or is simply not detected or consider 0 as concentration value for the lower-bound approach.*

ANNEX 2. TEMPLATES

The GMP DWH templates for configuring the disaggregated and aggregated databases for the three environmental matrices: air, breast milk and water are included in the zipped files of the Excel exercises and tutorials, under the TEMPLATES folder.

Annex 2- air-aggregated-template.xlsx

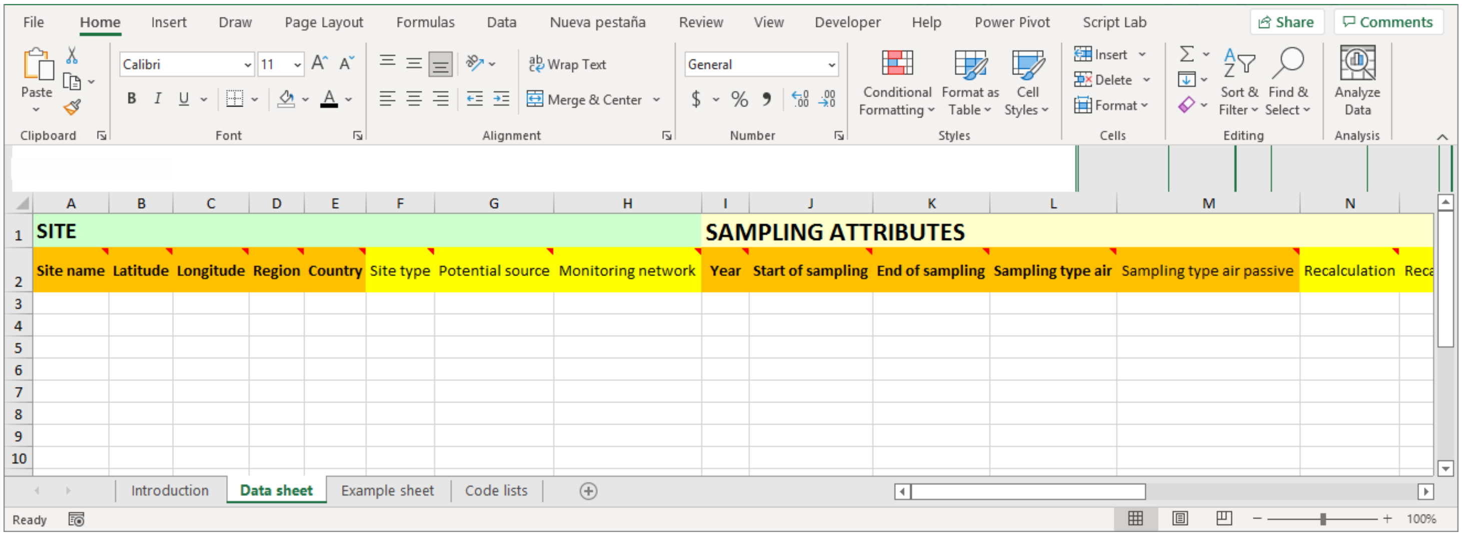
Annex 2- air-primary-template.xlsx

Annex 2- human-milk-aggregated-template.xlsx

Annex 2- human-milk-primary-template.xlsx

Annex 2- water-aggregated-template.xlsx

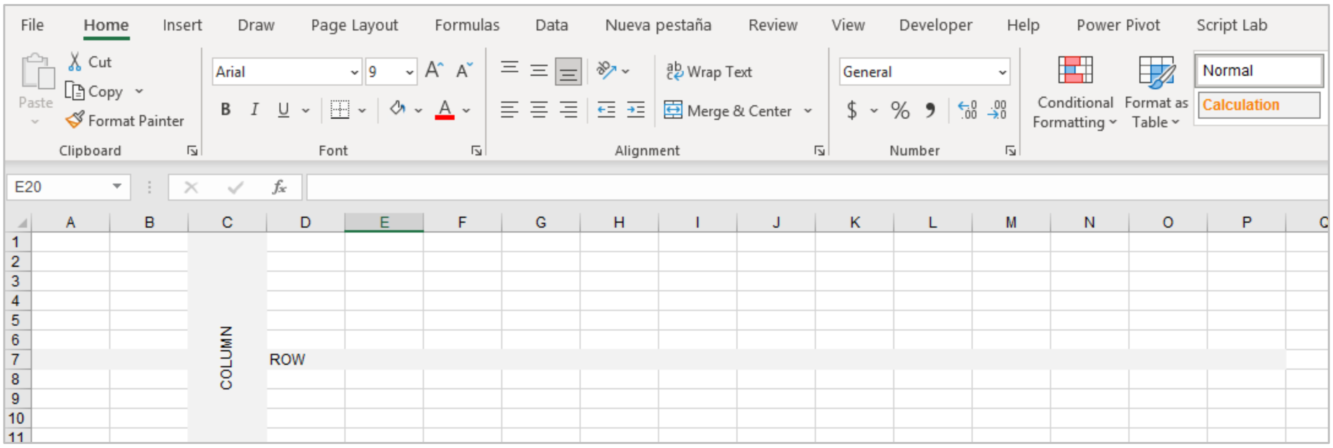
Annex 2- water-primary-template.xlsx



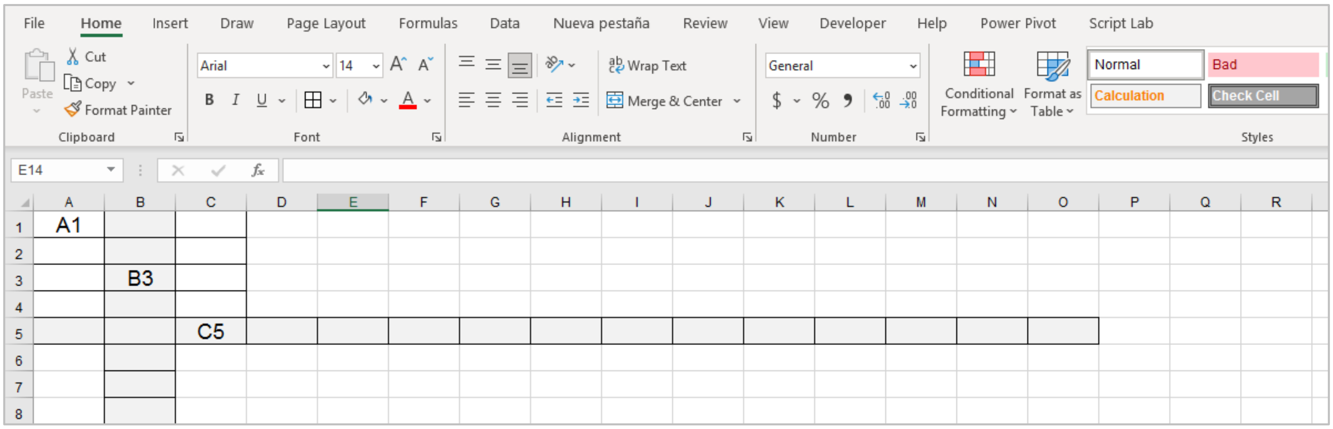
ANNEX 3. EXCEL FUNCTIONS

EXCEL (AS THE ANALYSIS TOOL)

The main feature of Excel, as it is known, is that the main screen shows a two-dimensional matrix that is made up of columns and rows.



In the intersection of the column and row a small box is formed named as cell. Each of them will have a unique address that will be made up of the column and the row to which it belongs, that is, the address will be a letter (column) and a number (row). For example, the upper left cell of the matrix has the address A1.



Thus, any mathematical operation in Excel refers to cells, for example =A1 – B3. There are two ways to refer to cells: relative reference (A1) and absolute reference ($ A $ 1).

In Excel, once you work with functions, you can create advanced formulas that will help you be more efficient in using Excel.

FORMULAS

A formula in Excel is a mathematical equation that is used from values or data. It can be created from direct values or with cell references. All formulas begin with the = symbol, and the values of the equation are added. Formulas are written in the Excel bar that is located at the top of the Excel sheet.

Example of a formula: = A1+B1

Formulas in Excel consist of:

1) **Constants or text.** A text can also be used within a formula, but it must always be enclosed by double quotation marks like "Text". Likewise, you can use values in the formulas (z = 2 * A1)
2) **Cell references.** Instead of using constants within our formulas, we can use cell references that will point to the cell that contains the value we want to include in our formula: = D9 - E9.
3) **Operators.** The operators used in Excel are the same mathematical operators that we know as the symbol (+) for addition, or the symbol (*) for multiplication or (/) for division or (-) subtraction.

FUNCTIONS

Functions in Excel are formulas predefined by the program. They are executed using specific values that are known as arguments. These are values that are structured and follow a specific sequence as if it were an Excel macro.

Example of a function: =SUM(F12:F18)

Without the SUM function, the formula could be: = F12+F13+F14+F15+F16+F17+F18.

In Excel formulas can use functions. That is, the formulas include functions in their operation to obtain the result that is being sought.

Example of a formula with functions: = SUM(A1:B1) + MEDIAN(A1:D10)

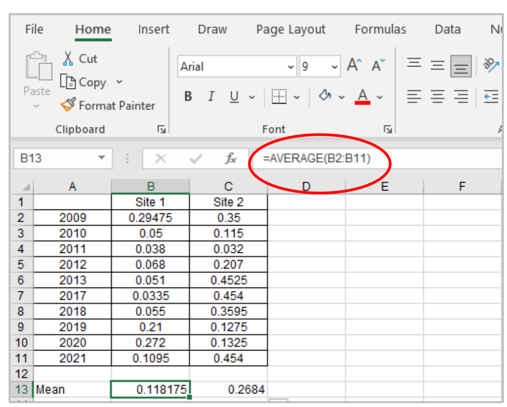
Some basic Excel functions are:

Average (MEDIA)

The average formula returns the arithmetic average value of the cells or range of cells. This result is also known as the arithmetic mean or mean.

Usage: = Average (cells with numbers)

Example: = AVERAGE (B2:B11) = 0.118175

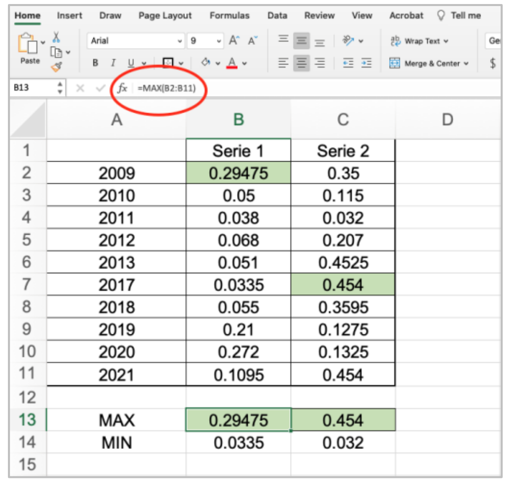


Maximum and Minimum (MAX and MIN)

When you want to know which is the highest or lowest value in a set, two name formulas are available: MAX and MIN. They can be used with separate cells or ranges of cells.

Usage: =MAX(cells)
=MIN(cells)

Example: =MAX(B2:B11) = 0.29475 =MIN(B2:B11)= 0.0335

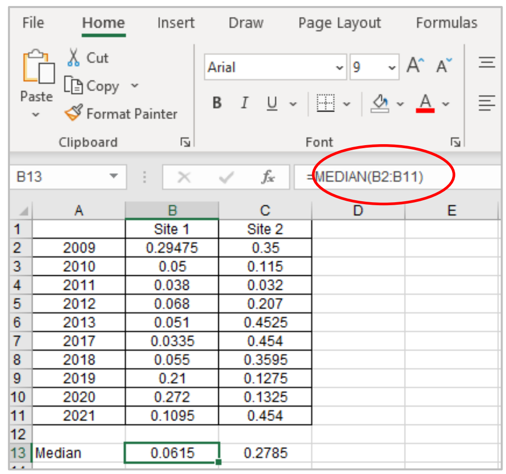

B13 =MAX(B2:B11)

	A	B	C	D
1		Serie 1	Serie 2	
2	2009	0.29475	0.35	
3	2010	0.05	0.115	
4	2011	0.038	0.032	
5	2012	0.068	0.207	
6	2013	0.051	0.4525	
7	2017	0.0335	0.454	
8	2018	0.055	0.3595	
9	2019	0.21	0.1275	
10	2020	0.272	0.1325	
11	2021	0.1095	0.454	
12				
13	MAX	0.29475	0.454	
14	MIN	0.0335	0.032	
15				

Median

The Median is the value that occupies the central place of all the data when they are ordered from least to greatest (calculated in the same way as the 50th percentile).

The function is expressed:
= MEDIAN (number1, number2, ...)


B13 =MEDIAN(B2:B11)

	A	B	C	D	E
1		Site 1	Site 2		
2	2009	0.29475	0.35		
3	2010	0.05	0.115		
4	2011	0.038	0.032		
5	2012	0.068	0.207		
6	2013	0.051	0.4525		
7	2017	0.0335	0.454		
8	2018	0.055	0.3595		
9	2019	0.21	0.1275		
10	2020	0.272	0.1325		
11	2021	0.1095	0.454		
12					
13	Median	0.0615	0.2785		

Percentile

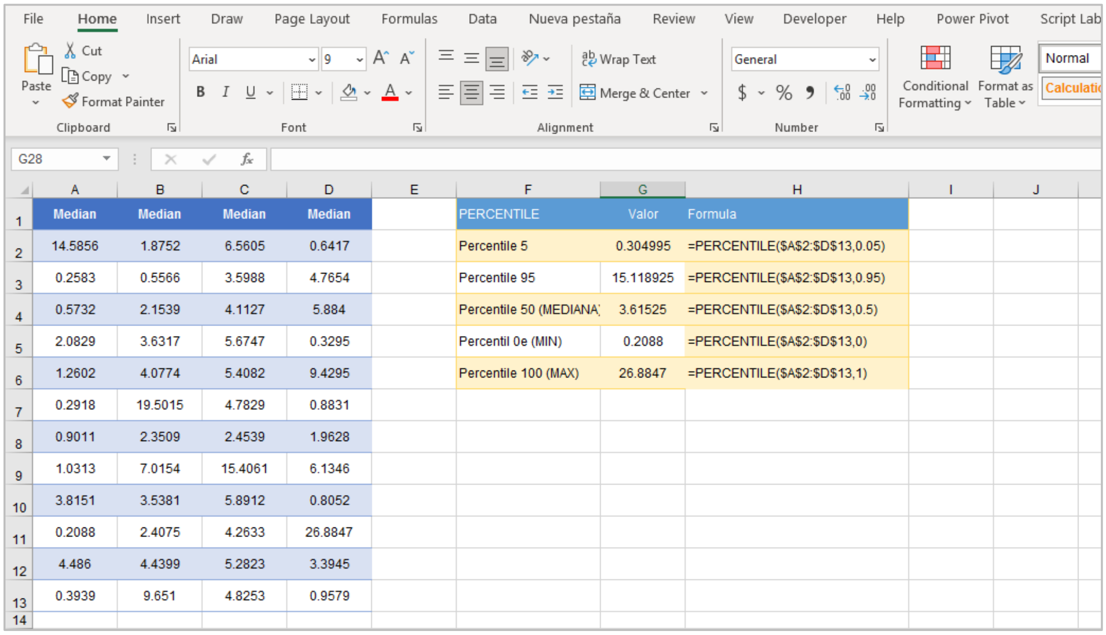
Percentile is the non-central position measure that provides information on the percentage of observations of a variable, ordered from lowest to highest, that are below its value. In this way, the 20th percentile (P20) would be the value of the variable, located at the limit of the first 20. Although, the percentile can be calculated for grouped data or not. There are complex formulas found in statistical manuals to calculate them. The easiest way is using a spreadsheet, as it is the case of Excel. The 5th and 95th percentiles are calculated as nonparametric measures of variation.

The percentile function returns the k-th percentile of the values in a range. This function allows you to set an acceptance range. For example, you can examine candidates who score above the 90th percentile.

The function is expressed: = PERCENTILE(matrix,k), where:

- The matrix is the array or range of data that defines the relative position.
- K is the percentile value in the range 0 to 1, inclusive.

The following image shows several percentiles:



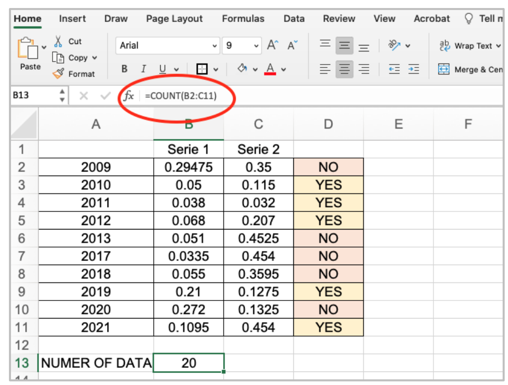
Median	Median	Median	Median
14.5856	1.8752	6.5605	0.6417
0.2583	0.5566	3.5988	4.7654
0.5732	2.1539	4.1127	5.884
2.0829	3.6317	5.6747	0.3295
1.2602	4.0774	5.4082	9.4295
0.2918	19.5015	4.7829	0.8831
0.9011	2.3509	2.4539	1.9628
1.0313	7.0154	15.4061	6.1346
3.8151	3.5381	5.8912	0.8052
0.2088	2.4075	4.2633	26.8847
4.486	4.4399	5.2823	3.3945
0.3939	9.651	4.8253	0.9579

PERCENTILE	Valor	Formula
Percentile 5	0.304995	=PERCENTILE($A$2:$D$13,0.05)
Percentile 95	15.118925	=PERCENTILE($A$2:$D$13,0.95)
Percentile 50 (MEDIANA)	3.61525	=PERCENTILE($A$2:$D$13,0.5)
Percentil 0e (MIN)	0.2088	=PERCENTILE($A$2:$D$13,0)
Percentile 100 (MAX)	26.8847	=PERCENTILE($A$2:$D$13,1)

Count

The COUNT function counts the number of cells that contain numbers and counts the numbers within the argument list. The COUNT function is used to get the number of entries in a number field from a range or array of numbers.

For example, you can write the following formula to count the numbers in the range B2: B6: = COUNT (B2: C11). In this example, because all five cells in the range contain numbers, the result is 20.



=COUNT(B2:C11)

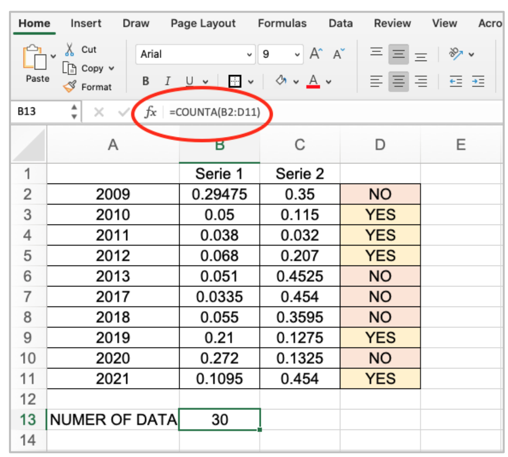
	Serie 1	Serie 2	
2009	0.29475	0.35	NO
2010	0.05	0.115	YES
2011	0.038	0.032	YES
2012	0.068	0.207	YES
2013	0.051	0.4525	NO
2017	0.0335	0.454	NO
2018	0.055	0.3595	NO
2019	0.21	0.1275	YES
2020	0.272	0.1325	NO
2021	0.1095	0.454	YES
NUMER OF DATA	20		

Counta

COUNTA is one of the formulas to count cells with values. Unlike the simple COUNT, COUNTA also counts values that are not numbers. The only thing is that it ignores empty cells, so it can be useful to know how many entries a table has, regardless of whether the data is numeric or not.

The function is expressed: =COUNTA(cells range)

Example: =COUNTA(B2:D11) = 30



=COUNTA(B2:D11)

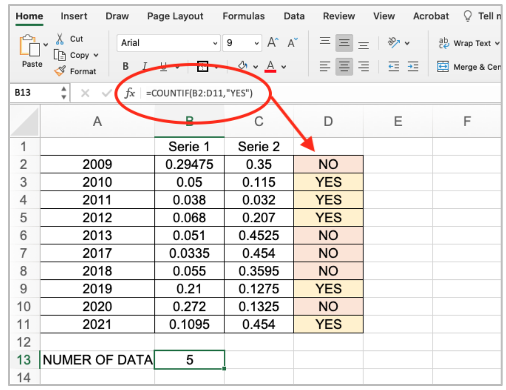
	Serie 1	Serie 2	
2009	0.29475	0.35	NO
2010	0.05	0.115	YES
2011	0.038	0.032	YES
2012	0.068	0.207	YES
2013	0.051	0.4525	NO
2017	0.0335	0.454	NO
2018	0.055	0.3595	NO
2019	0.21	0.1275	YES
2020	0.272	0.1325	NO
2021	0.1095	0.454	YES
NUMER OF DATA	30		

Countif

The COUNTIF formula is a mixture of the previous two. It will count the specified range of cells if they meet certain criterion. It may be that criterion has a certain value or that it meets certain conditions.

The function is expressed: = COUNTIF(cell range, criterion)

Example: = COUNTIF(B2:D11,"YES") = 5

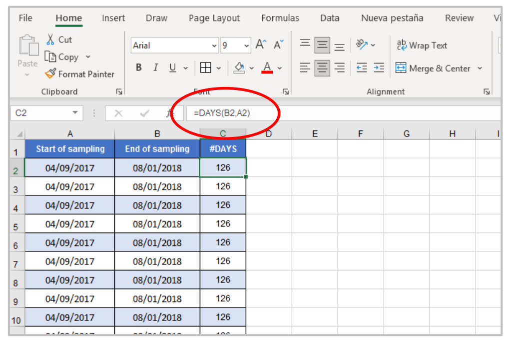


Days

Days' calculations are always a complex subject if it is done manually, but it is much easier when a formula does the job. DAYS tells you the number of days between two dates.

The function is expressed: = DAYS (first date, second date)

Example: = DAYS (B2,A2) = 126



Day

The DAY function returns the day number of a date between 1 and 31. The DAY function has only one argument, which is the serial number of the date to be analyzed. To exemplify the use of the DAY function, observe the following formula:

= DAY("02/08/2021") = 2

Month

The MONTH function allows you to obtain the month number of a date by returning an integer between 1 and 12, which represents the months between January and December.

= MONTH("02/08/2021") = 8

Year

The YEAR function returns the year corresponding to a date. Returns the year as an integer between 1900 and 9999.

= YEAR("02/08/2021") = 2021

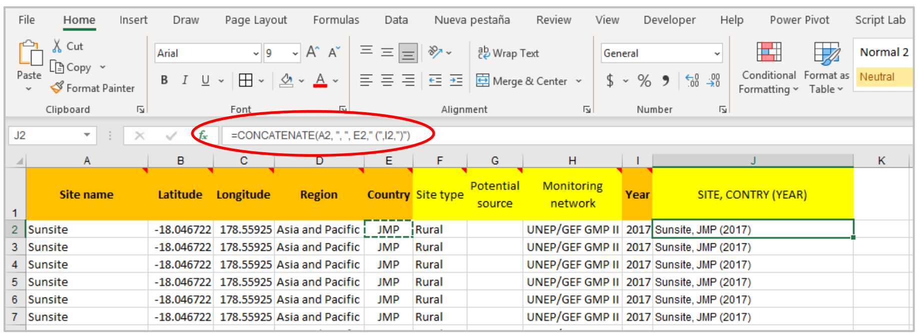
Concatenate

CONCATENATE is a formula whose utility is as simple as putting together several text elements in a single text. You cannot specify a range of cells as a parameter, but individual cells separated by commas.

The function is expressed: = CONCATENATE (cell1, cell2, cell3 ...)

Example: = CONCATENATE (DAY,"/", MONTH,"/", YEAR) = 08/02/2021

If it is required to join text in the database, this function is used, which is shown in the following image (= CONCATENATE (A2, ",", B2, "(", C2, ")")).

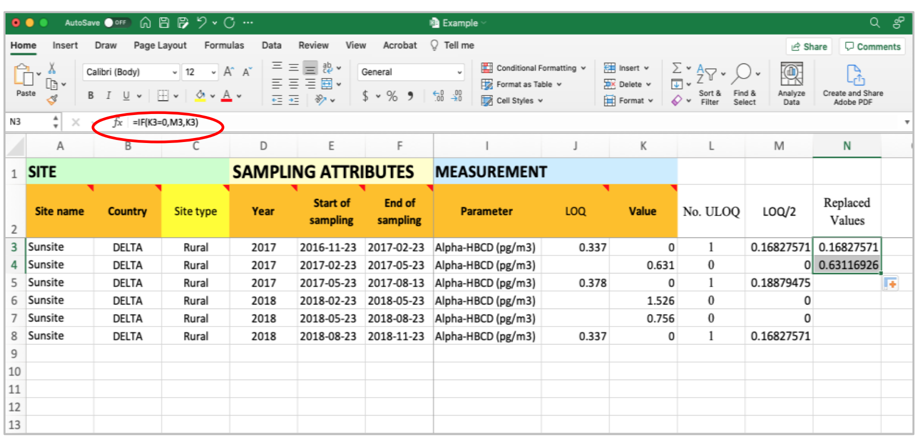


If

The IF function is one of the most popular functions in Excel, and it **allows you to make logical comparisons between a value and what you expect**. So an IF statement can have two results. The first result is if your comparison is True, the second if your comparison is False.

The function is expressed: = IF(logical_test,(value_if_true),(value_if_false))

Example: =IF(value=0, LOQ/2, value)

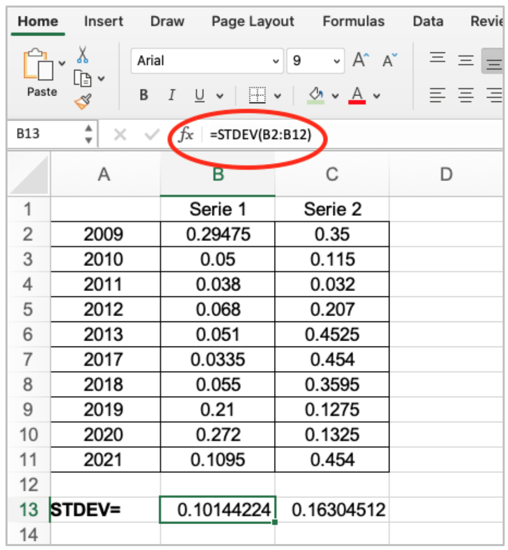


Stdev

The **STDEV** Function is categorized under Excel Statistical functions. The function returns the statistical rank of a given value within a supplied array of values. Thus, it determines the position of a specific value in an array. The function will estimate the standard deviation based on a sample.

The function is expressed: = STDEV(number1,[number2],…)

Example: =STDEV(B2:B12)



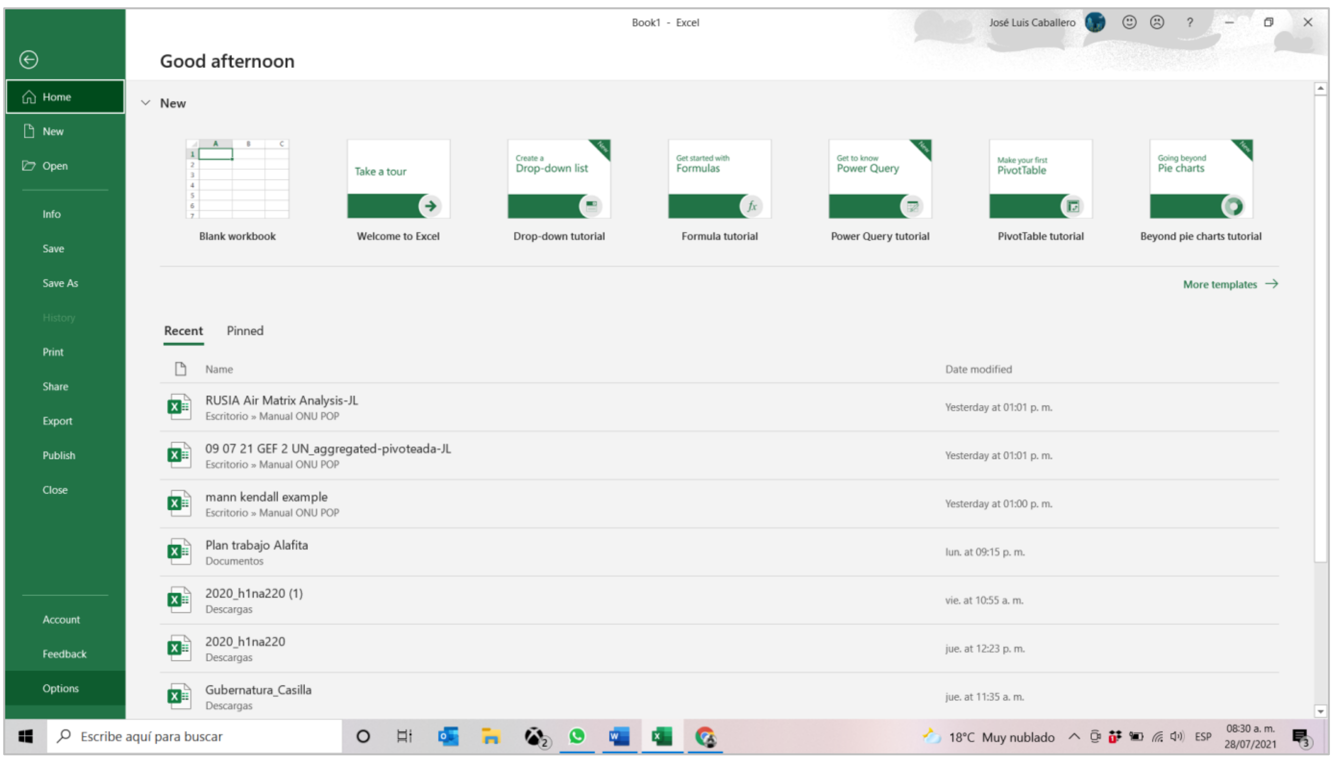
	A	B	C	D
1		Serie 1	Serie 2	
2	2009	0.29475	0.35	
3	2010	0.05	0.115	
4	2011	0.038	0.032	
5	2012	0.068	0.207	
6	2013	0.051	0.4525	
7	2017	0.0335	0.454	
8	2018	0.055	0.3595	
9	2019	0.21	0.1275	
10	2020	0.272	0.1325	
11	2021	0.1095	0.454	
12				
13	STDEV=	0.10144224	0.16304512	
14				

ANNEX 4. INSTALLING POWER PIVOT

Power Pivot is an Excel add-in you can use to perform powerful data analysis and create sophisticated data models. With Power Pivot, you can mash up large volumes of data from various sources, perform information analysis rapidly, and share insights easily.

In both Excel and in Power Pivot, you can create a Data Model, a collection of tables with relationships. The data model you see in a workbook in Excel is the same data model you see in the Power Pivot window. Any data you import into Excel is available in Power Pivot, and vice versa[1]. In order to aggregate data, we will use the power pivot complement for excel.

1. *Click on Home, then options.*



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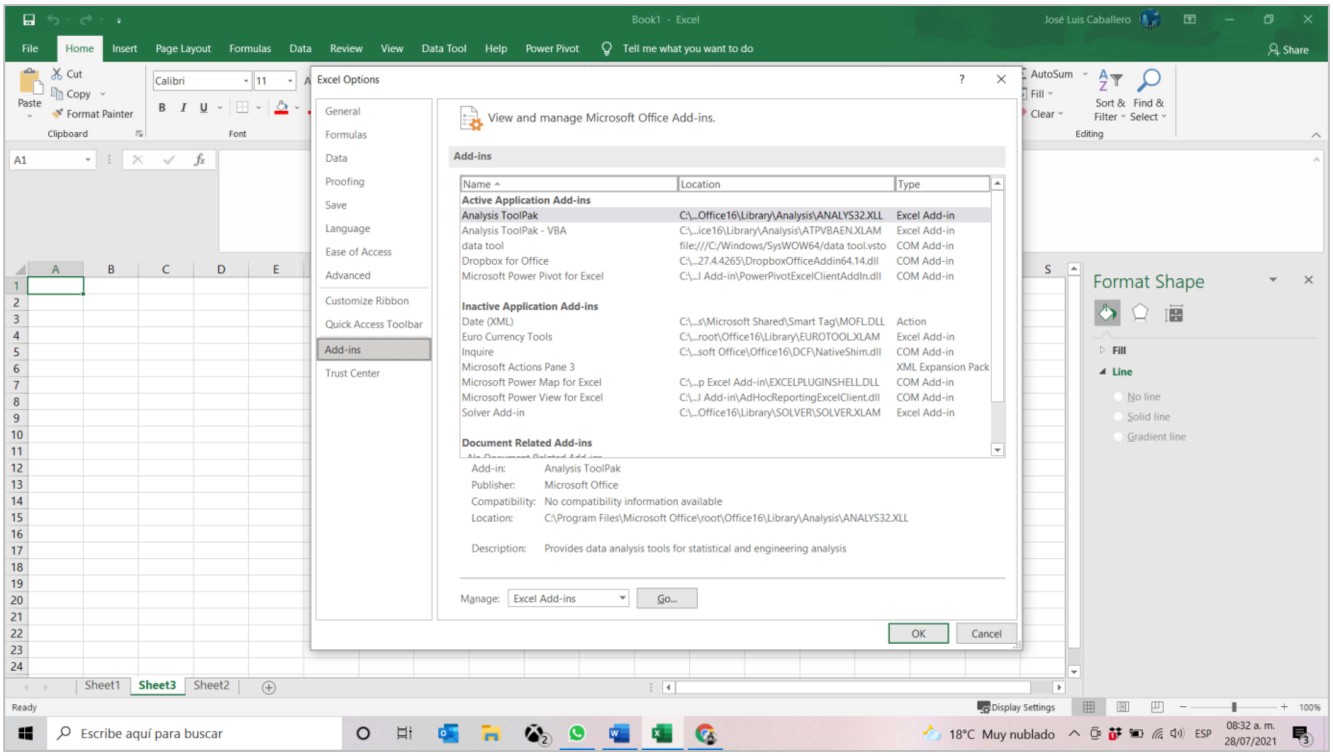
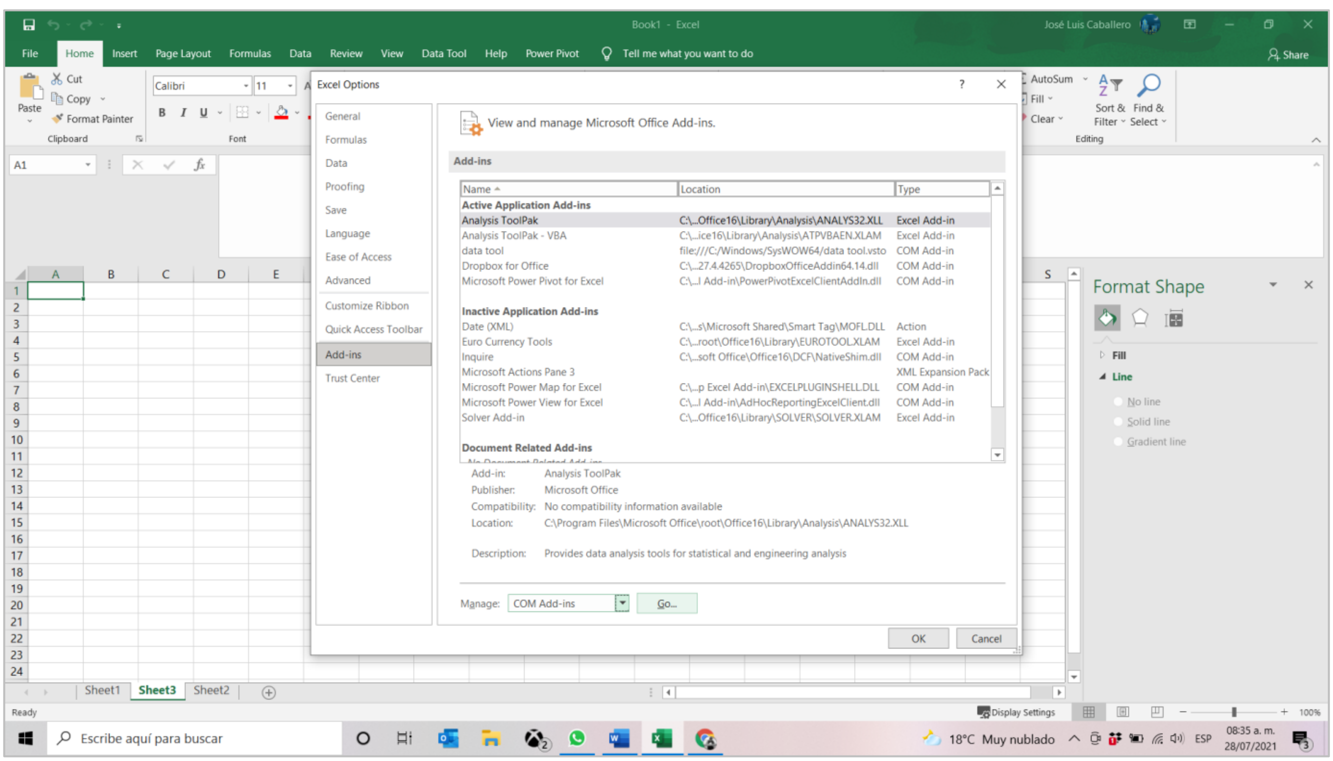
[1] More info on https://support.microsoft.com/en-us/office/power-pivot-powerful-data-analysis-and-data-modeling-in-excel-a9c2c6e2-cc49-4976-a7d7-40896795d045

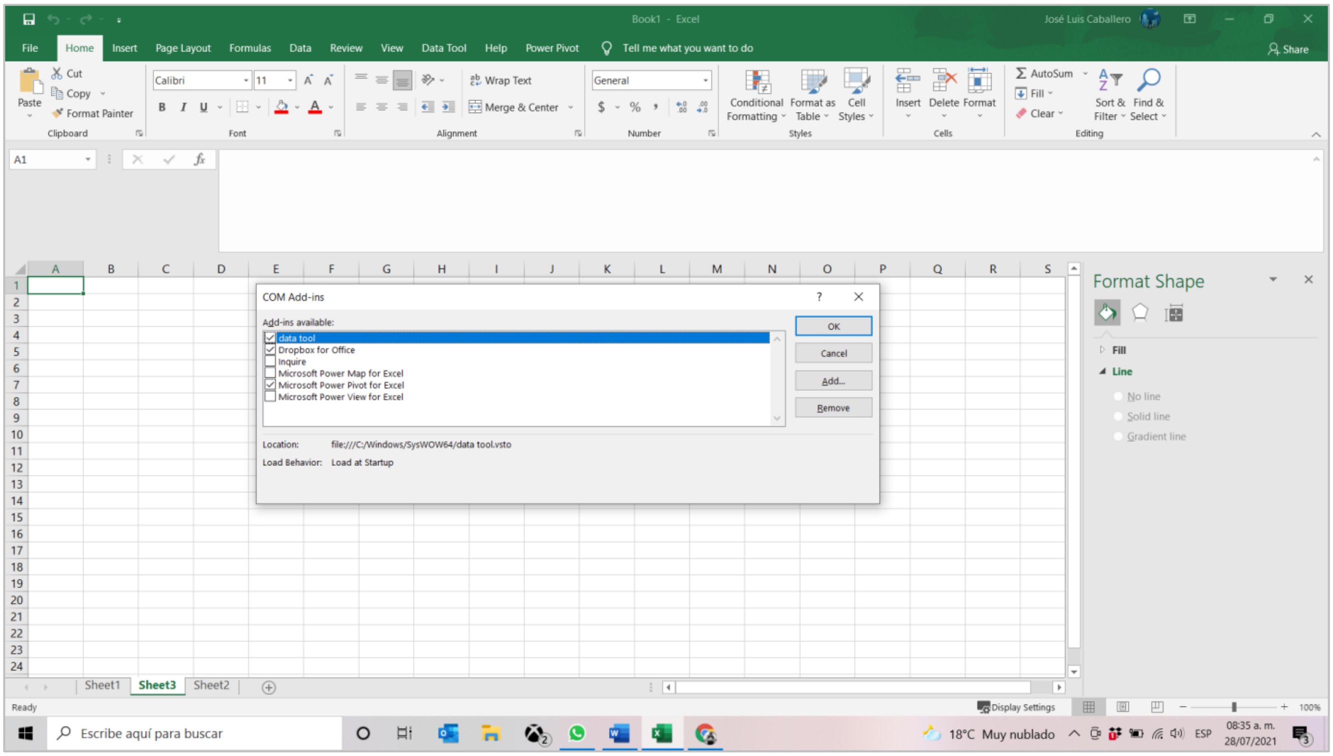
2. *Then click on add-ins and click on "go" at the bottom.*



3. *Then click on COM add-ins*



4. *Then click on go.*
5. *Click on power pivot. And click on OK.*



Now you'll have installed the power pivot complement. This will allow you to create pivot tables that will make easier to calculate statistics indicated on the template.

ANNEX 5. PROCEDURE HOW TO BUILD A DATABASE WITH AGGREGATED AND UN-AGGREGATED DATA

We will use Air matrix data from 6 Pacific islands, that cover the 2010-2011 and 2017-2019 monitoring periods regarding air samples.

We want to compare the POPs concentrations on the islands, with other countries and find out the following:

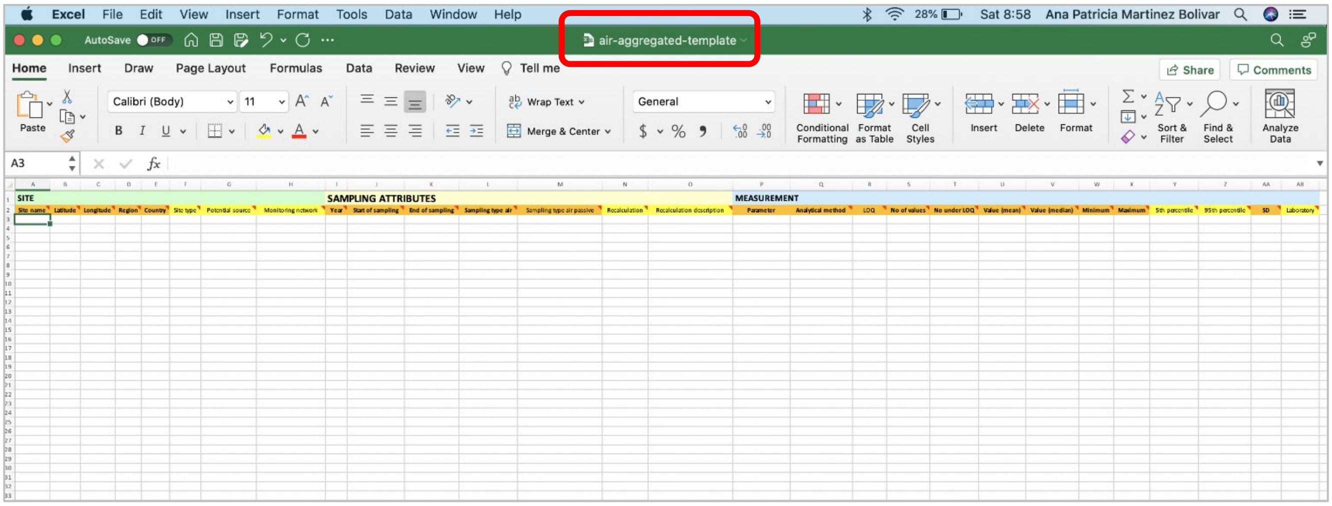
- Are there any differences between sampling periods regarding concentration of POPs in the air?
- Can we identify trends?

CONSTRUCT YOUR DATABASE

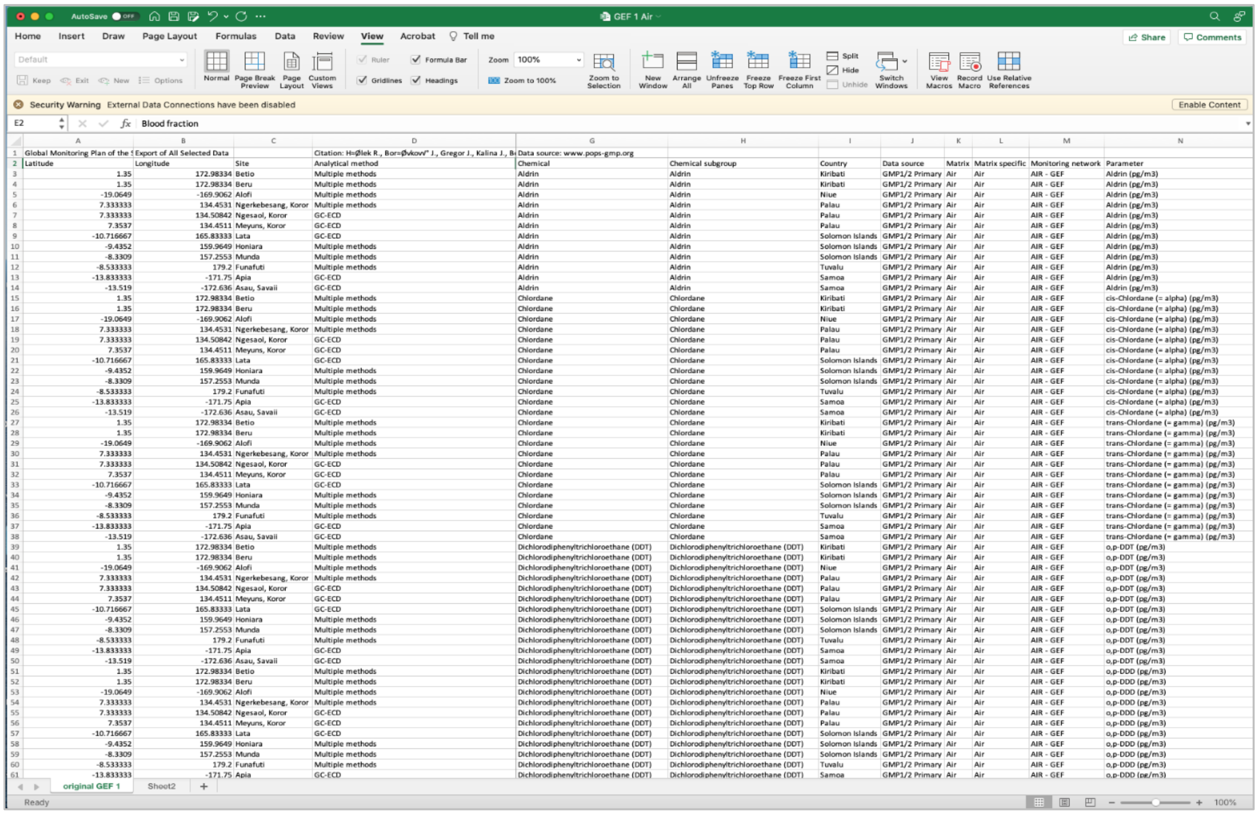
Suppose that we have two files, one with aggregated data called GEF 1 Air (2010-2011 data) and other with un-aggregated data called GEF 2 Air (data from 2017 to 2019) and we want to configurate a database with these two files in order to compare the two sampling periods. GEF 1 Air is an aggregated file and was downloaded from the GMP DWH and GEF 2 Air is an un-aggregated GMP data file.

A) Build Aggregated GEF 1 Air file

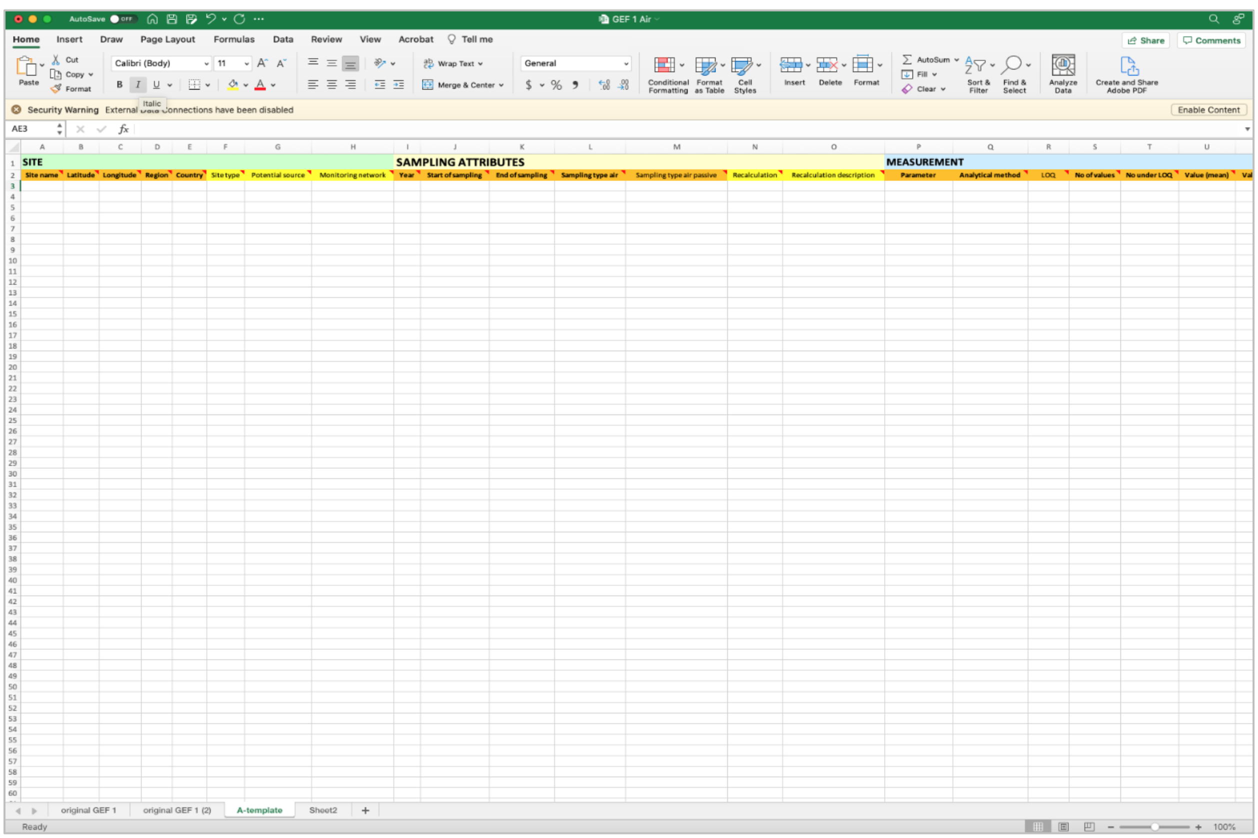
1. Select a template. For this case GMP DWH air- aggregated template.



2. Data of GEF 1 Air File will be incorporated to the GMP DWH air - aggregated template. Copy the “Data sheet” of the air- aggregated template file and paste it in the GEF 1 Air file. Change the name to A-template.

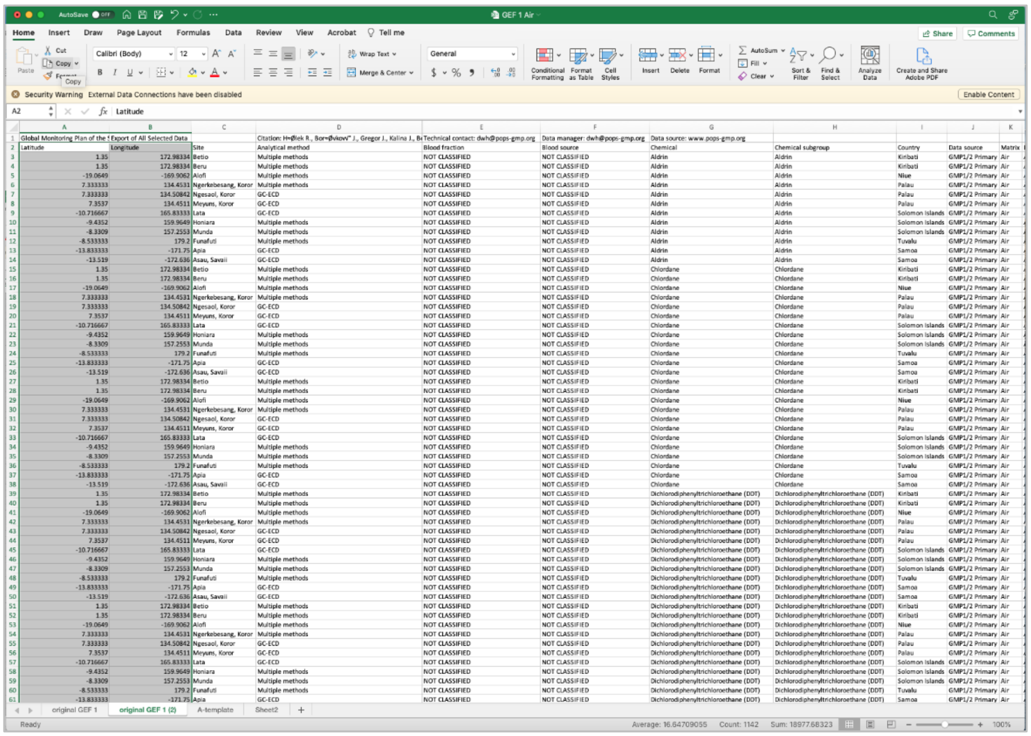


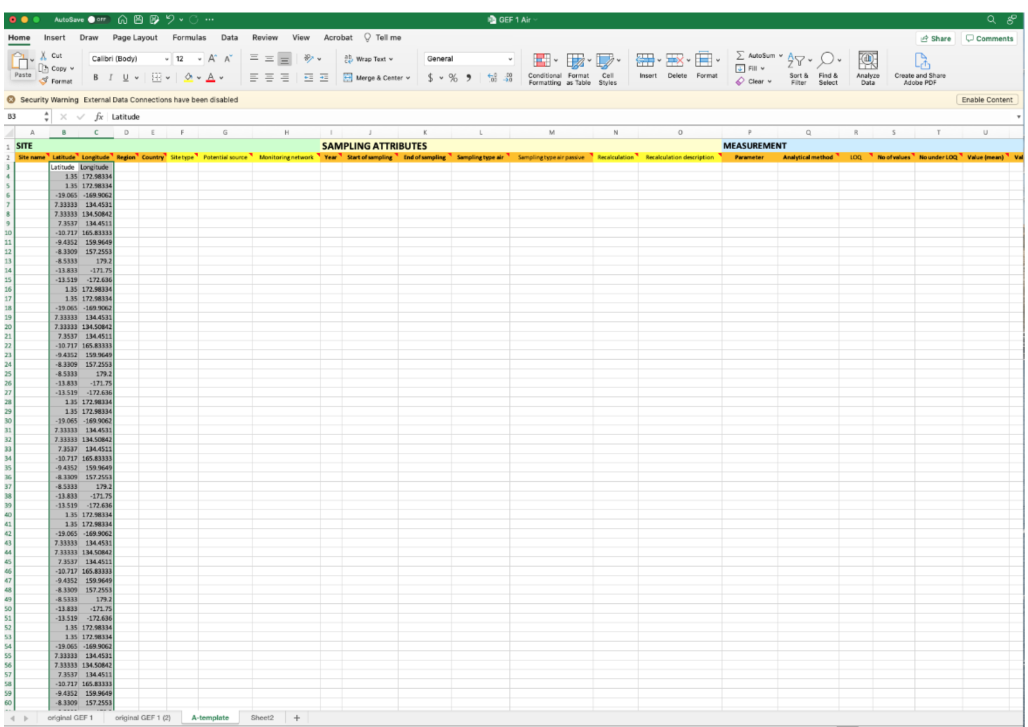
	A	B	C	D	G	H	I	J	K	L	M	N
1	Global Monitoring Plan of the S	Export of All Selected Data		Citation: H=Ølek R., Bor=Øvkovv" J., Gregor J., Kalina J., B	Data source: www.pops-gmp.org							
2	Latitude	Longitude	Site	Analytical method	Chemical	Chemical subgroup	Country	Data source	Matrix	Matrix specific	Monitoring network	Parameter
3	1.35	172.98334	Betio	Multiple methods	Aldrin	Aldrin	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
4	1.35	172.98334	Beru	Multiple methods	Aldrin	Aldrin	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
5	-19.0649	-169.9062	Alofi	Multiple methods	Aldrin	Aldrin	Niue	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
6	7.333333	134.4531	Ngerkebesang, Koror	Multiple methods	Aldrin	Aldrin	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
7	7.333333	134.50842	Ngesaol, Koror	GC-ECD	Aldrin	Aldrin	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
8	7.3537	134.4511	Meyuns, Koror	GC-ECD	Aldrin	Aldrin	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
9	-10.716667	165.83333	Lata	GC-ECD	Aldrin	Aldrin	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
10	-9.4352	159.9649	Honiara	Multiple methods	Aldrin	Aldrin	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
11	-8.3309	157.2553	Munda	Multiple methods	Aldrin	Aldrin	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
12	-8.533333	179.2	Funafuti	Multiple methods	Aldrin	Aldrin	Tuvalu	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
13	-13.833333	-171.75	Apia	GC-ECD	Aldrin	Aldrin	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
14	-13.519	-172.636	Asau, Savaii	GC-ECD	Aldrin	Aldrin	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	Aldrin (pg/m3)
15	1.35	172.98334	Betio	Multiple methods	Chlordane	Chlordane	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
16	1.35	172.98334	Beru	Multiple methods	Chlordane	Chlordane	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
17	-19.0649	-169.9062	Alofi	Multiple methods	Chlordane	Chlordane	Niue	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
18	7.333333	134.4531	Ngerkebesang, Koror	Multiple methods	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
19	7.333333	134.50842	Ngesaol, Koror	GC-ECD	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
20	7.3537	134.4511	Meyuns, Koror	GC-ECD	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
21	-10.716667	165.83333	Lata	GC-ECD	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
22	-9.4352	159.9649	Honiara	Multiple methods	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
23	-8.3309	157.2553	Munda	Multiple methods	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
24	-8.533333	179.2	Funafuti	Multiple methods	Chlordane	Chlordane	Tuvalu	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
25	-13.833333	-171.75	Apia	GC-ECD	Chlordane	Chlordane	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
26	-13.519	-172.636	Asau, Savaii	GC-ECD	Chlordane	Chlordane	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	cis-Chlordane (= alpha) (pg/m3)
27	1.35	172.98334	Betio	Multiple methods	Chlordane	Chlordane	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
28	1.35	172.98334	Beru	Multiple methods	Chlordane	Chlordane	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
29	-19.0649	-169.9062	Alofi	Multiple methods	Chlordane	Chlordane	Niue	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
30	7.333333	134.4531	Ngerkebesang, Koror	Multiple methods	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
31	7.333333	134.50842	Ngesaol, Koror	GC-ECD	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
32	7.3537	134.4511	Meyuns, Koror	GC-ECD	Chlordane	Chlordane	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
33	-10.716667	165.83333	Lata	GC-ECD	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
34	-9.4352	159.9649	Honiara	Multiple methods	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
35	-8.3309	157.2553	Munda	Multiple methods	Chlordane	Chlordane	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
36	-8.533333	179.2	Funafuti	Multiple methods	Chlordane	Chlordane	Tuvalu	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
37	-13.833333	-171.75	Apia	GC-ECD	Chlordane	Chlordane	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
38	-13.519	-172.636	Asau, Savaii	GC-ECD	Chlordane	Chlordane	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	trans-Chlordane (= gamma) (pg/m3)
39	1.35	172.98334	Betio	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
40	1.35	172.98334	Beru	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
41	-19.0649	-169.9062	Alofi	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Niue	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
42	7.333333	134.4531	Ngerkebesang, Koror	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
43	7.333333	134.50842	Ngesaol, Koror	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
44	7.3537	134.4511	Meyuns, Koror	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
45	-10.716667	165.83333	Lata	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
46	-9.4352	159.9649	Honiara	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
47	-8.3309	157.2553	Munda	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
48	-8.533333	179.2	Funafuti	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Tuvalu	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
49	-13.833333	-171.75	Apia	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
50	-13.519	-172.636	Asau, Savaii	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDT (pg/m3)
51	1.35	172.98334	Betio	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
52	1.35	172.98334	Beru	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Kiribati	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
53	-19.0649	-169.9062	Alofi	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Niue	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
54	7.333333	134.4531	Ngerkebesang, Koror	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
55	7.333333	134.50842	Ngesaol, Koror	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
56	7.3537	134.4511	Meyuns, Koror	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Palau	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
57	-10.716667	165.83333	Lata	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
58	-9.4352	159.9649	Honiara	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
59	-8.3309	157.2553	Munda	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Solomon Islands	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
60	-8.533333	179.2	Funafuti	Multiple methods	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Tuvalu	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)
61	-13.833333	-171.75	Apia	GC-ECD	Dichlorodiphenyltrichloroethane (DDT)	Dichlorodiphenyltrichloroethane (DDT)	Samoa	GMP1/2 Primary	Air	Air	AIR - GEF	o,p-DDD (pg/m3)



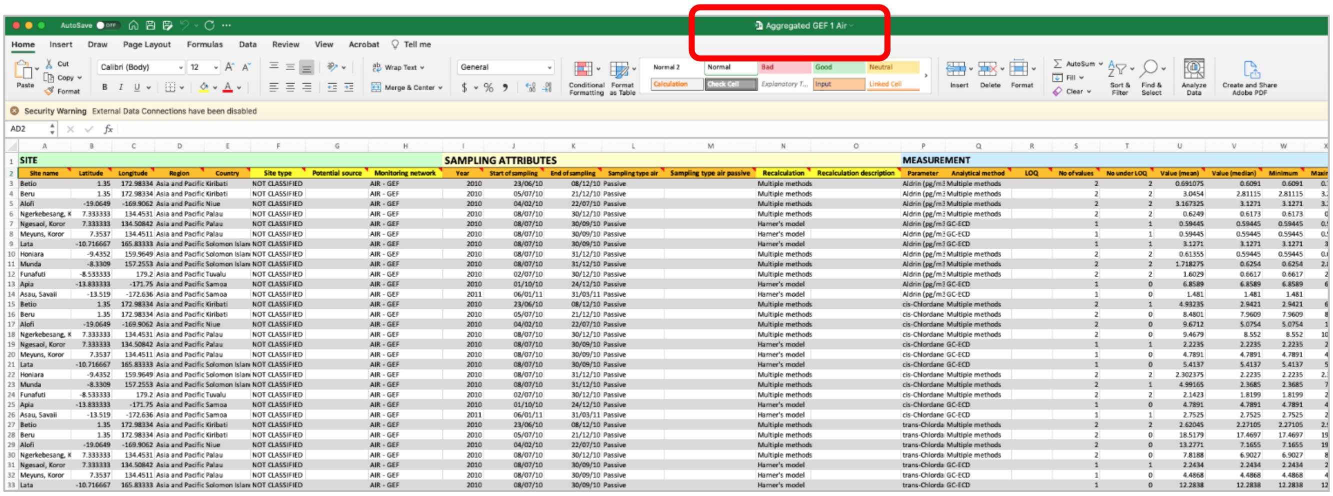
SITE								SAMPLING ATTRIBUTES							MEASUREMENT						
Site name	Latitude	Longitude	Region	Country	Site type	Potential source	Monitoring network	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	No of values	No under LOQ	Value (mean)	Val

3. Start by filling in the A-template sheet with the data we want to analyze (GEF 1 Air). It is recommended to duplicate the original GEF 1 sheet first and then copy and paste each column in order to complete this step. In other words, you will have to copy columns from original GEF 1 (2) sheet and paste them into the corresponding column of the aggregated data template, A-template sheet.





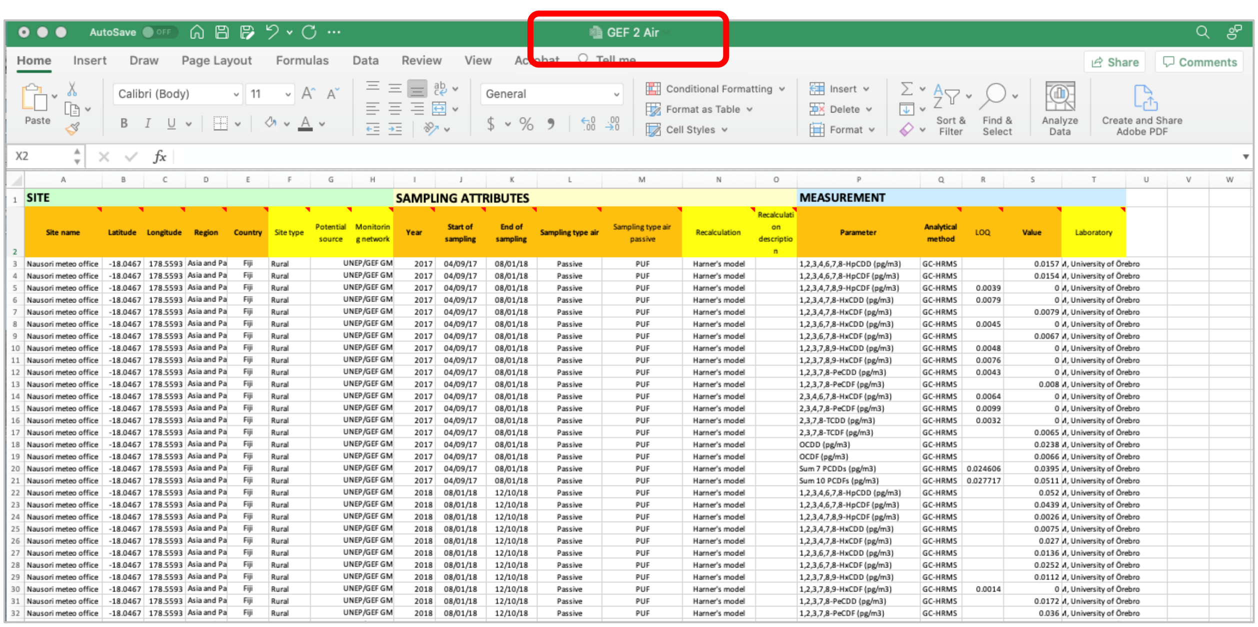
4. After all columns have been copied, review the A- template sheet to make sure all columns are completed. Duplicate de A-template sheet and save as AA-GEF 1. Delete row 3 with duplicate headings and save the file as Aggregated GEF 1 Air.

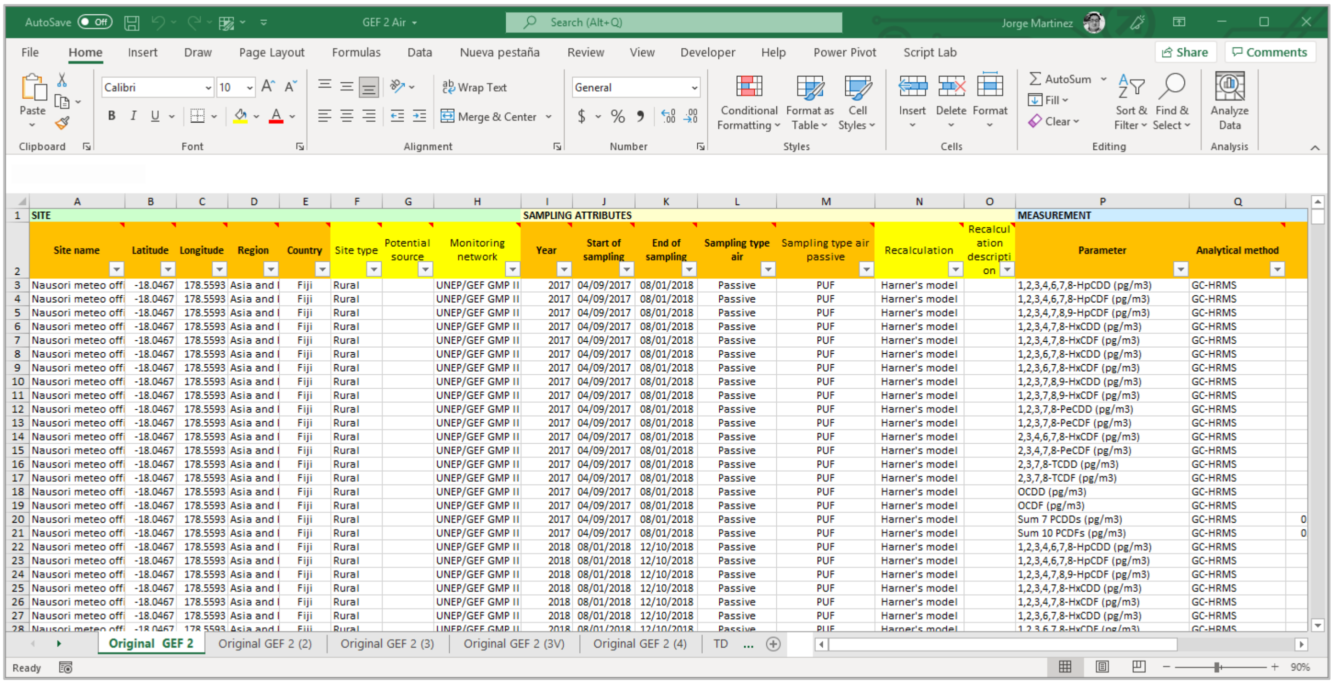


B) Build Aggregated GEF 2 Air file

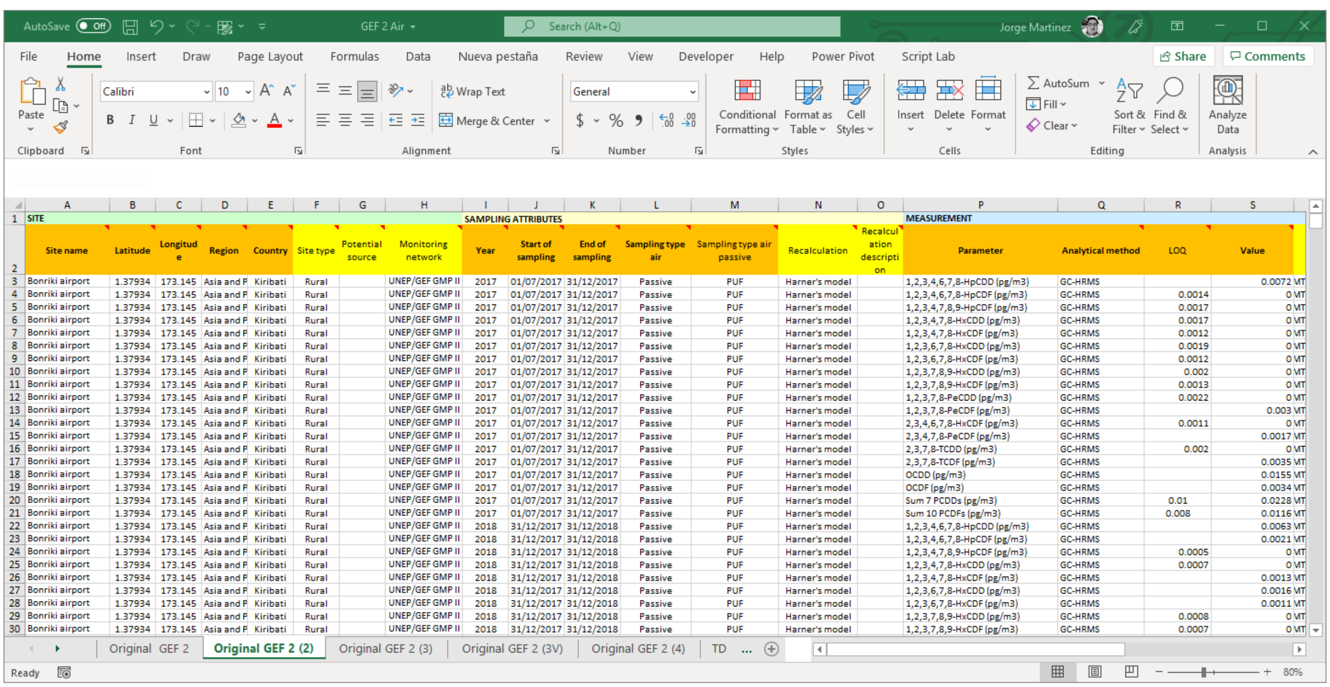
1. Select the same template. For this case GMP DWH air- aggregated template.

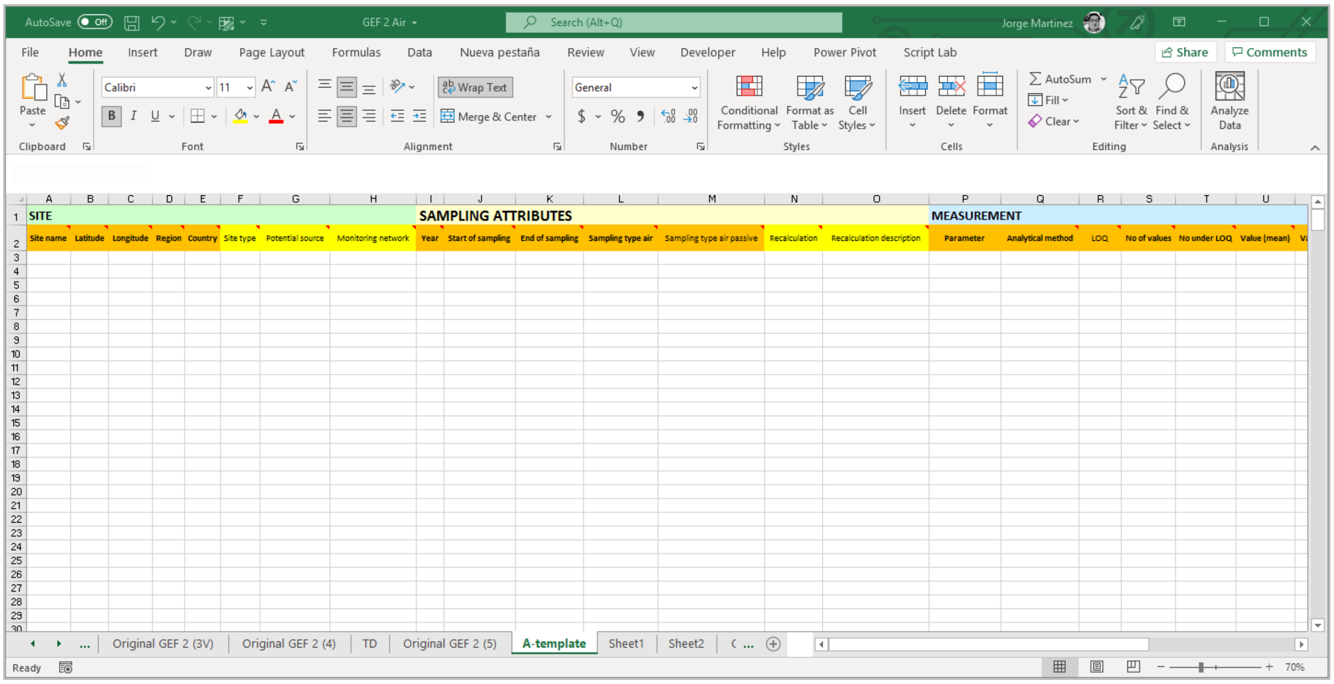
2. Open GEF 2 Air file. GEF 2 Air is an un-aggregated file. This file has many sheets, one per group of parameters, it is recommended to merge all sheets into one to facilitate data aggregation. We will call it “Original GEF 2”.





3. Open a new file. Copy the original GEF 2 sheet and paste it in the new file. Close GEF 2 Air. Duplicate the original GEF 2 sheet. Copy the “Data sheet” of the air- aggregated template file and paste it in this new file. Change the name of data sheet to A-template. Save the file as Aggregated GEF 2 Air. Aggregation can be made with functions and formulas as was described in procedure 2.3.2 or by pivot table.





4. **Calculating LOQ values**. Before the aggregation of the parameter's values per monitoring year, it is required to replace zero values, calculate number of values ULOQ and check the format of the start and end of sampling values. To calculate the number of ULOQ values first check the LOQ column against the Value column. When Values appear in the LOQ column the Value column should have zero values. If this is the case add a new column, named No. ULOQ, to the original GEF 2 (2) sheet that will allow us to count how many values under LOQ where recorded. The following formula is used for this purpose:

=IF(LOQ>0,1,0)

MEASUREMENT				
Parameter	Analytical method	LOQ	Value	Laboratory
1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro
1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro
1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro
1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro
1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro
1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro
1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro
1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro
1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro
1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro
1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro
2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro
2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro
2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro

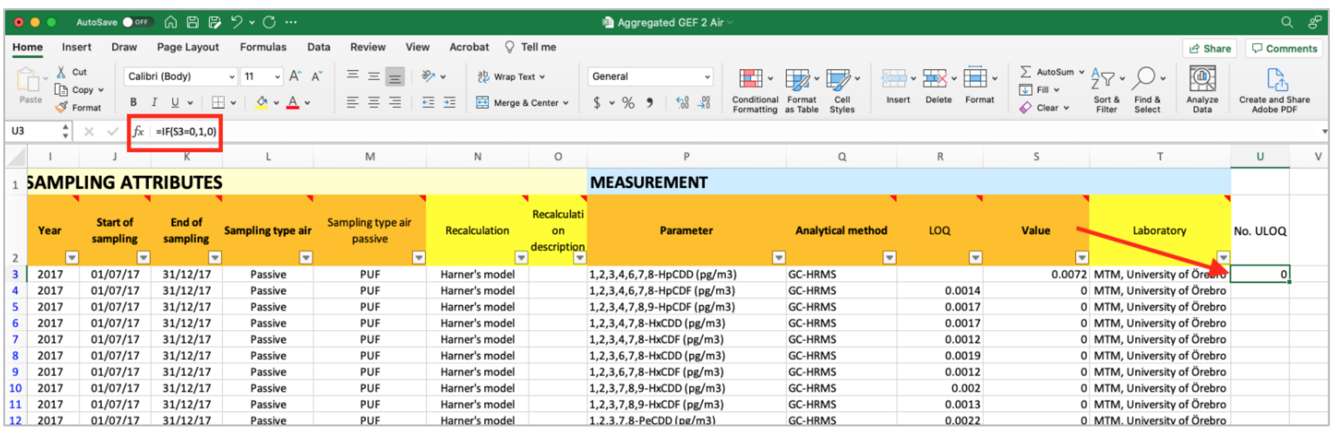
5. If this is not the case, then the ULOQ values should be calculated with the data in the Value column by applying the following formula:

=IF(Value=0,1,0)

MEASUREMENT				
Parameter	**Analytical method**	**LOQ**	**Value**	**Laboratory**
1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro
1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro
1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro
1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro
1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro
1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro
1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro
1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro
1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro
1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro
1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro
2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro
2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro
2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro
2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro
OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro
OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro
Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro
Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro

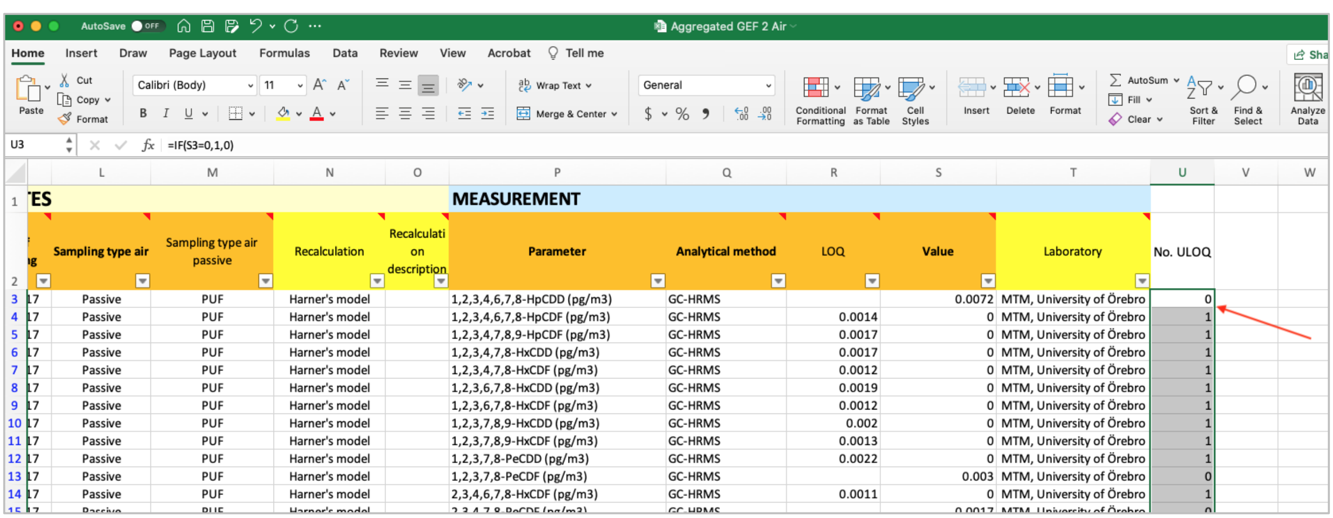
Therefore, for the Air GEF2 database, the following formula will be required:

=IF(S3=0,1,0)



Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation on description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	

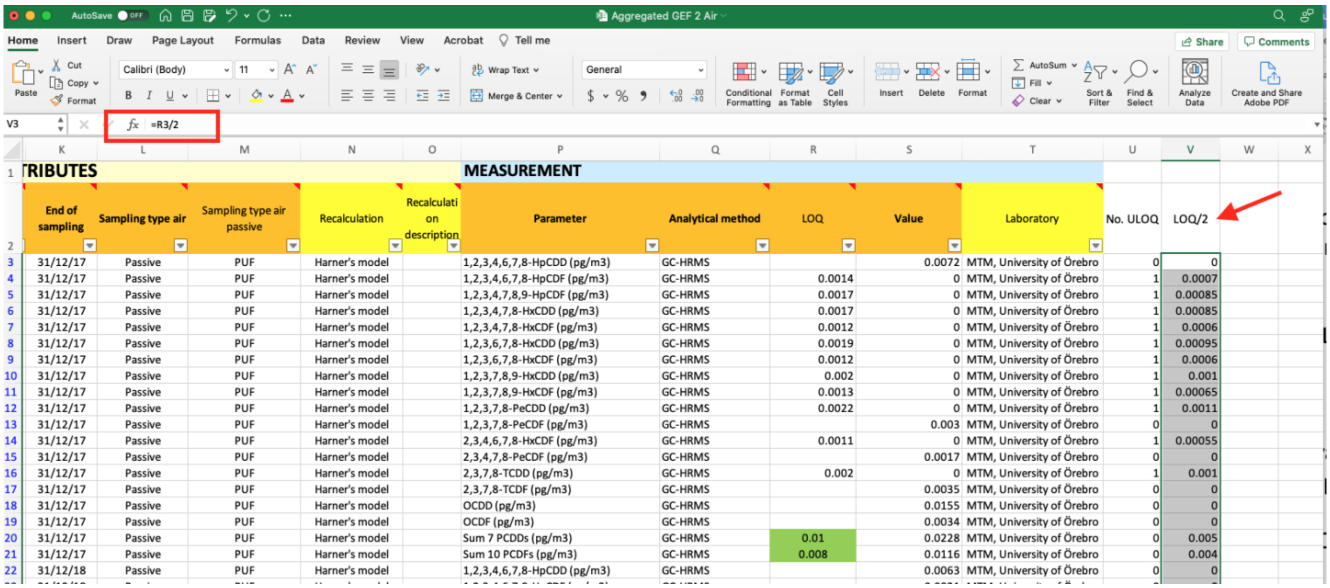
Drag the formula downwards to all cells by clicking in the lower right part of the cell.



Sampling type air	Sampling type air passive	Recalculation	Recalculation on description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ
Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0
Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1
Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0
Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1

6. According to the GMP Guidance, before aggregating the data, zero values are required to be replaced the by half of the LOQ values. Therefore, zero values should be replaced. In a new column, named LOQ/2, divide LOQ by two and copy the formula downwards to all cells.

=LOQ/2

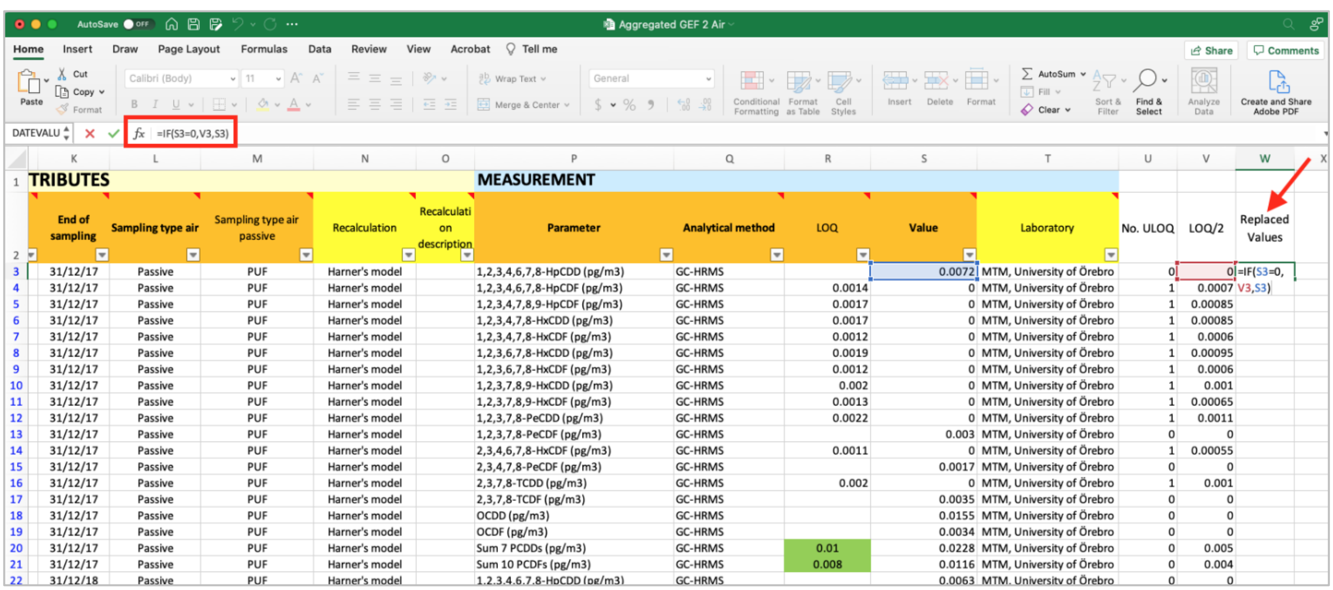


Row	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2
3	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0
4	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007
5	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085
6	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085
7	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006
8	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095
9	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006
10	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001
11	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065
12	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011
13	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0
14	31/12/17	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055
15	31/12/17	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0
16	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001
17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0
18	31/12/17	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0
19	31/12/17	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0
20	31/12/17	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005
21	31/12/17	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004
22	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	0

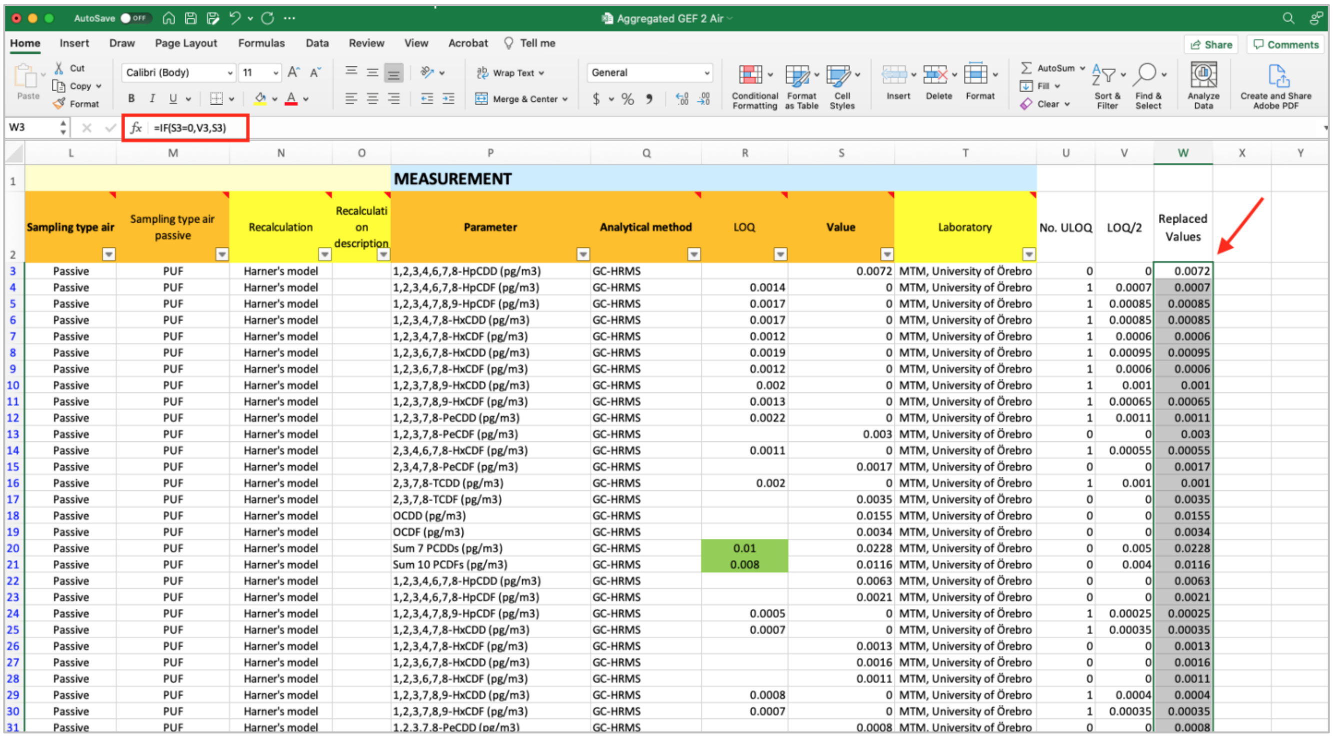
7. Next, you will need to replace zero values in the column named "Value". In a new column named, Replaced Values, type the following formula:

=IF(value=0, LOQ/2, value)

It should look like this: =IF(S3=0,V3,S3). Copy the formula downwards to all cells. These Replaced Values will be the new values for the calculation of the statistical parameters.

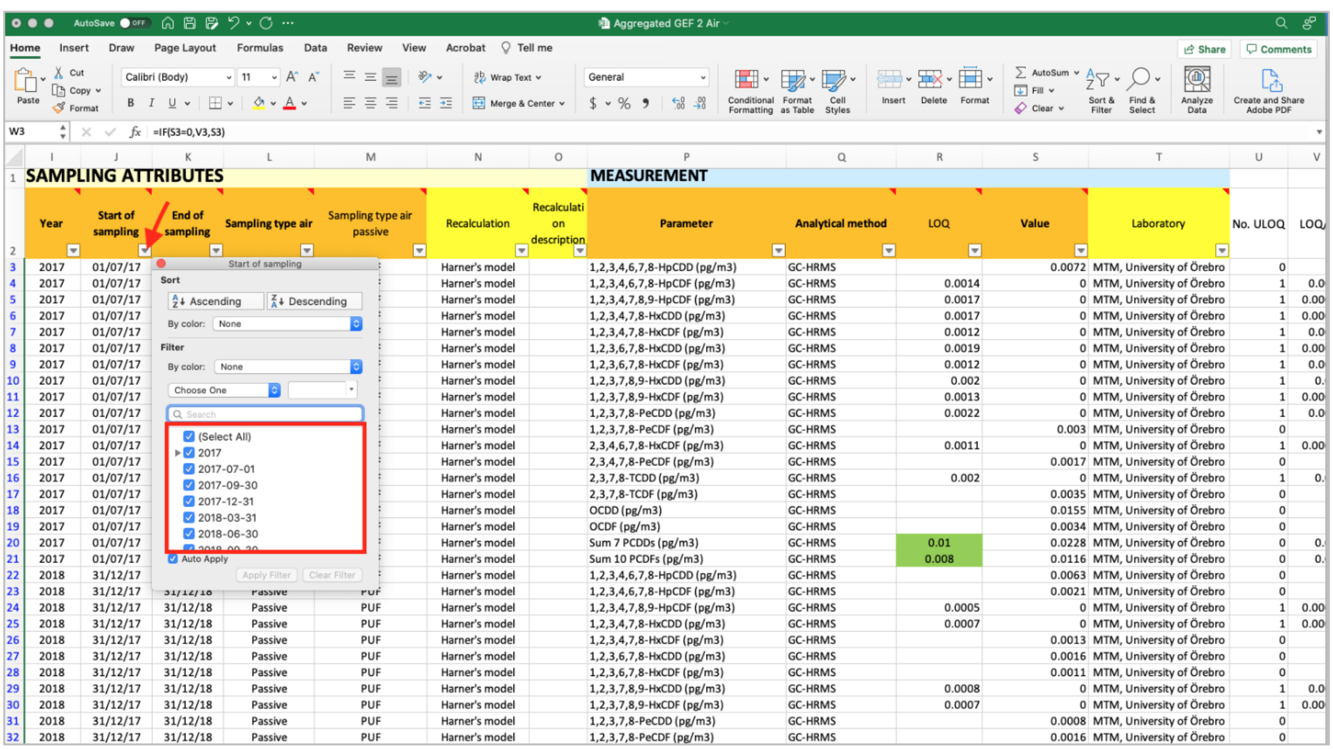


Row	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values
3	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0	=IF(S3=0,
4	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007	V3,S3)
5	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	
6	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	
7	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	
8	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095	
9	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	
10	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	
11	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065	
12	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011	
13	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0	
14	31/12/17	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055	
15	31/12/17	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0	
16	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	
17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0	
18	31/12/17	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0	
19	31/12/17	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0	
20	31/12/17	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005	
21	31/12/17	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004	
22	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	0	



	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values
1					MEASUREMENT							
3	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0	0.0072
4	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007	0.0007
5	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085
6	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085
7	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006
8	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095	0.00095
9	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006
10	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001
11	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065	0.00065
12	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011	0.0011
13	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0	0.003
14	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055	0.00055
15	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0	0.0017
16	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001
17	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0	0.0035
18	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0	0.0155
19	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0	0.0034
20	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005	0.0228
21	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004	0.0116
22	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	0	0.0063
23	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS		0.0021	MTM, University of Örebro	0	0	0.0021
24	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0005	0	MTM, University of Örebro	1	0.00025	0.00025
25	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035
26	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS		0.0013	MTM, University of Örebro	0	0	0.0013
27	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	0	0.0016
28	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0011	MTM, University of Örebro	0	0	0.0011
29	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.0008	0	MTM, University of Örebro	1	0.0004	0.0004
30	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035
31	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	0	0.0008

8. Review the format of the sampling periods by filtering the dates. They should be in date format, if not, change the format using the Date Time function and then select DATEVALUE. A number will appear. Change the format with format cells.

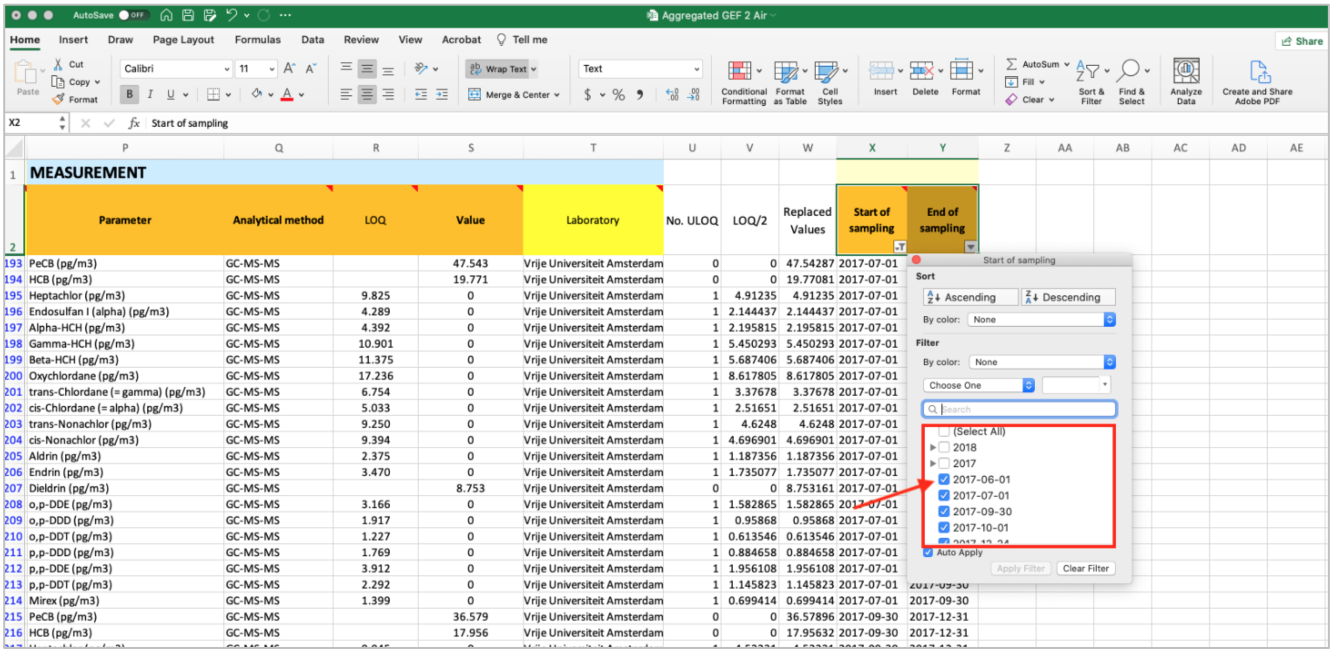


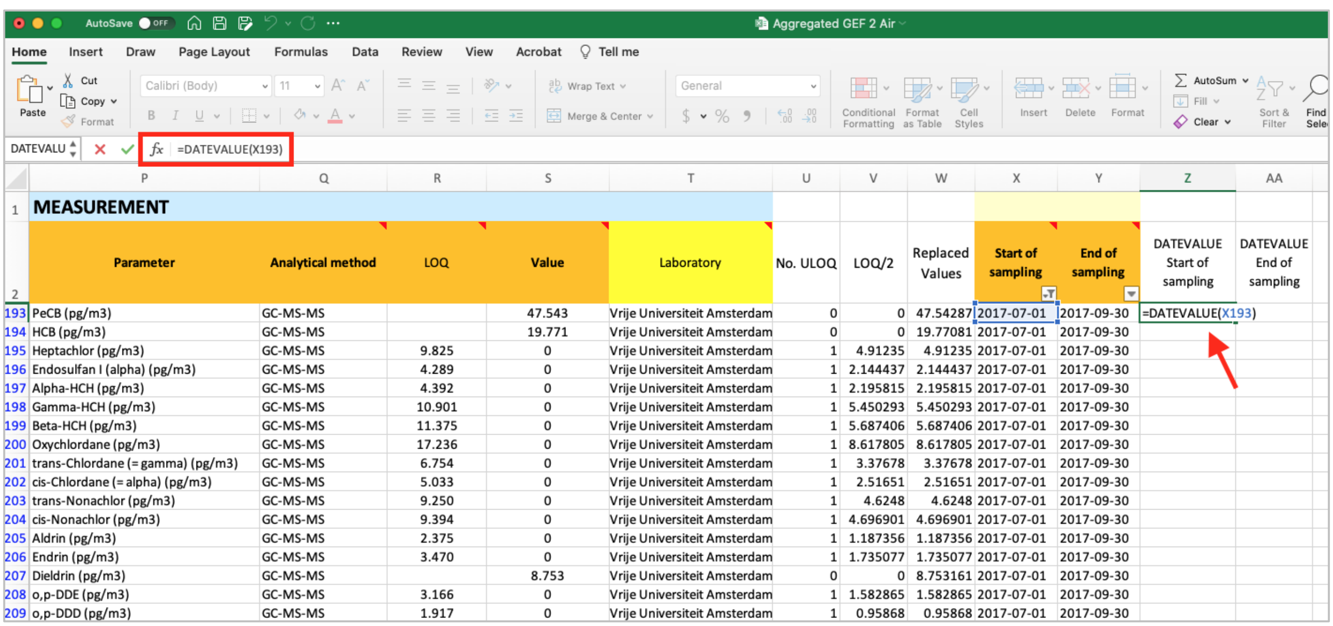
	Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/
1	SAMPLING ATTRIBUTES							MEASUREMENT						
3	2017	01/07/17				Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	
4	2017	01/07/17				Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0
5	2017	01/07/17				Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00
6	2017	01/07/17				Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00
7	2017	01/07/17				Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0
8	2017	01/07/17				Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00
9	2017	01/07/17				Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0
10	2017	01/07/17				Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.
11	2017	01/07/17				Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00
12	2017	01/07/17				Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0
13	2017	01/07/17				Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	
14	2017	01/07/17				Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00
15	2017	01/07/17				Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	
16	2017	01/07/17				Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.
17	2017	01/07/17				Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	
18	2017	01/07/17				Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	
19	2017	01/07/17				Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	
20	2017	01/07/17				Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.
21	2017	01/07/17				Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.
22	2018	31/12/17				Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	
23	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS		0.0021	MTM, University of Örebro	0	
24	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0005	0	MTM, University of Örebro	1	0.00
25	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00
26	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS		0.0013	MTM, University of Örebro	0	
27	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	
28	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0011	MTM, University of Örebro	0	
29	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.0008	0	MTM, University of Örebro	1	0.0
30	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00
31	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	
32	2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	

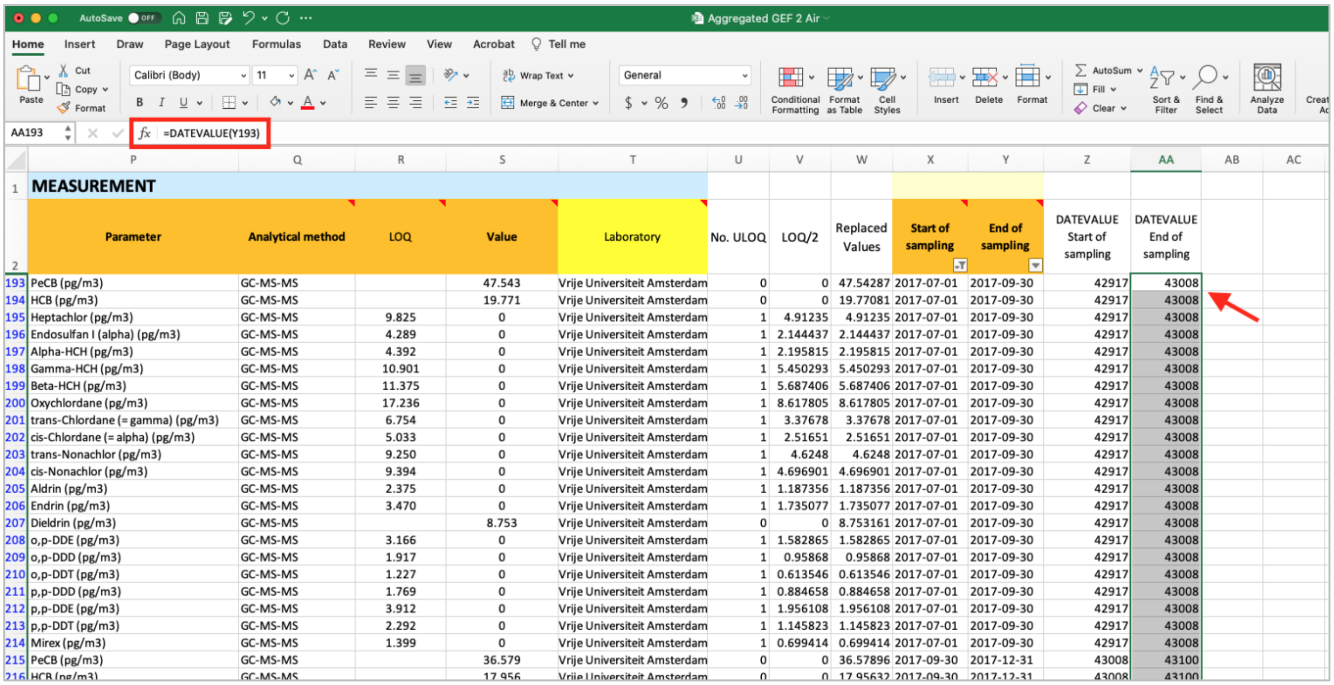
Therefore, for the Air GEF2 database, will be required to change the formatting of several cells. It is recommended to copy the two columns of Start/End of sampling to perform the formatting change and then replace these columns.

Copy the columns and then filter the cells that do not have date formatting. Use Excel's DATEVALUE function and drag the formula for all the cells. Your formulas will look like these:

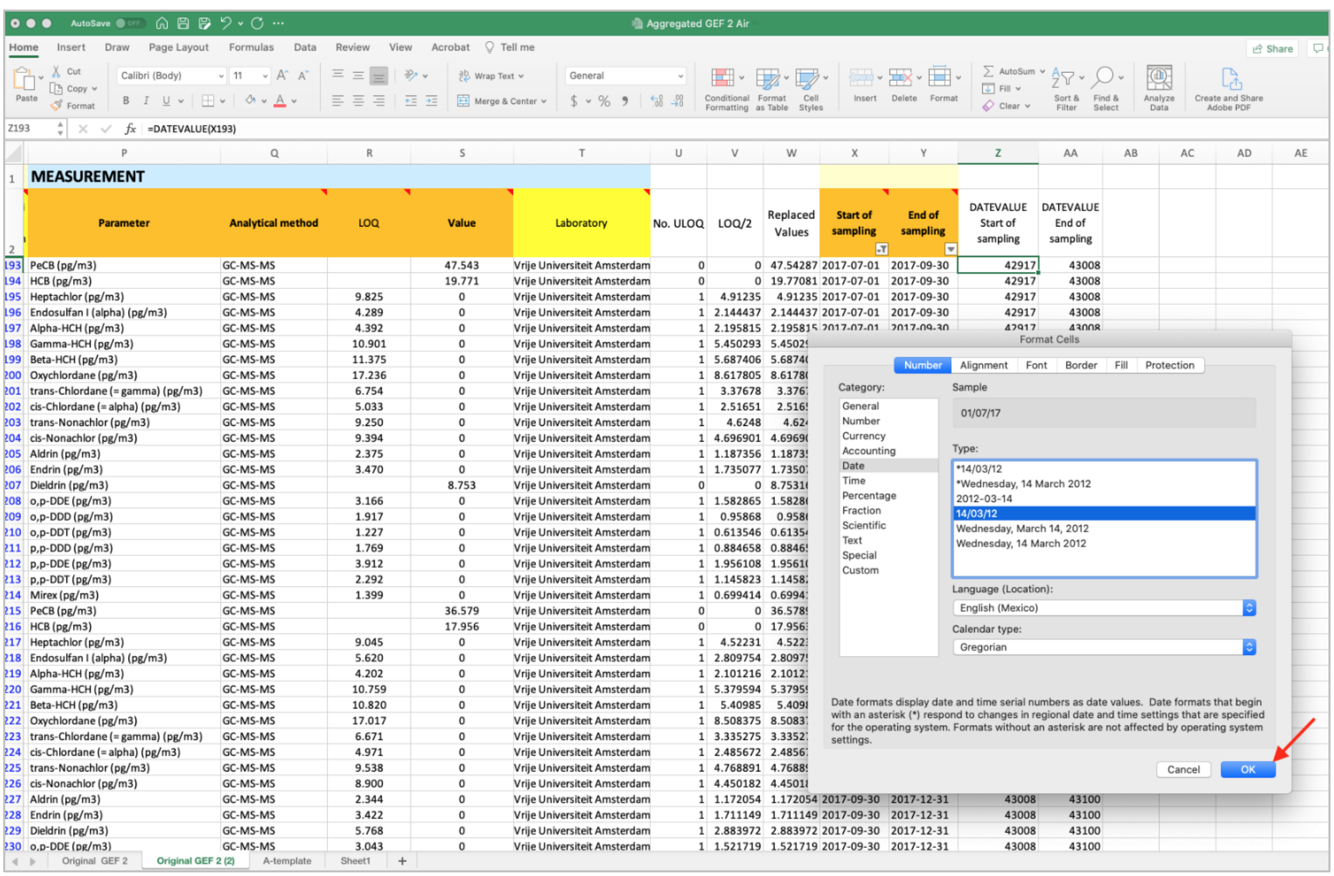
=DATEVALUE(X193)
and
=DATEVALUE(Y193)

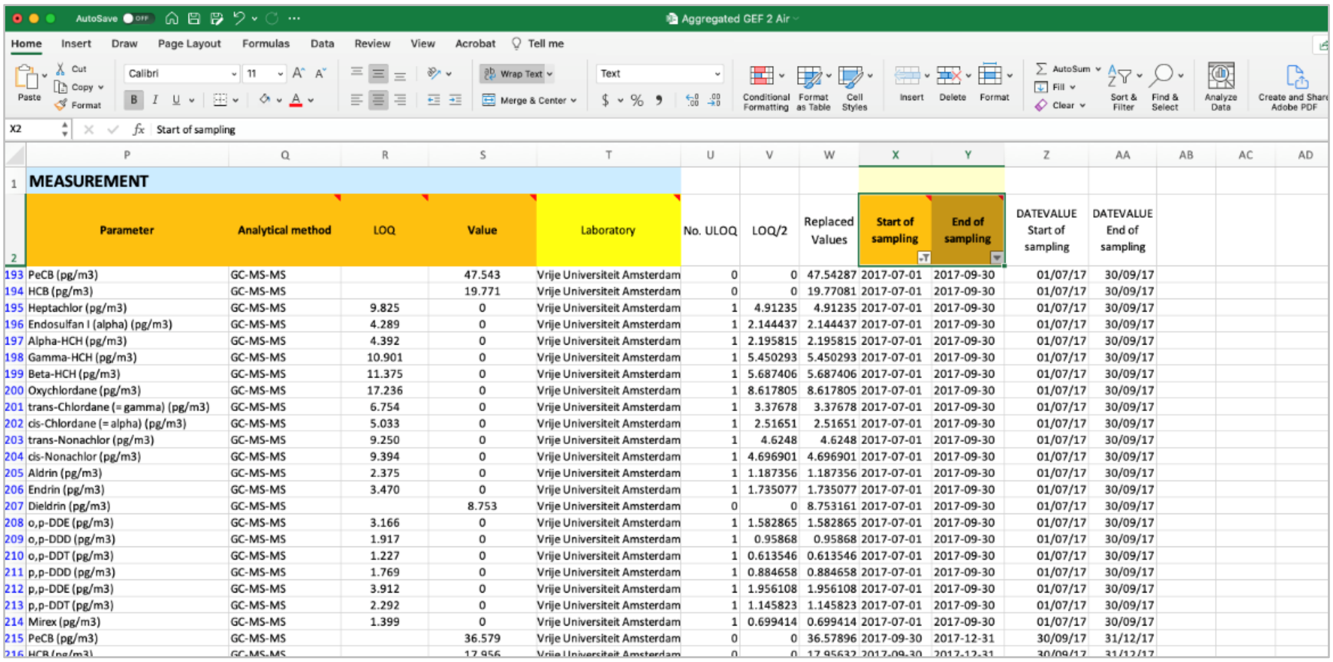






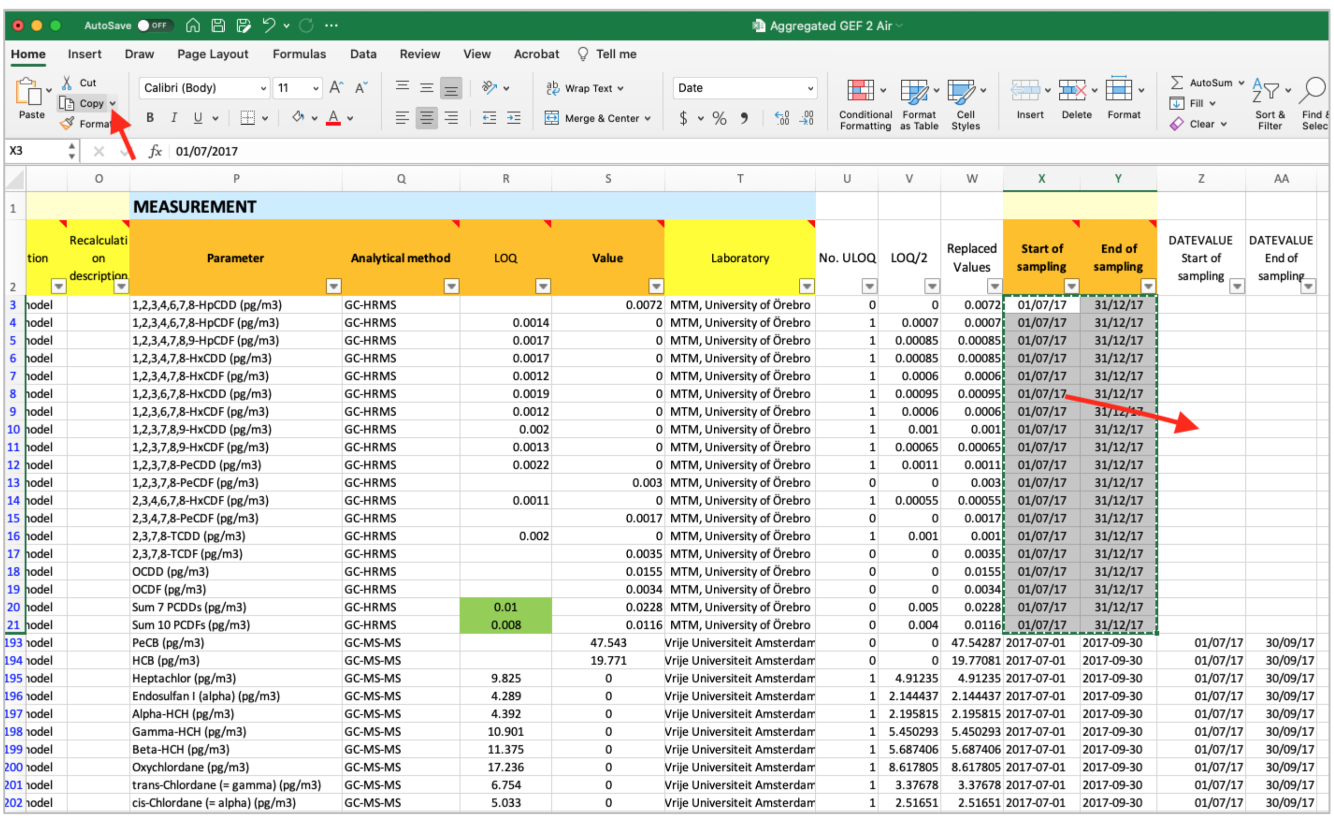
Change the format with format cells, click on date and then choose the format **dd/mm/yy**. Drag the format to all cells and finally, replace this format in the original Star /End of sampling cells.



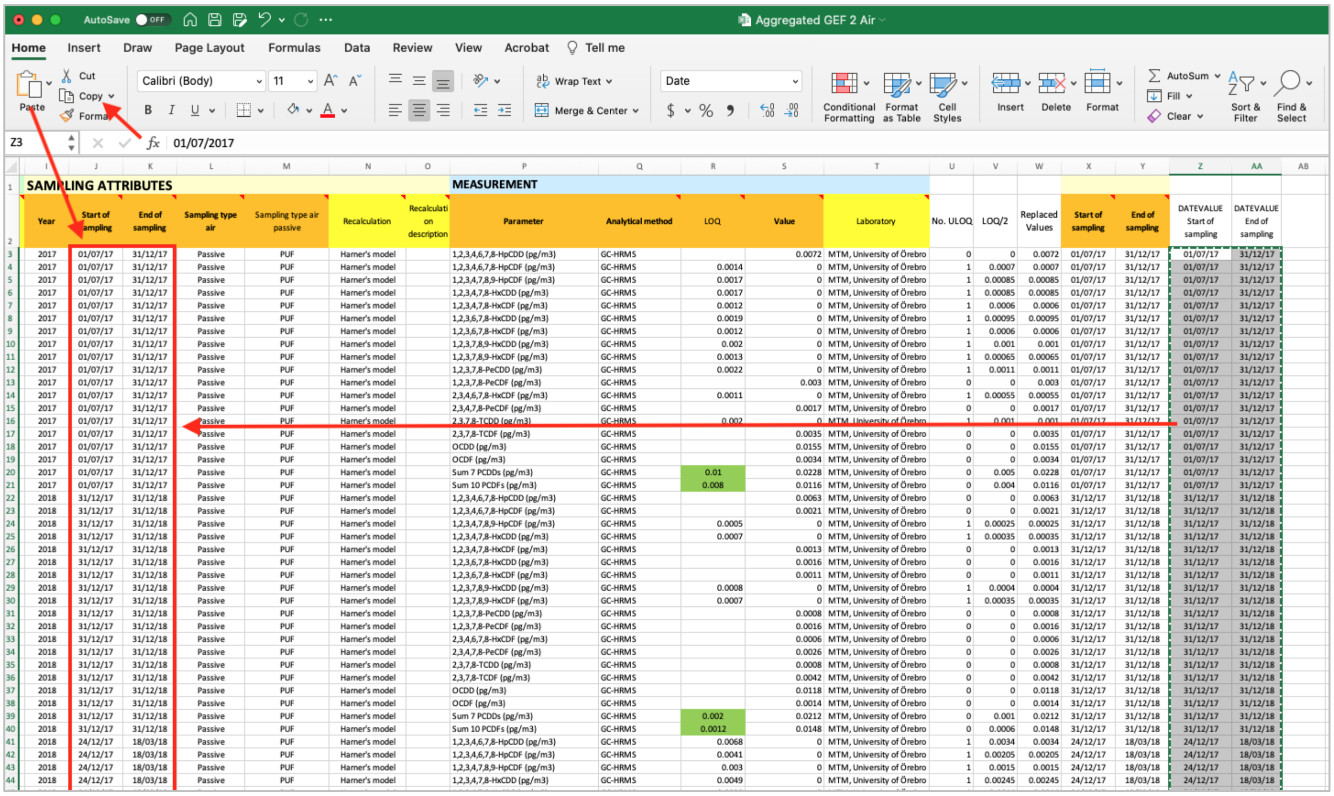


	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values	Start of sampling	End of sampling	DATEVALUE Start of sampling	DATEVALUE End of sampling
1	MEASUREMENT											
193	PeCB (pg/m3)	GC-MS-MS		47.543	Vrije Universiteit Amsterdam	0	0	47.54287	2017-07-01	2017-09-30	01/07/17	30/09/17
194	HCB (pg/m3)	GC-MS-MS		19.771	Vrije Universiteit Amsterdam	0	0	19.77081	2017-07-01	2017-09-30	01/07/17	30/09/17
195	Heptachlor (pg/m3)	GC-MS-MS	9.825	0	Vrije Universiteit Amsterdam	1	4.91235	4.91235	2017-07-01	2017-09-30	01/07/17	30/09/17
196	Endosulfan I (alpha) (pg/m3)	GC-MS-MS	4.289	0	Vrije Universiteit Amsterdam	1	2.144437	2.144437	2017-07-01	2017-09-30	01/07/17	30/09/17
197	Alpha-HCH (pg/m3)	GC-MS-MS	4.392	0	Vrije Universiteit Amsterdam	1	2.195815	2.195815	2017-07-01	2017-09-30	01/07/17	30/09/17
198	Gamma-HCH (pg/m3)	GC-MS-MS	10.901	0	Vrije Universiteit Amsterdam	1	5.450293	5.450293	2017-07-01	2017-09-30	01/07/17	30/09/17
199	Beta-HCH (pg/m3)	GC-MS-MS	11.375	0	Vrije Universiteit Amsterdam	1	5.687406	5.687406	2017-07-01	2017-09-30	01/07/17	30/09/17
200	Oxychlordane (pg/m3)	GC-MS-MS	17.236	0	Vrije Universiteit Amsterdam	1	8.617805	8.617805	2017-07-01	2017-09-30	01/07/17	30/09/17
201	trans-Chlordane (= gamma) (pg/m3)	GC-MS-MS	6.754	0	Vrije Universiteit Amsterdam	1	3.37678	3.37678	2017-07-01	2017-09-30	01/07/17	30/09/17
202	cis-Chlordane (= alpha) (pg/m3)	GC-MS-MS	5.033	0	Vrije Universiteit Amsterdam	1	2.51651	2.51651	2017-07-01	2017-09-30	01/07/17	30/09/17
203	trans-Nonachlor (pg/m3)	GC-MS-MS	9.250	0	Vrije Universiteit Amsterdam	1	4.6248	4.6248	2017-07-01	2017-09-30	01/07/17	30/09/17
204	cis-Nonachlor (pg/m3)	GC-MS-MS	9.394	0	Vrije Universiteit Amsterdam	1	4.696901	4.696901	2017-07-01	2017-09-30	01/07/17	30/09/17
205	Aldrin (pg/m3)	GC-MS-MS	2.375	0	Vrije Universiteit Amsterdam	1	1.187356	1.187356	2017-07-01	2017-09-30	01/07/17	30/09/17
206	Endrin (pg/m3)	GC-MS-MS	3.470	0	Vrije Universiteit Amsterdam	1	1.735077	1.735077	2017-07-01	2017-09-30	01/07/17	30/09/17
207	Dieldrin (pg/m3)	GC-MS-MS		8.753	Vrije Universiteit Amsterdam	0	0	8.753161	2017-07-01	2017-09-30	01/07/17	30/09/17
208	o,p-DDE (pg/m3)	GC-MS-MS	3.166	0	Vrije Universiteit Amsterdam	1	1.582865	1.582865	2017-07-01	2017-09-30	01/07/17	30/09/17
209	o,p-DDD (pg/m3)	GC-MS-MS	1.917	0	Vrije Universiteit Amsterdam	1	0.95868	0.95868	2017-07-01	2017-09-30	01/07/17	30/09/17
210	o,p-DDT (pg/m3)	GC-MS-MS	1.227	0	Vrije Universiteit Amsterdam	1	0.613546	0.613546	2017-07-01	2017-09-30	01/07/17	30/09/17
211	p,p-DDD (pg/m3)	GC-MS-MS	1.769	0	Vrije Universiteit Amsterdam	1	0.884658	0.884658	2017-07-01	2017-09-30	01/07/17	30/09/17
212	p,p-DDE (pg/m3)	GC-MS-MS	3.912	0	Vrije Universiteit Amsterdam	1	1.956108	1.956108	2017-07-01	2017-09-30	01/07/17	30/09/17
213	p,p-DDT (pg/m3)	GC-MS-MS	2.292	0	Vrije Universiteit Amsterdam	1	1.145823	1.145823	2017-07-01	2017-09-30	01/07/17	30/09/17
214	Mirex (pg/m3)	GC-MS-MS	1.399	0	Vrije Universiteit Amsterdam	1	0.699414	0.699414	2017-07-01	2017-09-30	01/07/17	30/09/17
215	PeCB (pg/m3)	GC-MS-MS		36.579	Vrije Universiteit Amsterdam	0	0	36.57896	2017-09-30	2017-12-31	30/09/17	31/12/17
216	HCB (pg/m3)	GC-MS-MS		17.956	Vrije Universiteit Amsterdam	0	0	17.95632	2017-09-30	2017-12-31	30/09/17	31/12/17

Before replacing the cells, it is recommended to clear the filter and copy and paste the originally date-formatted cells into the blank cells of the DATEVALUE columns, and then replace all the Start/End of Sampling columns with the DATEVALUE columns by copying and pasting values.

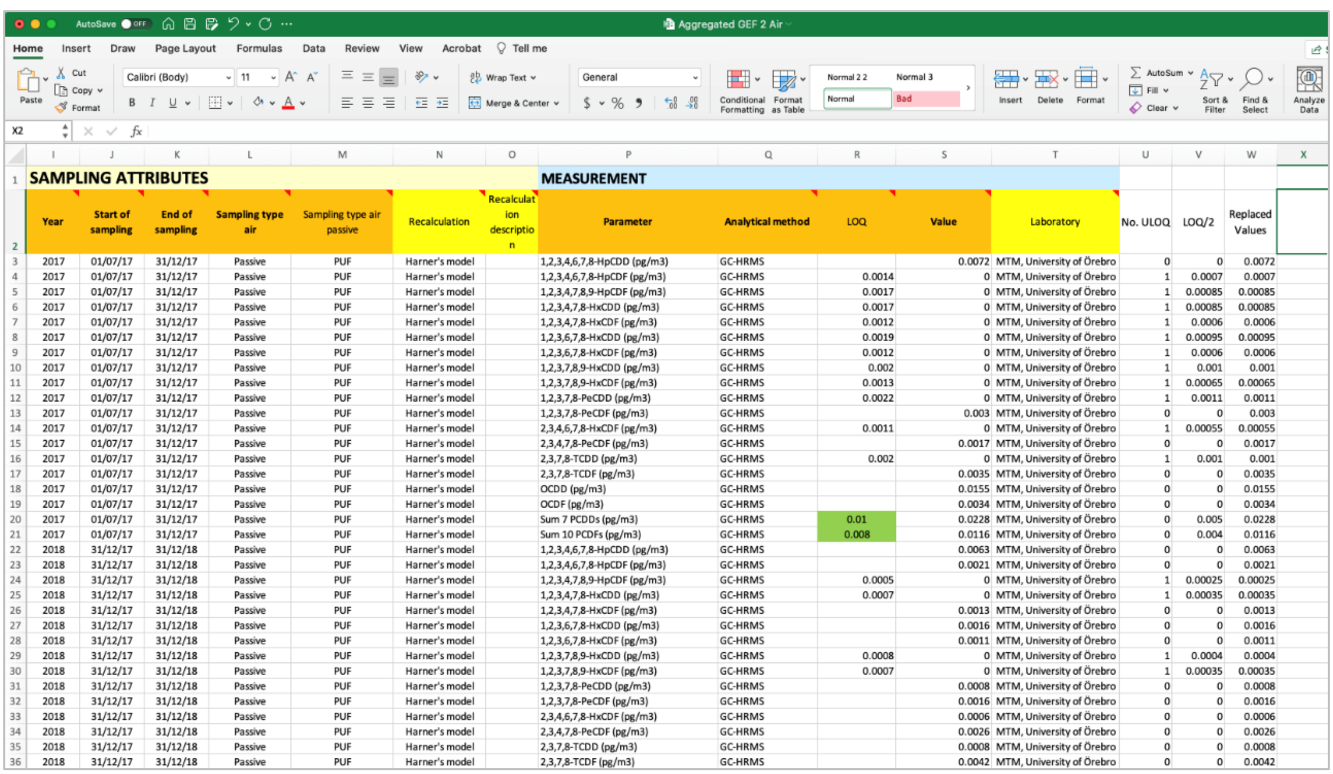


	tion	Recalculation on description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values	Start of sampling	End of sampling	DATEVALUE Start of sampling	DATEVALUE End of sampling
1			MEASUREMENT											
3	hodel		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0	0.0072	01/07/17	31/12/17		
4	hodel		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007	0.0007	01/07/17	31/12/17		
5	hodel		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085	01/07/17	31/12/17		
6	hodel		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085	01/07/17	31/12/17		
7	hodel		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006	01/07/17	31/12/17		
8	hodel		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095	0.00095	01/07/17	31/12/17		
9	hodel		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006	01/07/17	31/12/17		
10	hodel		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001	01/07/17	31/12/17		
11	hodel		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065	0.00065	01/07/17	31/12/17		
12	hodel		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011	0.0011	01/07/17	31/12/17		
13	hodel		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0	0.003	01/07/17	31/12/17		
14	hodel		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055	0.00055	01/07/17	31/12/17		
15	hodel		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0	0.0017	01/07/17	31/12/17		
16	hodel		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001	01/07/17	31/12/17		
17	hodel		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0	0.0035	01/07/17	31/12/17		
18	hodel		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0	0.0155	01/07/17	31/12/17		
19	hodel		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0	0.0034	01/07/17	31/12/17		
20	hodel		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005	0.0228	01/07/17	31/12/17		
21	hodel		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004	0.0116	01/07/17	31/12/17		
193	hodel		PeCB (pg/m3)	GC-MS-MS		47.543	Vrije Universiteit Amsterdam	0	0	47.54287	2017-07-01	2017-09-30	01/07/17	30/09/17
194	hodel		HCB (pg/m3)	GC-MS-MS		19.771	Vrije Universiteit Amsterdam	0	0	19.77081	2017-07-01	2017-09-30	01/07/17	30/09/17
195	hodel		Heptachlor (pg/m3)	GC-MS-MS	9.825	0	Vrije Universiteit Amsterdam	1	4.91235	4.91235	2017-07-01	2017-09-30	01/07/17	30/09/17
196	hodel		Endosulfan I (alpha) (pg/m3)	GC-MS-MS	4.289	0	Vrije Universiteit Amsterdam	1	2.144437	2.144437	2017-07-01	2017-09-30	01/07/17	30/09/17
197	hodel		Alpha-HCH (pg/m3)	GC-MS-MS	4.392	0	Vrije Universiteit Amsterdam	1	2.195815	2.195815	2017-07-01	2017-09-30	01/07/17	30/09/17
198	hodel		Gamma-HCH (pg/m3)	GC-MS-MS	10.901	0	Vrije Universiteit Amsterdam	1	5.450293	5.450293	2017-07-01	2017-09-30	01/07/17	30/09/17
199	hodel		Beta-HCH (pg/m3)	GC-MS-MS	11.375	0	Vrije Universiteit Amsterdam	1	5.687406	5.687406	2017-07-01	2017-09-30	01/07/17	30/09/17
200	hodel		Oxychlordane (pg/m3)	GC-MS-MS	17.236	0	Vrije Universiteit Amsterdam	1	8.617805	8.617805	2017-07-01	2017-09-30	01/07/17	30/09/17
201	hodel		trans-Chlordane (= gamma) (pg/m3)	GC-MS-MS	6.754	0	Vrije Universiteit Amsterdam	1	3.37678	3.37678	2017-07-01	2017-09-30	01/07/17	30/09/17
202	hodel		cis-Chlordane (= alpha) (pg/m3)	GC-MS-MS	5.033	0	Vrije Universiteit Amsterdam	1	2.51651	2.51651	2017-07-01	2017-09-30	01/07/17	30/09/17



Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values	Start of sampling	End of sampling	DATEVALUE Start of sampling	DATEVALUE End of sampling
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0	0.0072	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007	0.0007	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095	0.00095	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065	0.00065	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011	0.0011	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0	0.003	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055	0.00055	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0	0.0017	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0	0.0035	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0	0.0155	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0	0.0034	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005	0.0228	01/07/17	31/12/17	01/07/17	31/12/17
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004	0.0116	01/07/17	31/12/17	01/07/17	31/12/17
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	0	0.0063	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS		0.0021	MTM, University of Örebro	0	0	0.0021	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0005	0	MTM, University of Örebro	1	0.00025	0.00025	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS		0.0013	MTM, University of Örebro	0	0	0.0013	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	0	0.0016	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0011	MTM, University of Örebro	0	0	0.0011	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.0008	0	MTM, University of Örebro	1	0.0004	0.0004	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	0	0.0008	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	0	0.0016	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0006	MTM, University of Örebro	0	0	0.0006	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0026	MTM, University of Örebro	0	0	0.0026	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	0	0.0008	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0042	MTM, University of Örebro	0	0	0.0042	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0118	MTM, University of Örebro	0	0	0.0118	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0014	MTM, University of Örebro	0	0	0.0014	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.002	0.0212	MTM, University of Örebro	0	0.001	0.0212	31/12/17	31/12/18	31/12/17	31/12/18
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.0012	0.0148	MTM, University of Örebro	0	0.0006	0.0148	31/12/17	31/12/18	31/12/17	31/12/18
2018	24/12/17	18/03/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS	0.0068	0	MTM, University of Örebro	1	0.0034	0.0034	24/12/17	18/03/18	24/12/17	18/03/18
2018	24/12/17	18/03/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0041	0	MTM, University of Örebro	1	0.00205	0.00205	24/12/17	18/03/18	24/12/17	18/03/18
2018	24/12/17	18/03/18	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.003	0	MTM, University of Örebro	1	0.0015	0.0015	24/12/17	18/03/18	24/12/17	18/03/18
2018	24/12/17	18/03/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0049	0	MTM, University of Örebro	1	0.00245	0.00245	24/12/17	18/03/18	24/12/17	18/03/18

To finish, delete all the columns that were used to format the Start/end of Sampling. The sheet can be duplicated before you delete the columns. Your sheet will look like this:

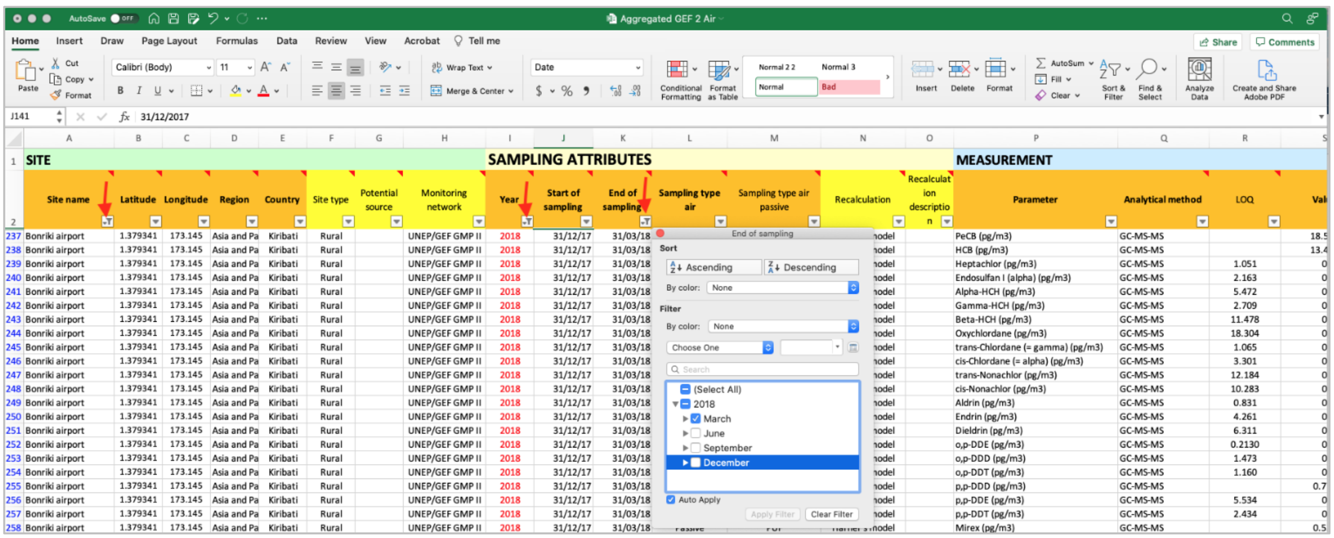


Year	Start of sampling	End of sampling	Sampling type air	Sampling type air passive	Recalculation	Recalculation description	Parameter	Analytical method	LOQ	Value	Laboratory	No. ULOQ	LOQ/2	Replaced Values
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0072	MTM, University of Örebro	0	0	0.0072
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS	0.0014	0	MTM, University of Örebro	1	0.0007	0.0007
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0017	0	MTM, University of Örebro	1	0.00085	0.00085
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS	0.0019	0	MTM, University of Örebro	1	0.00095	0.00095
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0012	0	MTM, University of Örebro	1	0.0006	0.0006
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0013	0	MTM, University of Örebro	1	0.00065	0.00065
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS	0.0022	0	MTM, University of Örebro	1	0.0011	0.0011
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.003	MTM, University of Örebro	0	0	0.003
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS	0.0011	0	MTM, University of Örebro	1	0.00055	0.00055
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0017	MTM, University of Örebro	0	0	0.0017
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS	0.002	0	MTM, University of Örebro	1	0.001	0.001
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0035	MTM, University of Örebro	0	0	0.0035
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		OCDD (pg/m3)	GC-HRMS		0.0155	MTM, University of Örebro	0	0	0.0155
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		OCDF (pg/m3)	GC-HRMS		0.0034	MTM, University of Örebro	0	0	0.0034
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		Sum 7 PCDDs (pg/m3)	GC-HRMS	0.01	0.0228	MTM, University of Örebro	0	0.005	0.0228
2017	01/07/17	31/12/17	Passive	PUF	Harner's model		Sum 10 PCDFs (pg/m3)	GC-HRMS	0.008	0.0116	MTM, University of Örebro	0	0.004	0.0116
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDD (pg/m3)	GC-HRMS		0.0063	MTM, University of Örebro	0	0	0.0063
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,6,7,8-HpCDF (pg/m3)	GC-HRMS		0.0021	MTM, University of Örebro	0	0	0.0021
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8,9-HpCDF (pg/m3)	GC-HRMS	0.0005	0	MTM, University of Örebro	1	0.00025	0.00025
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDD (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,4,7,8-HxCDF (pg/m3)	GC-HRMS		0.0013	MTM, University of Örebro	0	0	0.0013
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDD (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	0	0.0016
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0011	MTM, University of Örebro	0	0	0.0011
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDD (pg/m3)	GC-HRMS	0.0008	0	MTM, University of Örebro	1	0.0004	0.0004
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8,9-HxCDF (pg/m3)	GC-HRMS	0.0007	0	MTM, University of Örebro	1	0.00035	0.00035
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	0	0.0008
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		1,2,3,7,8-PeCDF (pg/m3)	GC-HRMS		0.0016	MTM, University of Örebro	0	0	0.0016
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,4,6,7,8-HxCDF (pg/m3)	GC-HRMS		0.0006	MTM, University of Örebro	0	0	0.0006
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,4,7,8-PeCDF (pg/m3)	GC-HRMS		0.0026	MTM, University of Örebro	0	0	0.0026
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,7,8-TCDD (pg/m3)	GC-HRMS		0.0008	MTM, University of Örebro	0	0	0.0008
2018	31/12/17	31/12/18	Passive	PUF	Harner's model		2,3,7,8-TCDF (pg/m3)	GC-HRMS		0.0042	MTM, University of Örebro	0	0	0.0042

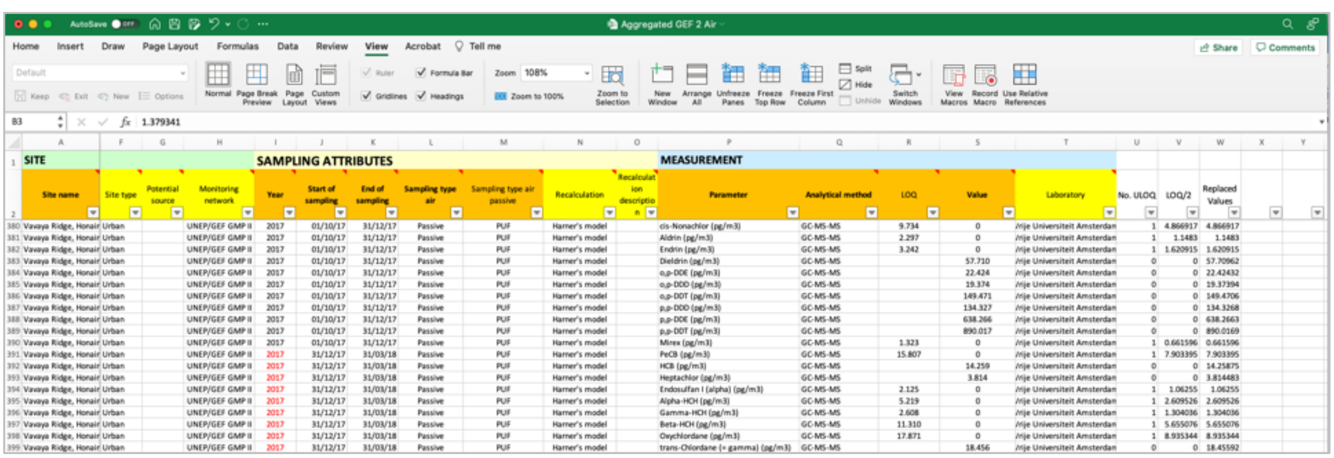
9. To calculate the statistical parameters. It is necessary to aggregate the concentration values of each measured parameter over each monitoring year. If 4, 3 or 2 samples were taken in a year, their statistical parameters should be calculated according to the number of samples measured in the corresponding year. The grouping of sampling periods will be very important to get the most out of the data.

In the case of the GEF Air 2 database, for the sites located in Kiribati and Solomon Islands, only two sampling periods were carried out in 2007 and four in 2008. Therefore, it is recommended, following the GMP Guidance, that the data be grouped considering three periods for 2007 and three for 2008, adjusting the database as follows.

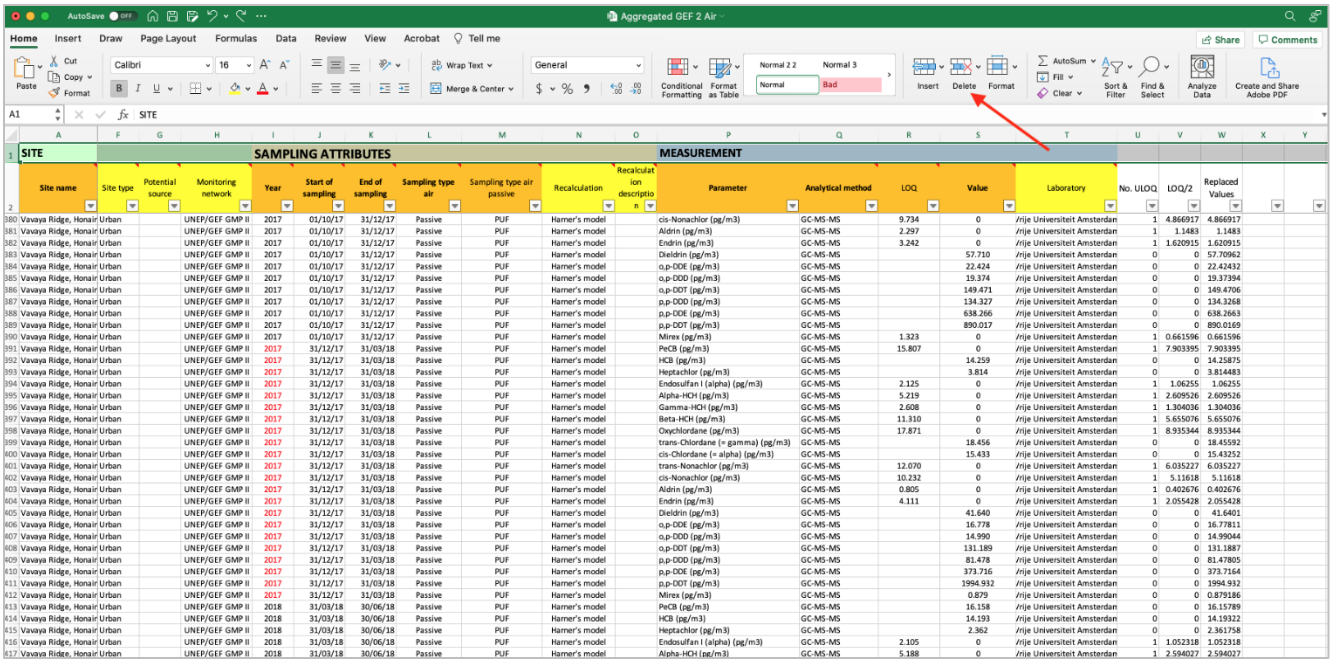
Filter the database by site, year and by the period you want to adjust. And mark the cells with different color.



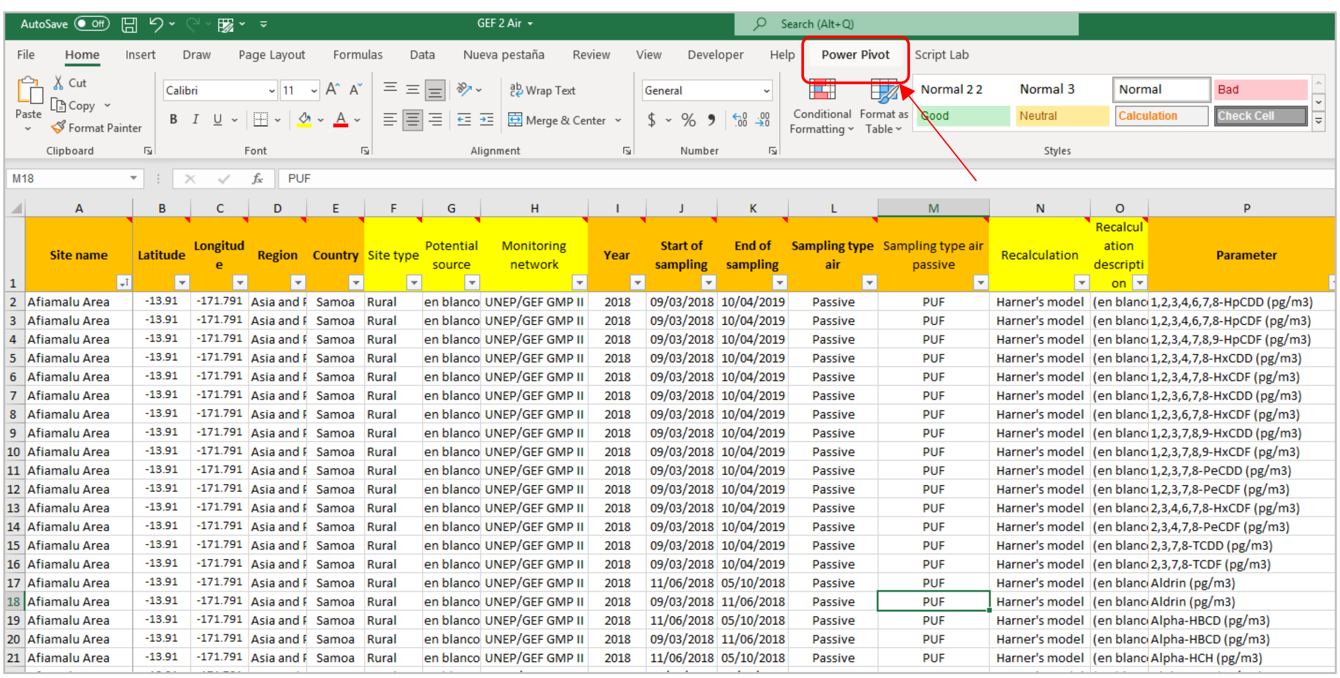
Change the years 2018 marked in red to 2017 so that when aggregating the database and calculating the statistical parameters, by means of formulas or through the Excel Power Pivot tool, the period from 12/31/17 to 3/31/18 is considered within the year 2017. Clear the filters and your database is ready to calculate the aggregated parameters.



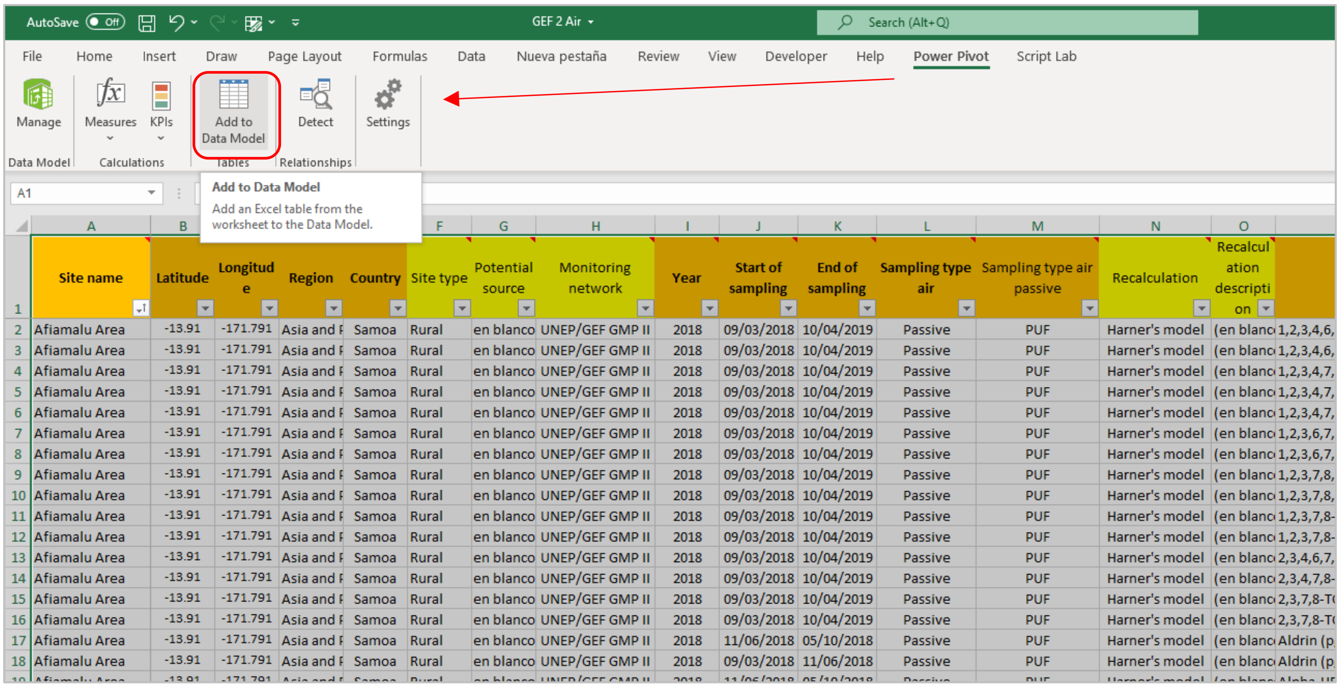
10. Aggregation using Excel Power Pivot. Excel is an excellent tool for running statistical functions and formulas to aggregate values, as shown in procedure 2.3.2, but you can also use another Excel tool called Power Pivot. The procedure that follows uses this Excel tool. If you do not have it, see Appendix 4. Working with Power Pivot will allow you to aggregate the entire database. We will start by calculating the statistics indicated in the template. Start by deleting the first row.



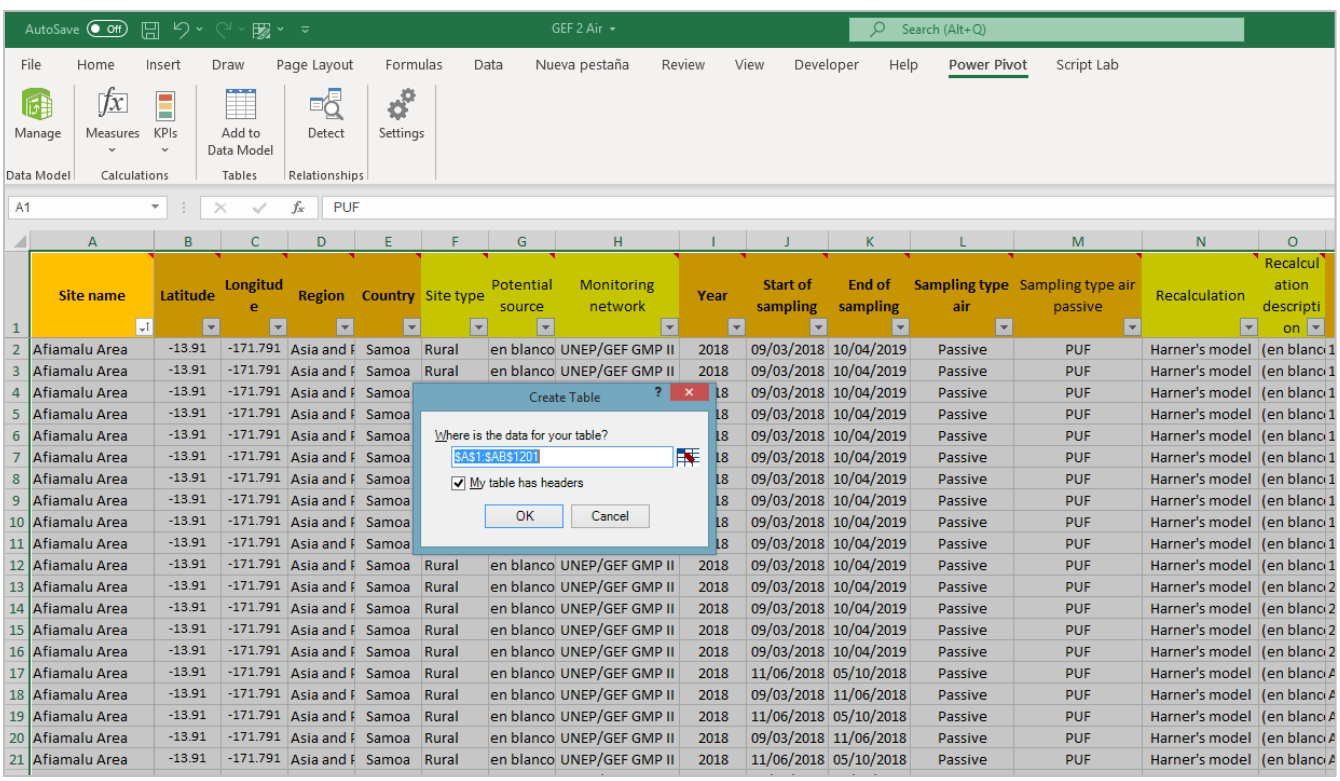
Then click on power pivot



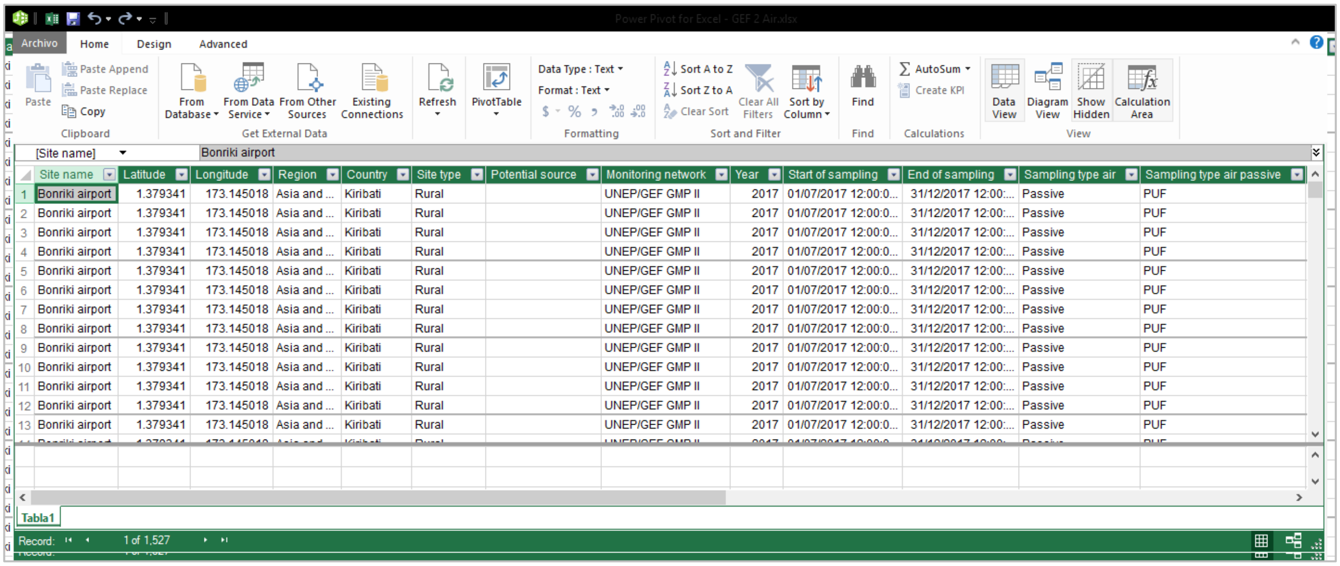
Add to data model



Click on the box “my table has headers” and click ok.



Next, we go to the column Replaced values setting the cursor at the bottom. Then, write the statistical formulas that will we needed:



media:=average(Tabla1[Replaced Values])

median:=median(Tabla1[Replaced Values])

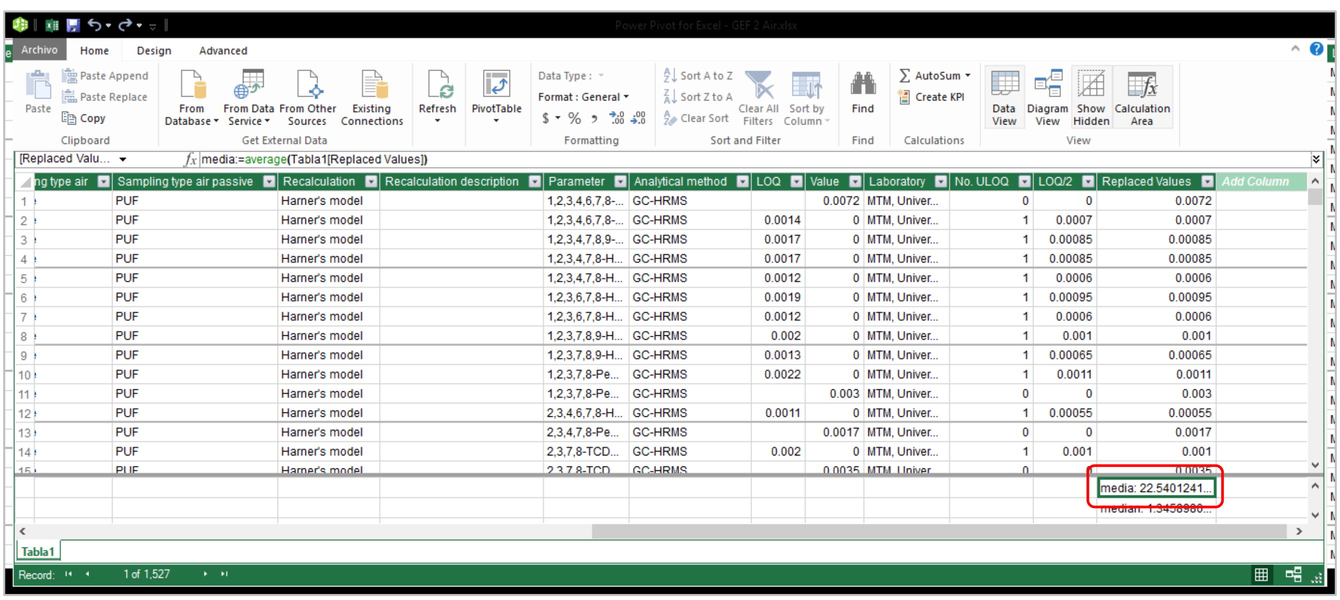
desvest:=stdev.p(Tabla1[Replaced Values])

95thpercentile:=percentile.inc(Tabla1[Replaced Values],.95)

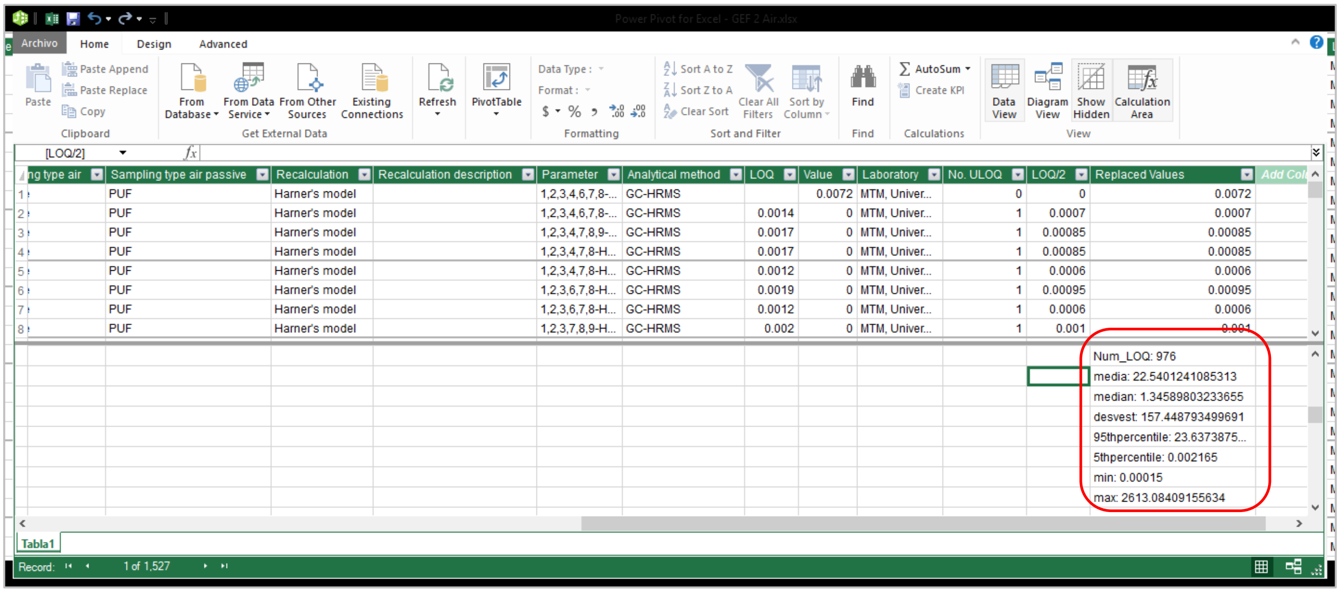
5thpercentile:=percentile.inc(Tabla1[Replaced Values],.05)

min:=min(Tabla1[Replaced Values])

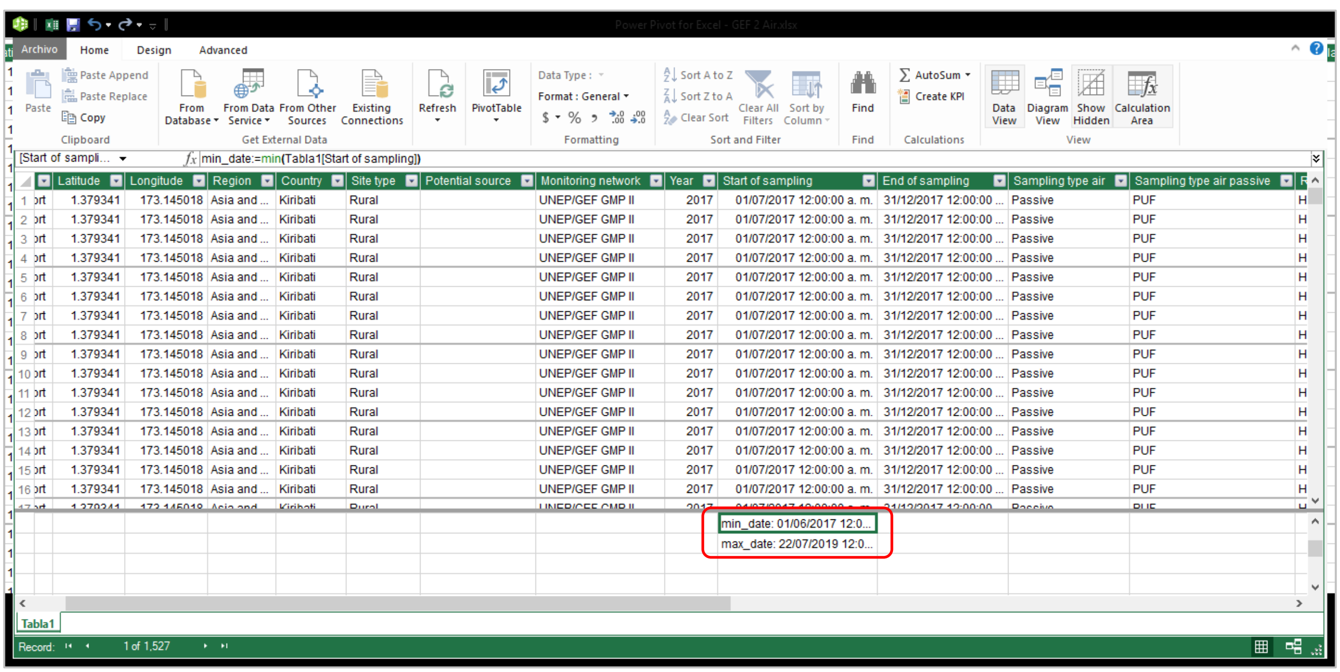
max:=max(Tabla1[Replaced Values])



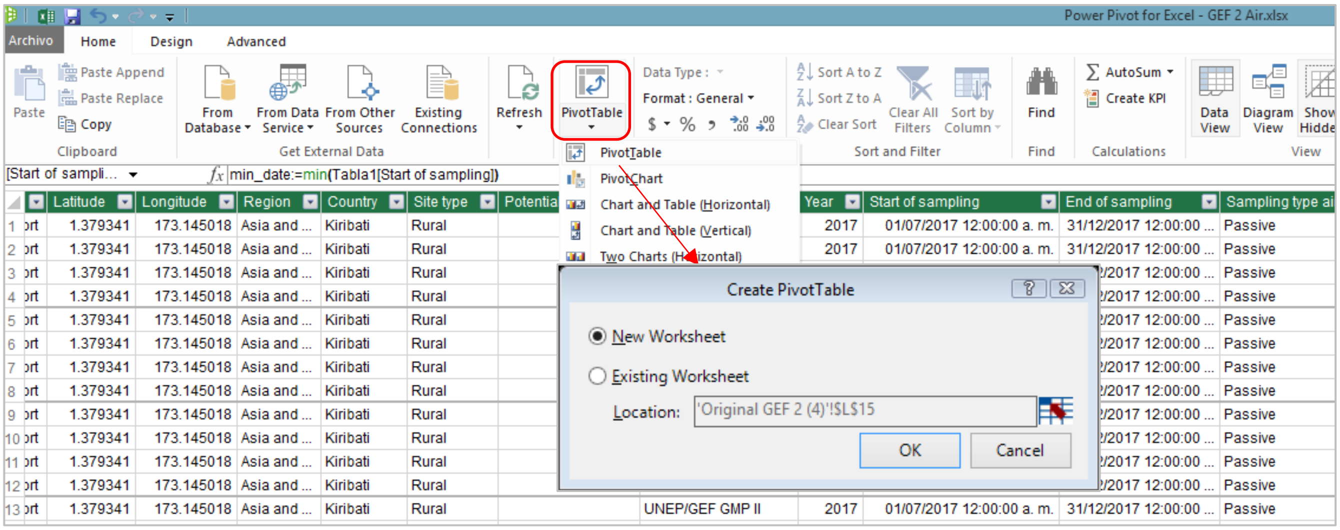
These formulas will calculate the statistics we require. Once all formulas have been written, the sheet will look like this:



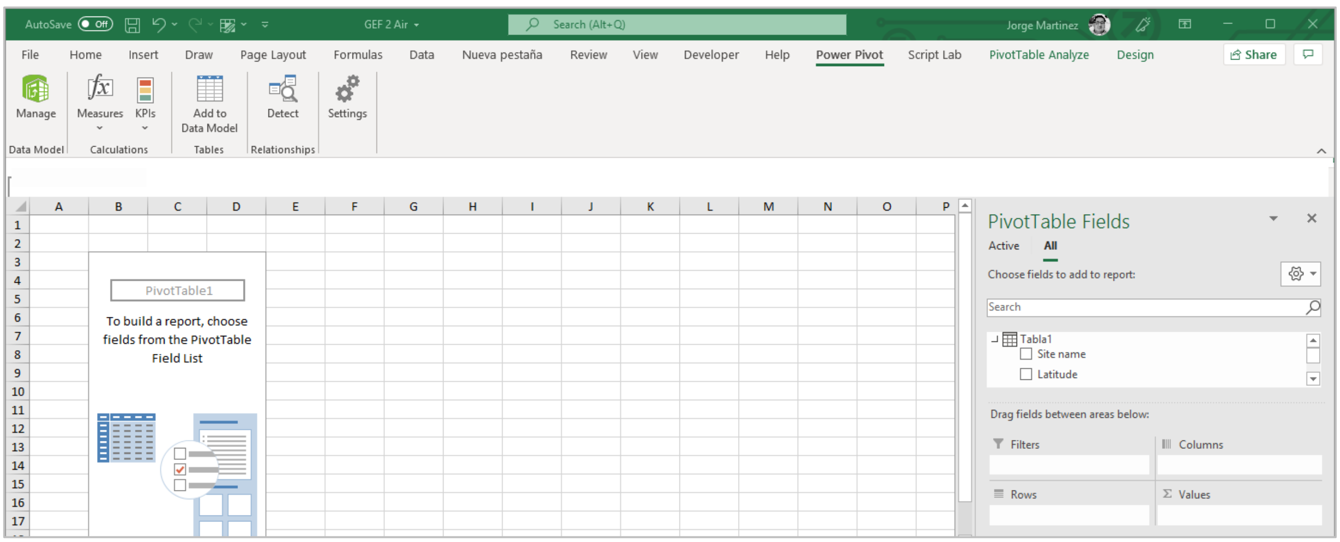
Next, calculate start and end of sampling of each monitoring year by setting the cursor at the bottom of the column Start of sampling and using the formula MIN, and by setting the cursor at the bottom of the column End of sampling and using the formula MAX.

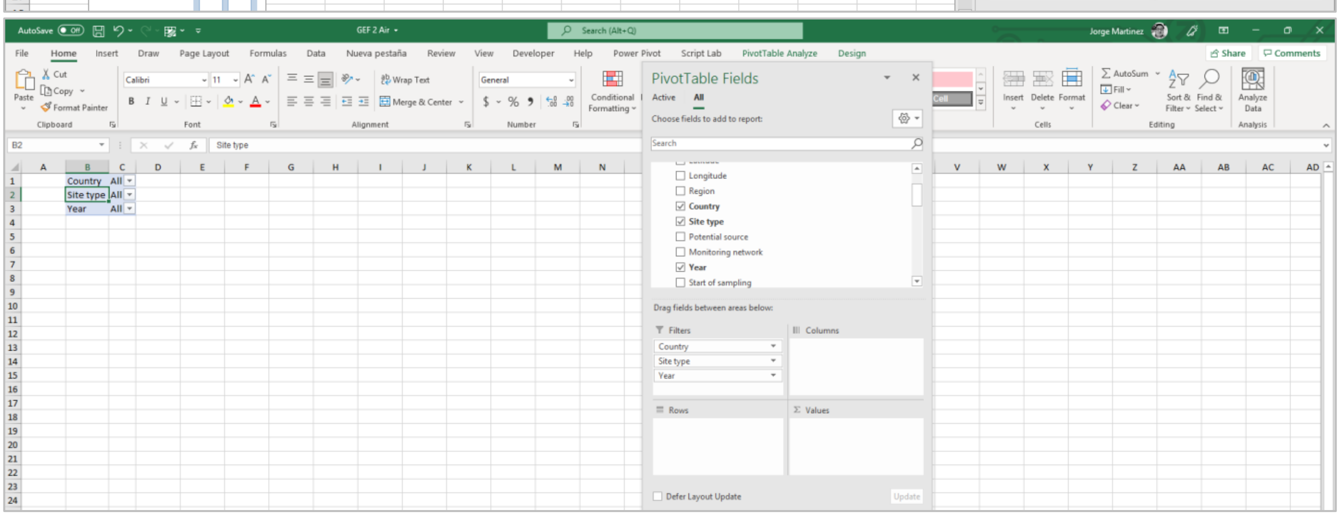


These formulas will calculate the statistics we require. However, we need to create a pivot table to configurate the database. Next, insert a pivot table, click on new worksheet and then on ok.



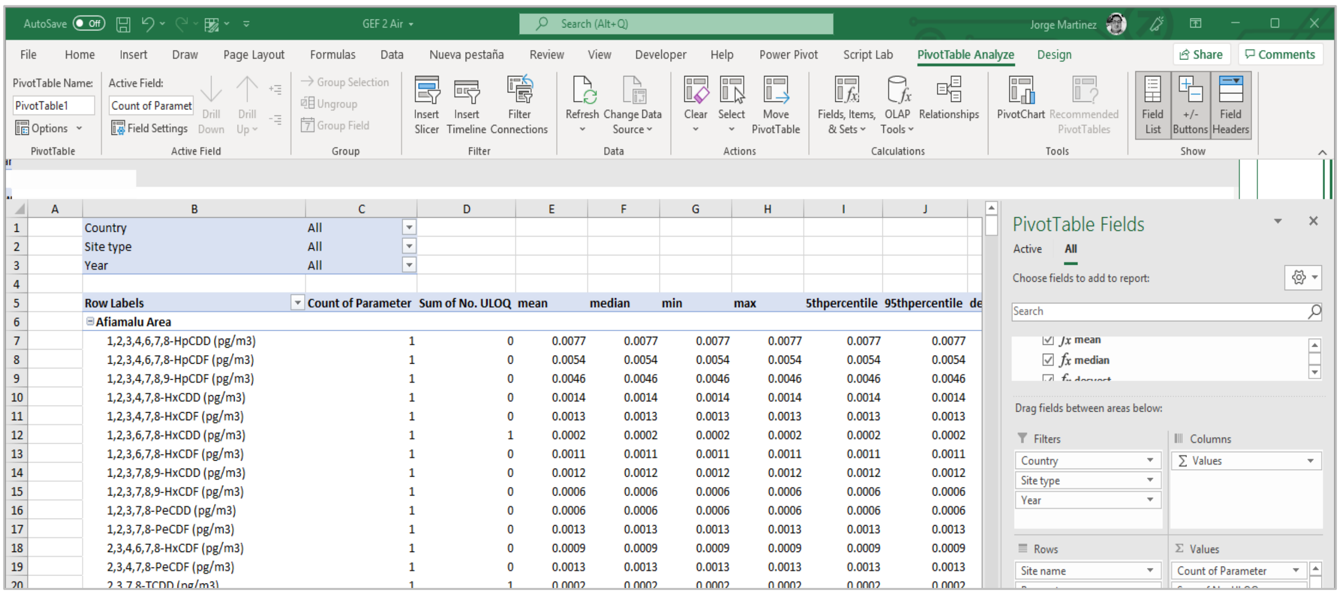
Next, the variables must be selected. Drag to the Filters box the following variables: Country, Site type, Year. Order is very important:



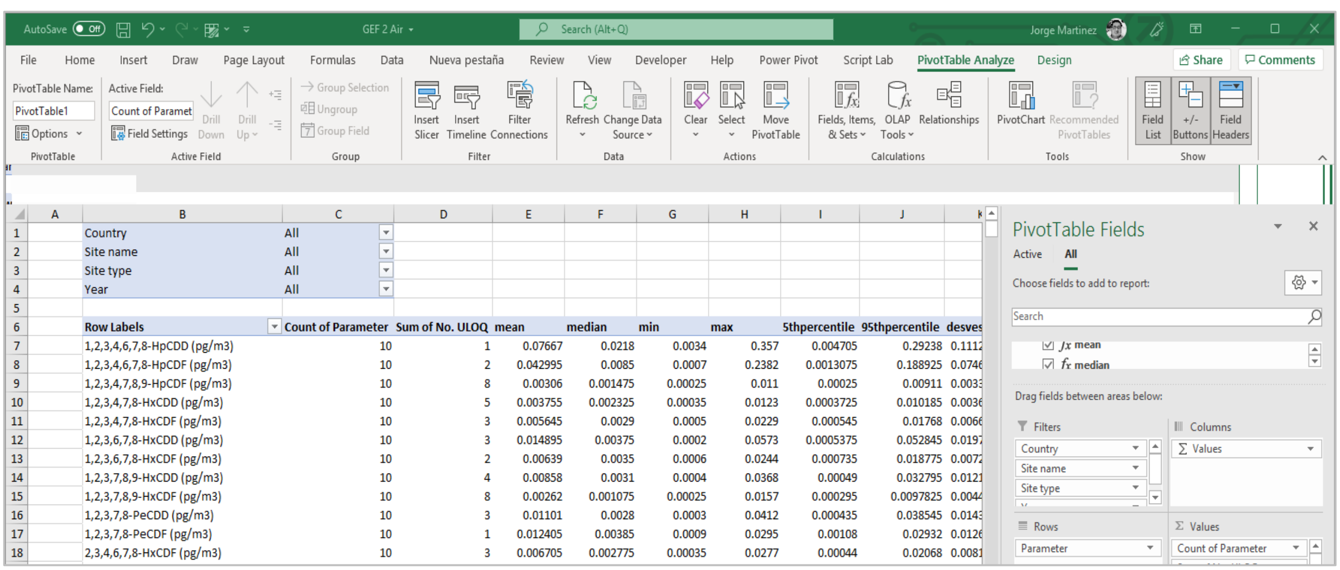


Next, drag the variables Parameter and Site name to the rows window. Drag also Parameter, No. ULOQ, and the statistical parameters to the value Box.

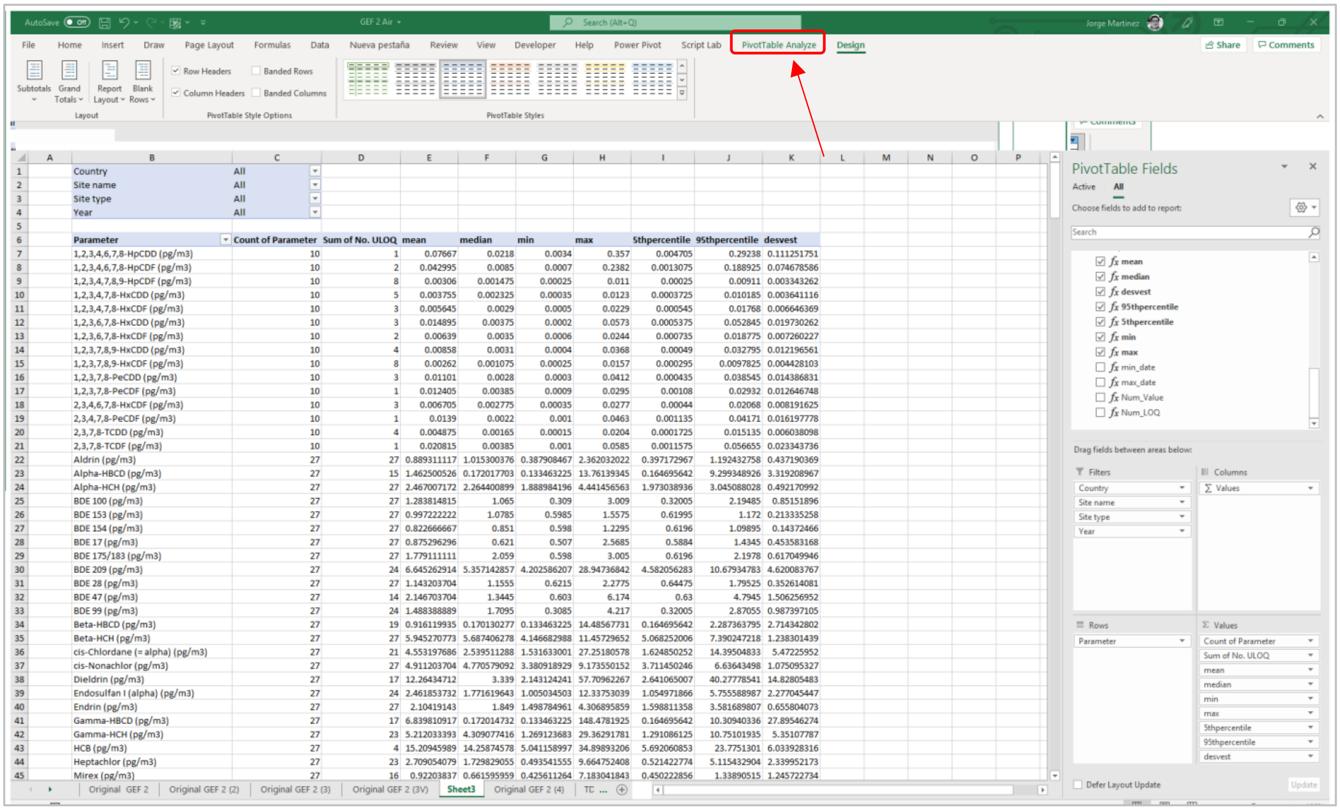
- Count of parameter
- Sum of No. ULOQ
- Mean
- Median
- Min
- Max
- 5th percentile
- 95th percentile
- Standard deviation



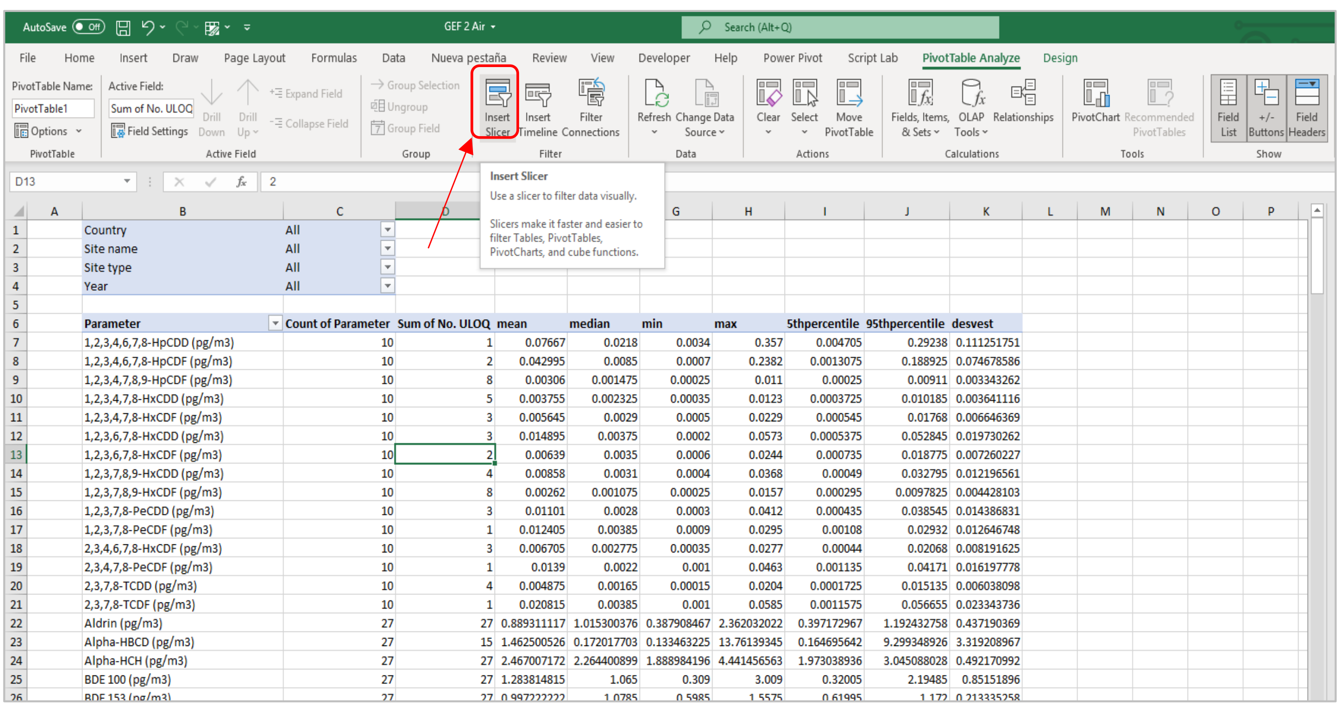
Your pivot table window will look like this:



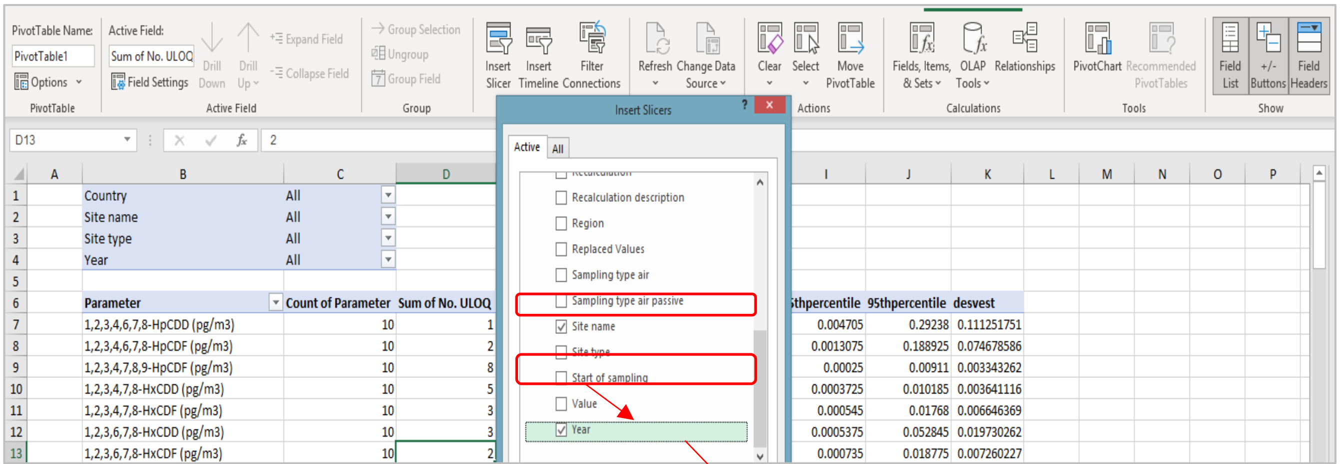
Now, we'll make it easier to select the site and year we want to analyze. We'll click on the menu "PivotTable Analyze"



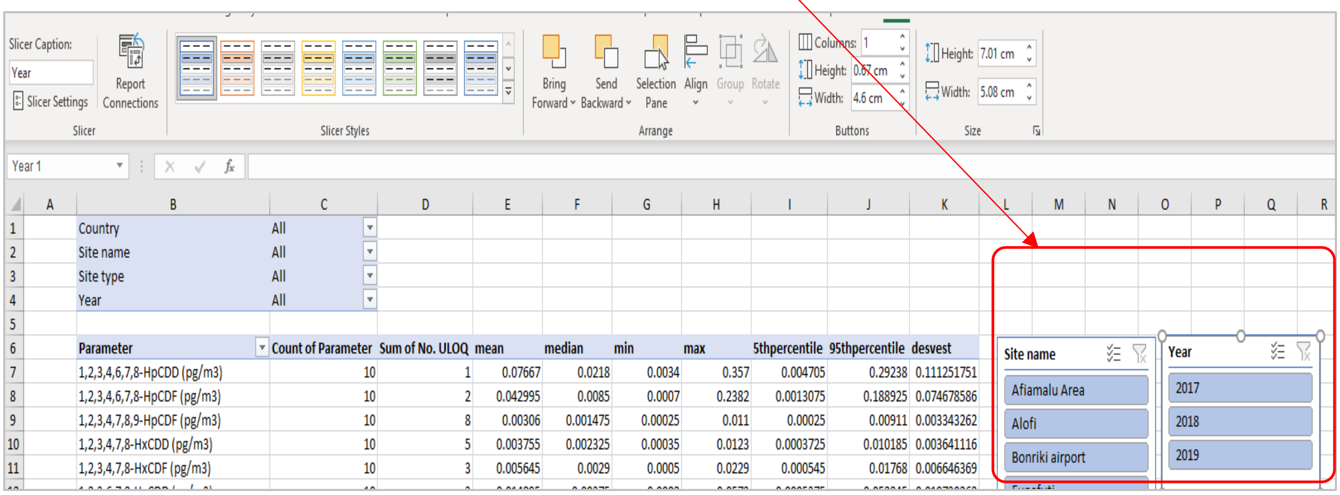
Then click on insert slice



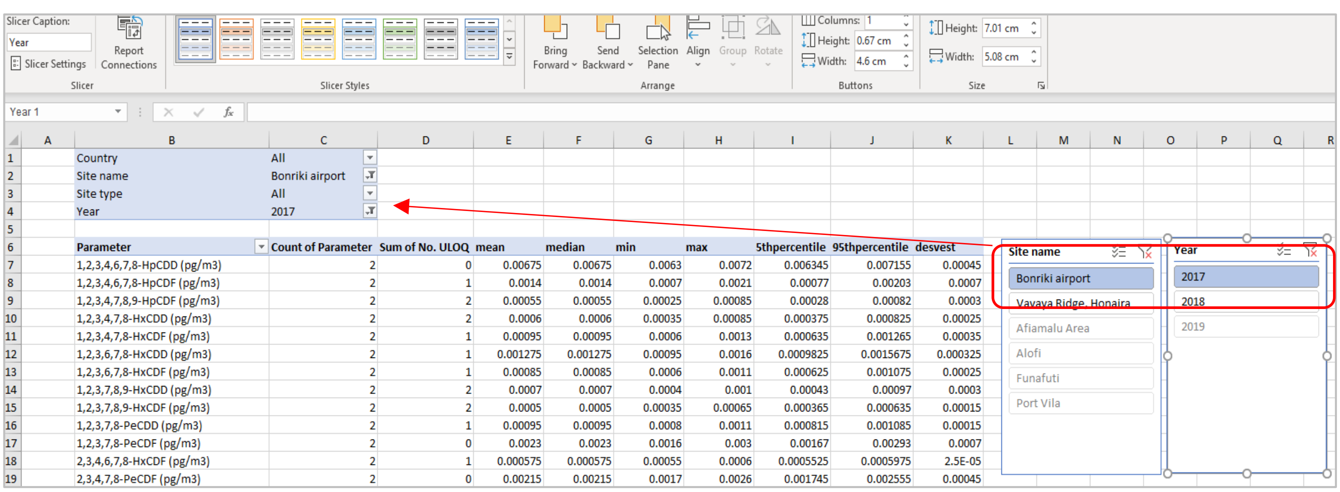
Click on the site and year boxes. Click ok.

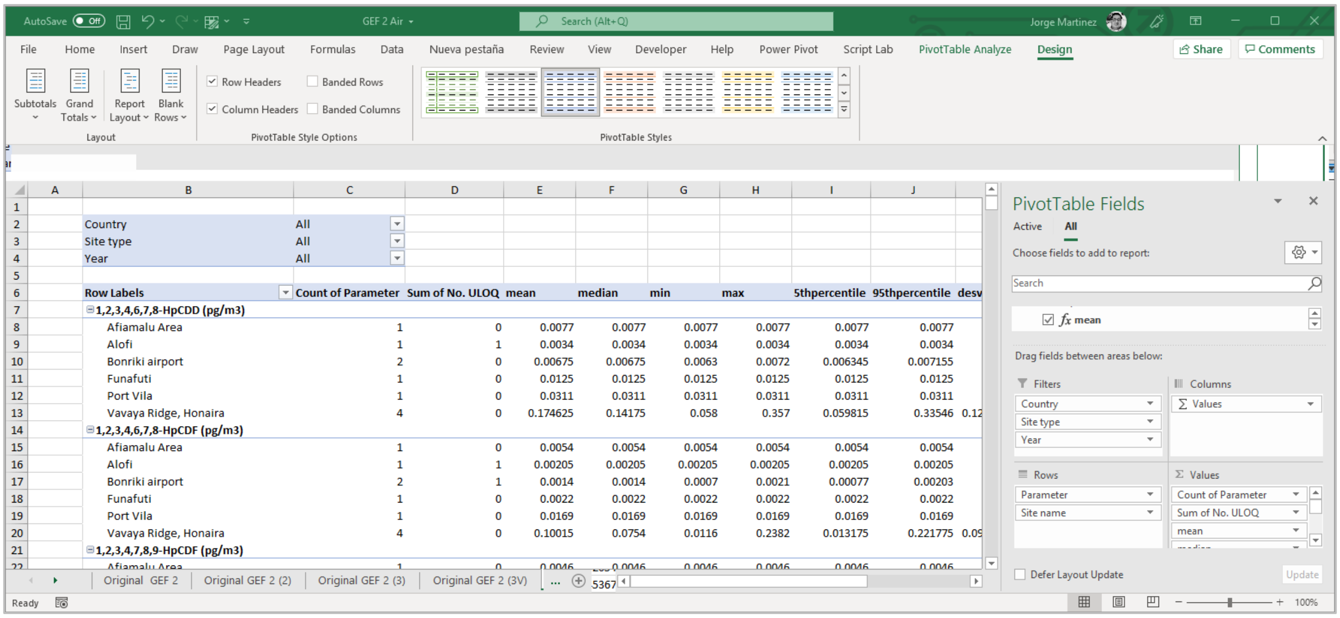


Your sheet will look like this:

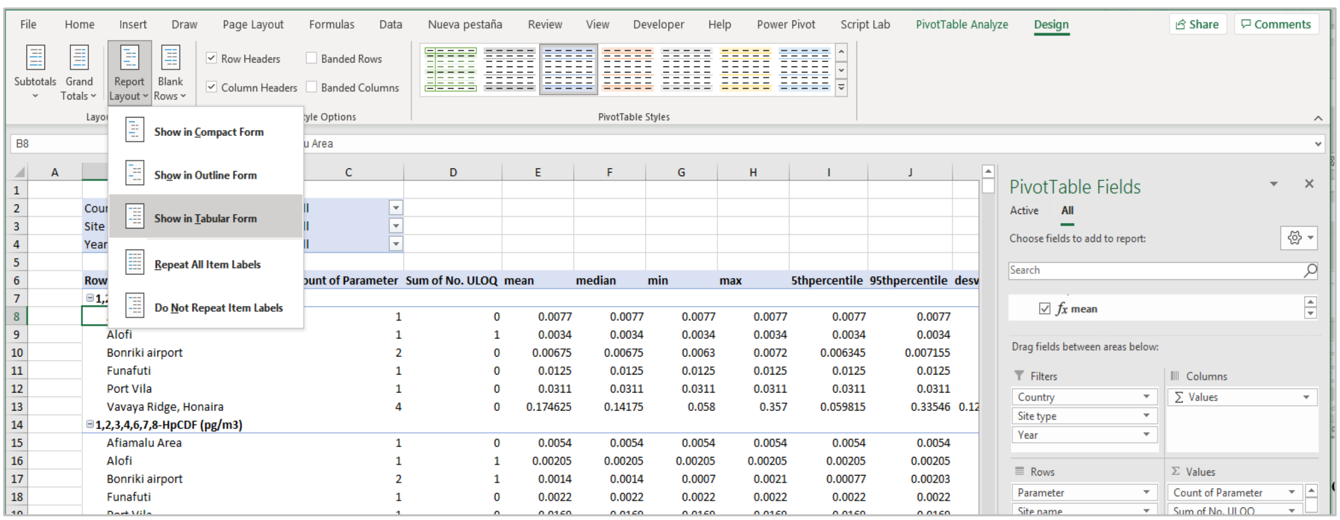


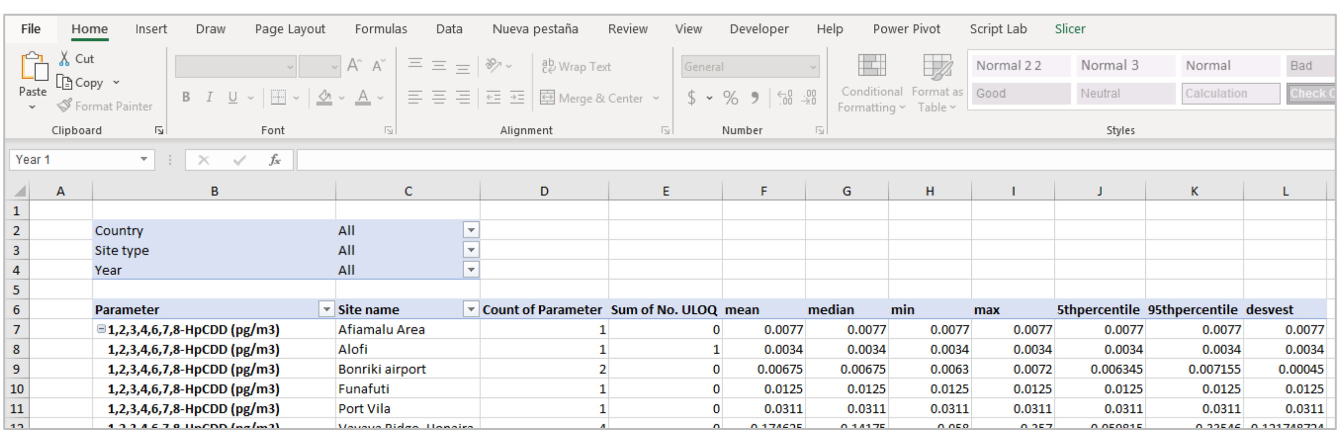
Now you can select every site and year, and copy paste the data into your aggregated data sheet.

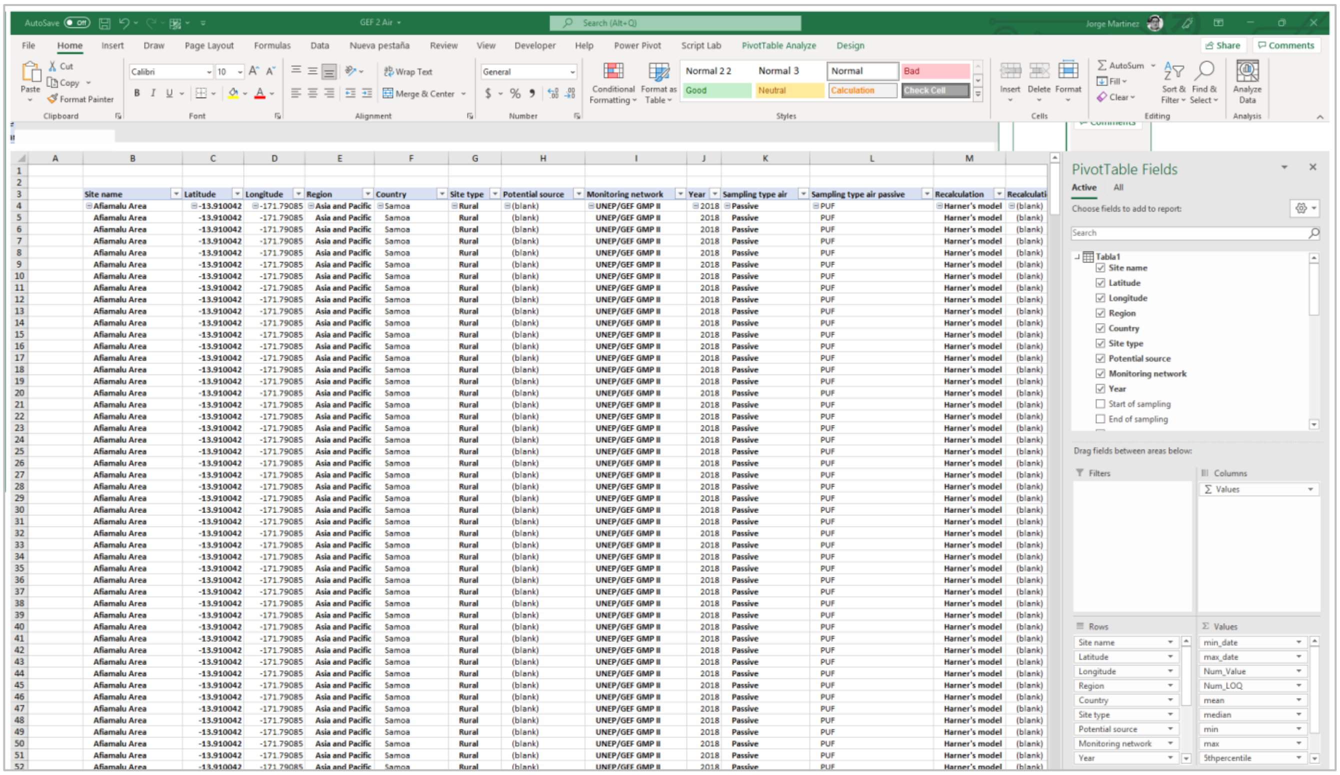




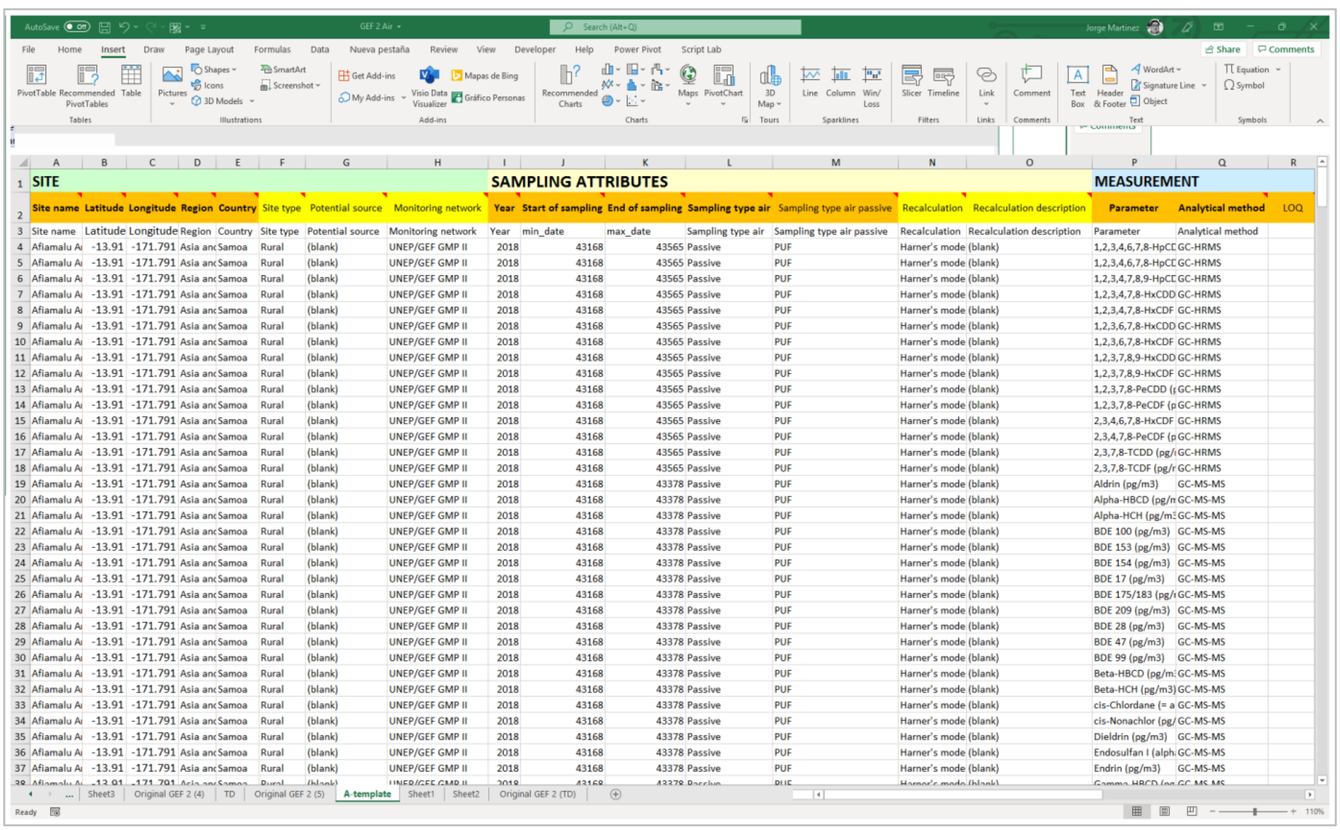
Click on the design tab and open ***Report Layout*** and then click Show in tabular form. The table will look as follows:



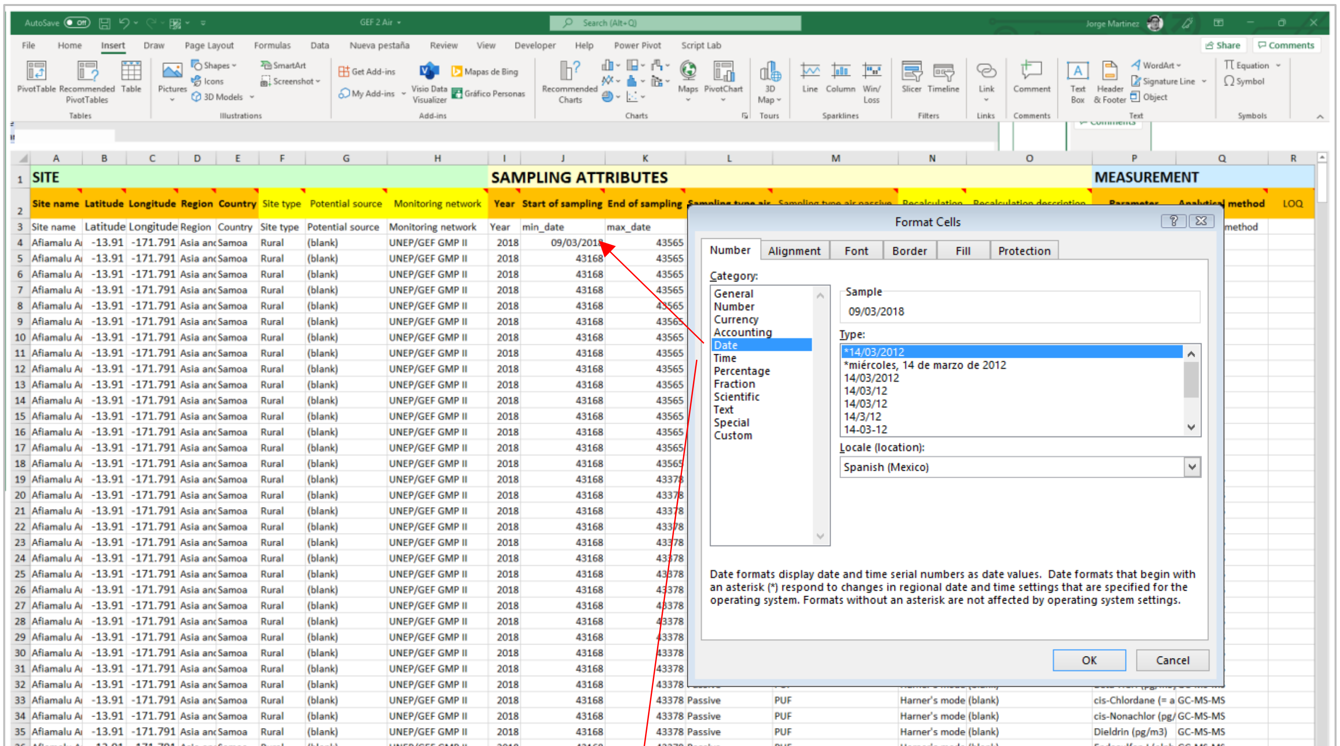


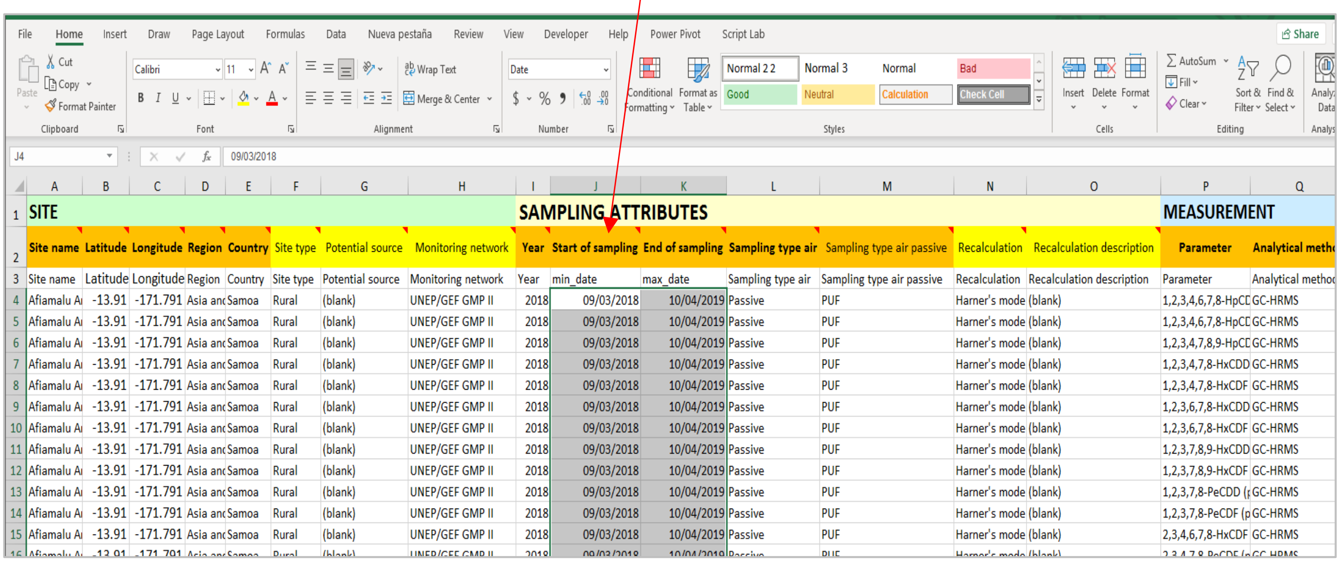


Copy and paste site by site onto the aggregated data in the template (Sheet "A-template")



If needed, give format to the Dates





Copy A-template to a new sheet. You can name it GEF 2 Aggregate and fill the template with the data from the Original GEF 2 (2) sheet and with the aggregated statistical parameters calculated per site using the Power Pivot tool. Remember that the LOQ column will remain blank in the aggregated template.

11. To finalize the procedure, the two aggregated databases GEF 1 and GEF 2 need to be merged into a single Excel spreadsheet.

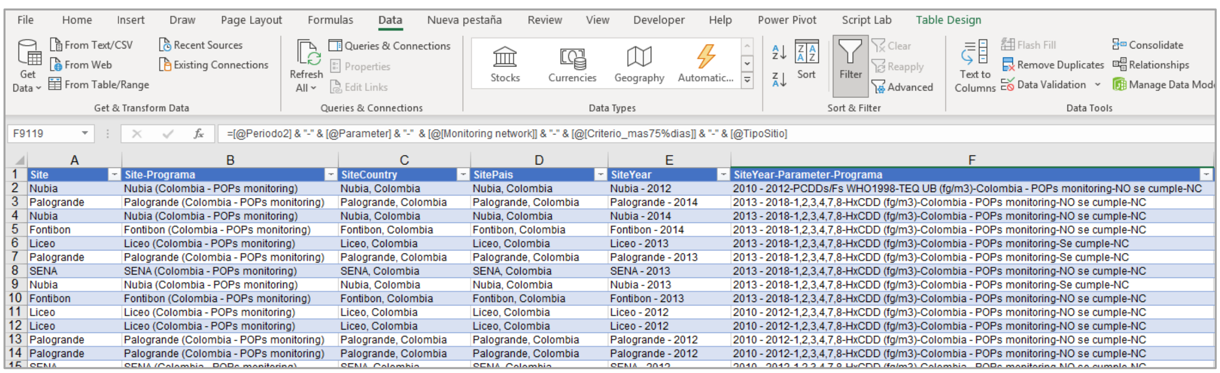
ANNEX 6. PIVOT TABLE

The pivot table is a flexible report, a report where you can easily change the columns and rows that are required to be displayed on the screen. This report is so flexible that you can also choose the type of calculation to be performed on the source data without the need to write a single formula.

A pivot table is also a summary of statistical data that is obtained from another, larger data set. This summary data can have calculations such as sum, data frequency, average, or another type of calculation that will be automatically obtained when the data is grouped. They are called pivot tables because they do not have a fixed structure. They can be organized in one way or another until useful information is found in the data.

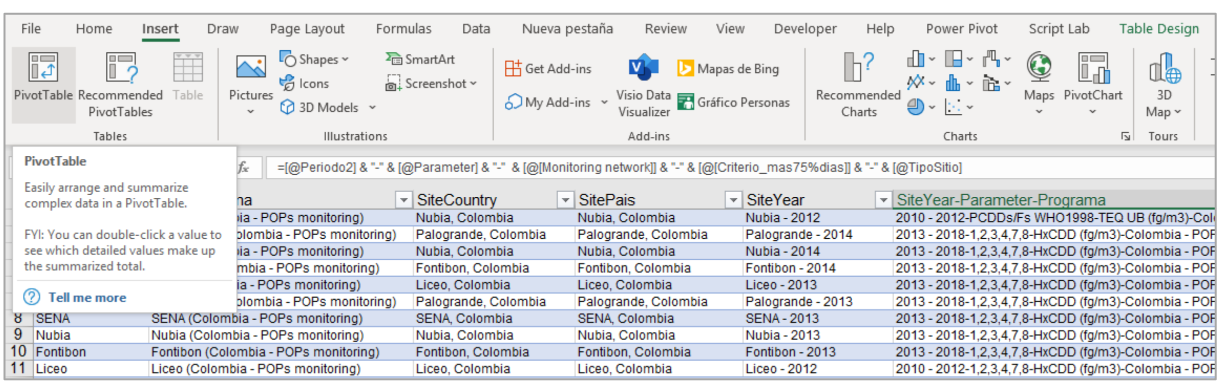
Creating a pivot table is a simple task, but it is important to know all the details of this process to get the most out of it. Before creating a pivot table, you must have tabular data, that is, data that is organized in rows and columns where each column has a title.

The following image shows an example of tabular data.

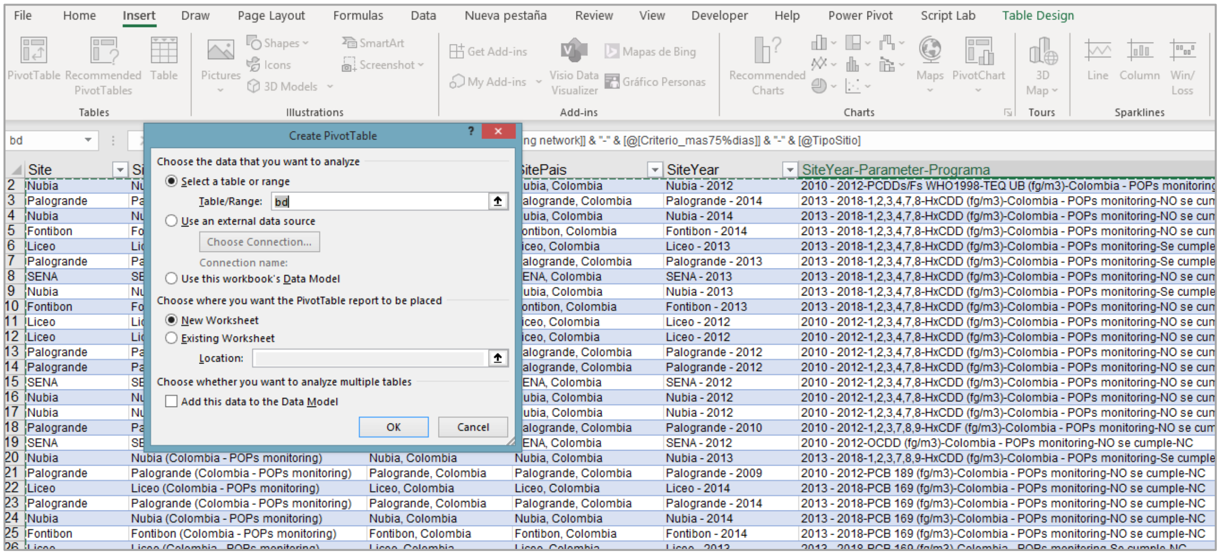


To create a pivot table, follow these steps:

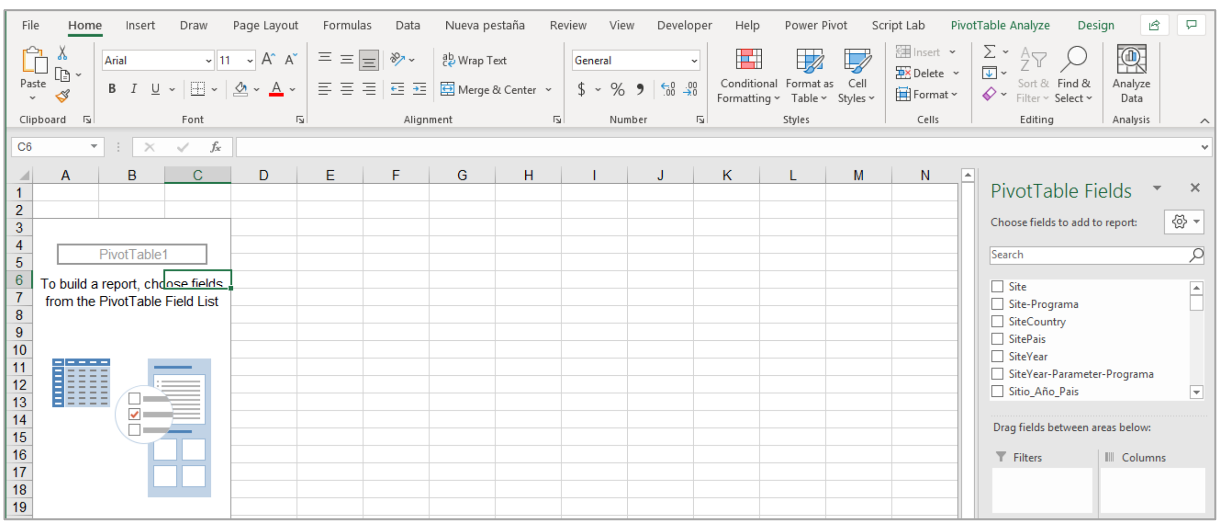
- Click on any cell in the source data.
- Go to the Insert tab and then to the Pivot Table button in the Tables group.



When you click on this element, the Create Pivot Table dialog box will be displayed and accept the default values.

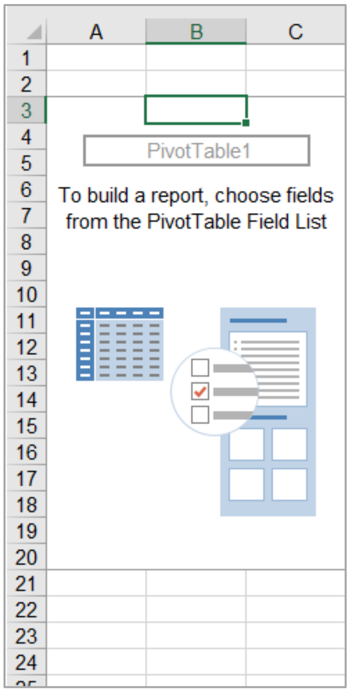


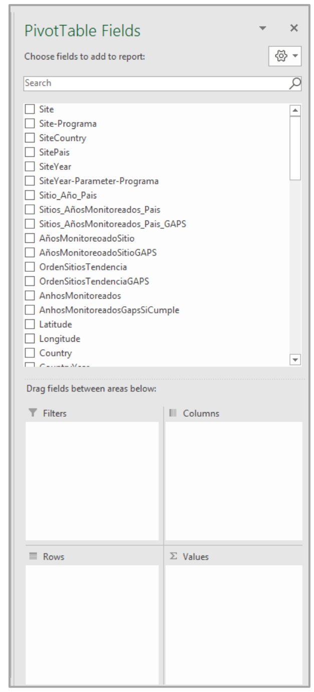
Thus, when clicking on "OK", a new sheet will be created with a blank pivot table.



The pivot table has been created, only it is empty, and the fields that will be displayed in the report will have to be configured. Inside the box of the pivot table, which is shown in the left side of the sheet, you can read the following legend that indicates how to create the report: “To build a report, choose fields from the Pivot Table Field List".

In the right part of the Excel window, the Pivot Table Fields panel is shown, which will have the list of all the fields that we can choose to create the report. The fields of our interest will have to be dragged to one of the four areas shown at the bottom of the panel.



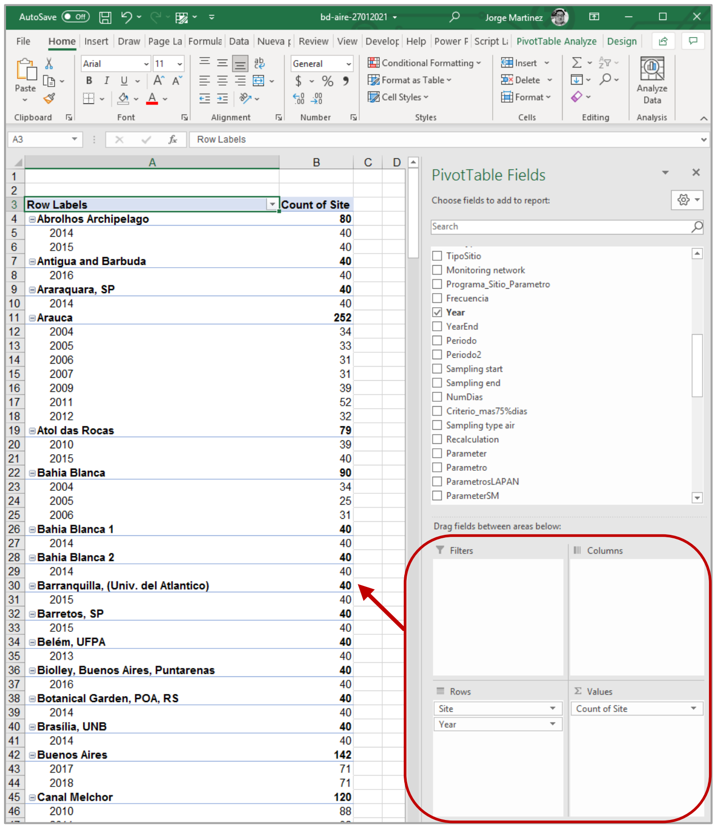


For the first report, you could drag the Year field to the Columns area, the Site field to the Rows area, and again the Site field to the Values area. Once these changes have been made, the report will be ready as shown in the following image:

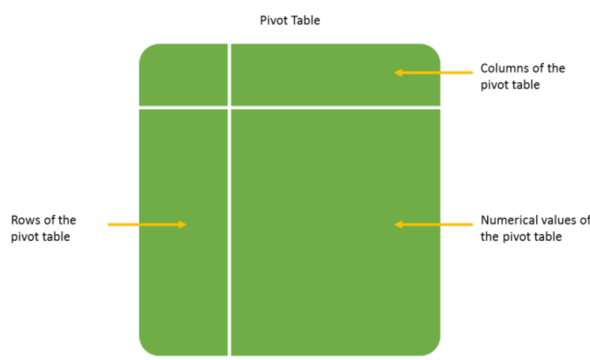
A3 | Count of Site

Count of Site	Column Labels														
Row Labels	**2004**	**2005**	**2006**	**2007**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Grand Total**
Abrolhos Archipelago										40	40				80
Antigua and Barbuda												40			40
Araraquara, SP										40					40
Arauca	34	33	31	31	39		52	32							252
Atol das Rocas						39					40				79
Bahia Blanca	34	25	31												90
Bahia Blanca 1										40					40
Bahia Blanca 2										40					40
Barranquilla, (Univ. del Atlantico)											40				40
Barretos, SP											40				40
Belém, UFPA									40						40
Biolley, Buenos Aires, Puntarenas												40			40
Botanical Garden, POA, RS										40					40
Brasília, UNB										40					40
Buenos Aires													71	71	142

The numbers that are observed in the central part of the pivot table are the result of counting the amount of data of each year that appear in the original database and this calculation is performed automatically without the need to enter any formula. You can also move the fields even after you have created the pivot table, for example, the following image shows that the Year field was dragged to the Rows area.

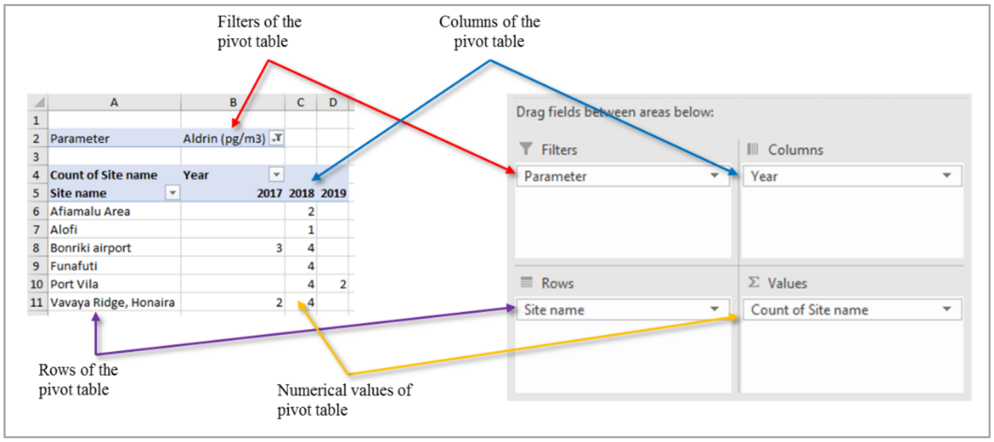


Pivot tables allow you to group data in different ways in order to obtain the information that is required. Instead of using formulas, you can use a pivot table to get the desired result. A pivot table allows us to make comparisons between different columns of a table. You can imagine a pivot table as follows:

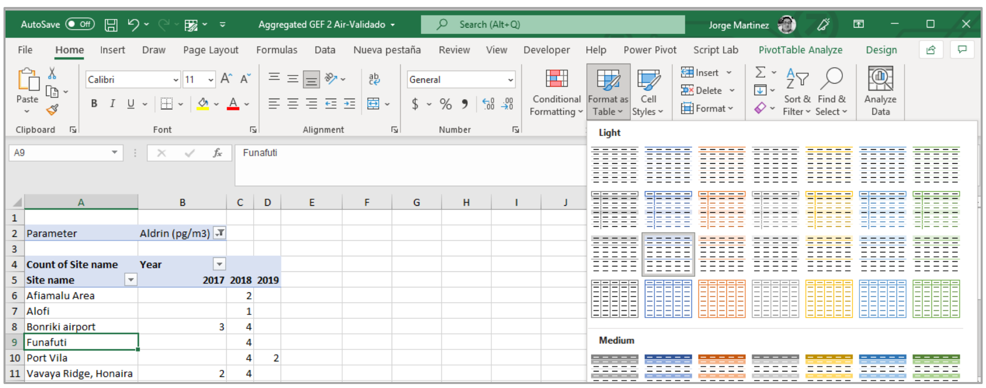


Parts of a pivot table. These areas denote each of the parts of a pivot table.

- **Filter.** The fields that are placed in this area will create filters for the pivot table through which the information seen on the screen can be restricted. These filters are in addition to those that can be done between the specified columns and rows.
- **Column.** This area contains the fields that will be displayed as columns of the pivot table.
- **Row.** Contains the fields that determine the rows in the pivot table.
- **Values.** They are the fields that will be placed in the "cells" of the pivot table, and these will be calculated for each column and row intersection (cell).

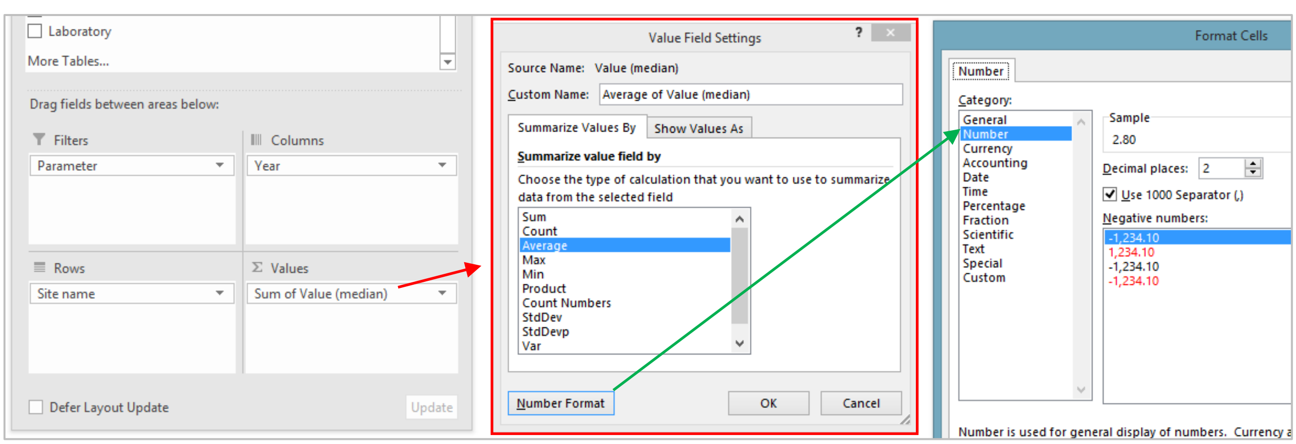


Pivot Table Format. Once a pivot table has been created, it can be easily formatted as a data table in Excel. The Excel Design tab includes special commands for formatting a pivot table.



Grouped values in a pivot table can also be quickly formatted so that they can be formatted properly as a number. The following steps should be followed:

- From the menu shown below, the option “Value Field Settings” must be selected.
- When you click on this item, the window to select "Number format" appears. Clicking on the Number Format button will display the Format Cells dialog box where you can select the desired format:

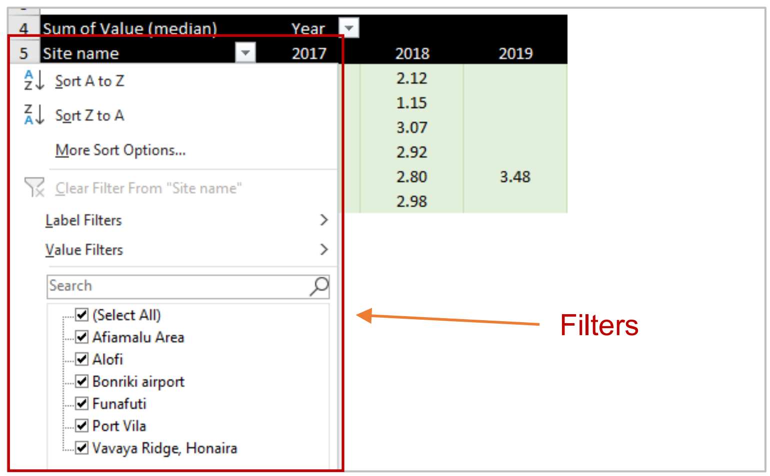


So then, a table can be obtained with the following format:

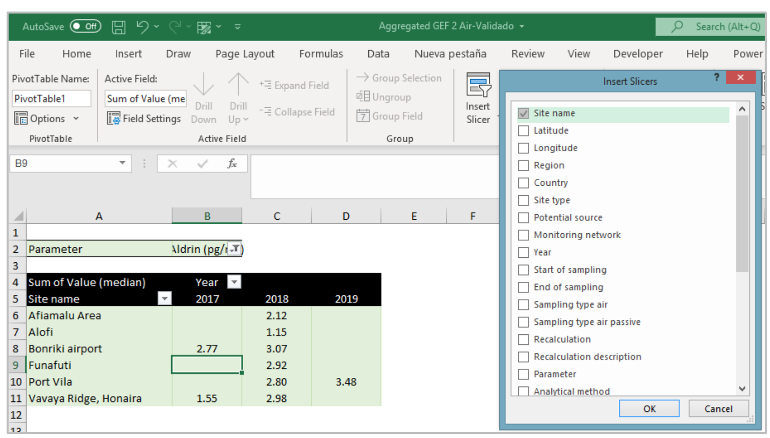
	A	B	C	D
1				
2	Parameter	Aldrin (pg/m3)		
3				
4	Sum of Value (median)	Year		
5	Site name	2017	2018	2019
6	Afiamalu Area		2.120988275	
7	Alofi		1.1515	
8	Bonriki airport	2.774926111	3.074690865	
9	Funafuti		2.92212049	
10	Port Vila		2.799556536	3.484154918
11	Vavaya Ridge, Honaira	1.550975809	2.984187047	

	A	B	C	D
1				
2	Parameter	Aldrin (pg/m3)		
3				
4	Average of Value (median)	Year		
5	Site name	2017	2018	2019
6	Afiamalu Area		1.06	
7	Alofi		1.15	
8	Bonriki airport	0.92	0.77	
9	Funafuti		0.73	
10	Port Vila		0.70	1.74
11	Vavaya Ridge, Honaira	0.78	0.75	

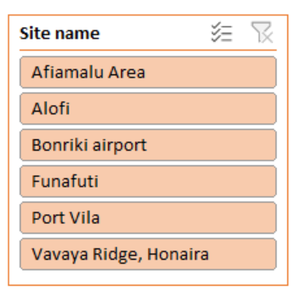
Pivot Tables Filter. You can filter and sort the information that is inside a pivot table using the filters that Excel places by default in the report such as Column Labels and Row Labels. By selecting any of the filter options, the information will be summarized, and it will only show a subset of the data from the pivot table.



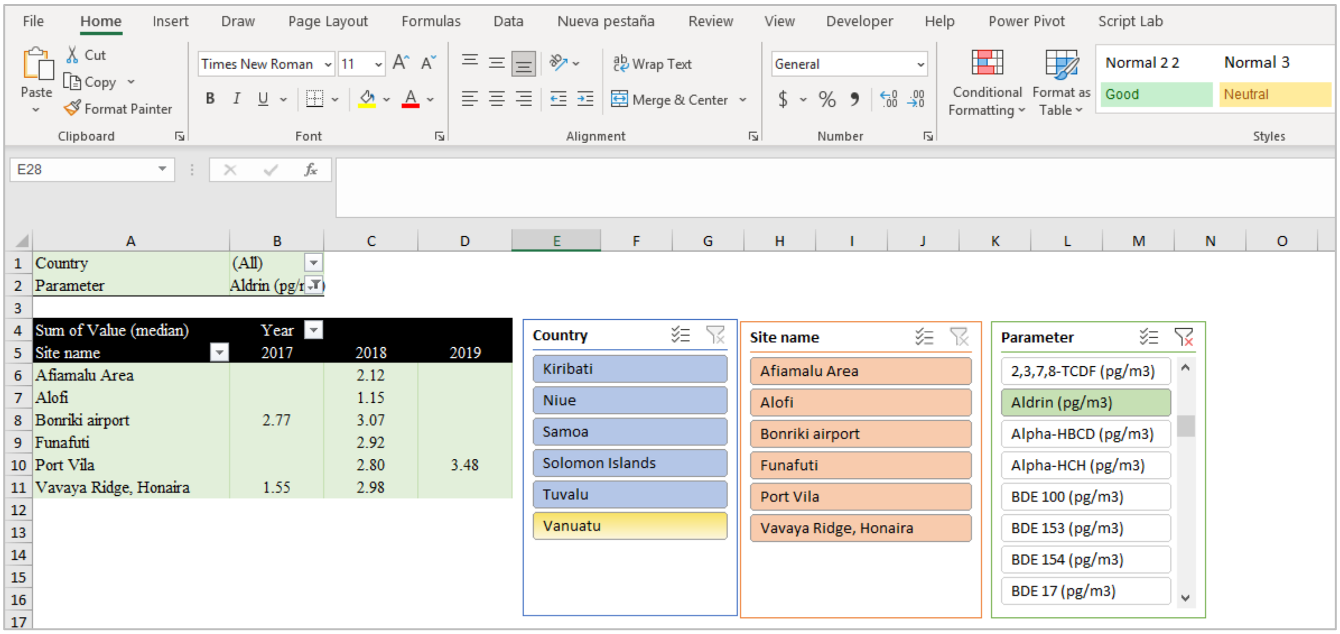
Data segmentation. Pivot Table data segmentation is a new feature in Excel 2010 that allows you to filter data within a PivotTable. Information can be easily filtered in more than one column. To do this, click on any cell in the dynamic table and then on "Analysis of the dynamic table", then, within the filter group, click on the command Insert Data Segmentation.



In this box select the fields that you want to use as filters in the pivot table and Excel will place a filter for each selected field, in this case Site name is selected:



Thus, the option to filter the data by the selected fields appears



ANNEX 7. GRAPHICS

A graph is a representation of certain values that allows a comparative check to be made visually. Graphs are one of the most powerful tools for reporting, and data analysis, among others.

The objective of graphs is to make the information shown more understandable than the numbers themselves. In order to meet this objective a graph should have the following characteristics:

- Visually explain the values better than the values themselves.
- Be self-explanatory, i.e., a graph should be simple and not require an explanation by its author.
- It should indicate the units in which the values are expressed. It is not the same if the graph is in **pg/m^3** (picogram/cubic meter) than **ng/m^3** (nanogram/cubic meter). Since a **picogram** is 10^{-12} grams and a **nanogram** =10^{-9} grams.
- When you have several series show a legend for each one to understand very clearly the content of the graph.
- A graph should be clean. Try not to fill it with colors on the axes, series, etc... also, if possible, remove all distracting elements.

Types of charts in Excel

From the beginnings of Microsoft Excel, the graphs have been one of its strong points and for that reason they do not stop inventing new types of graphs. Here are the different types of Excel charts you can create.

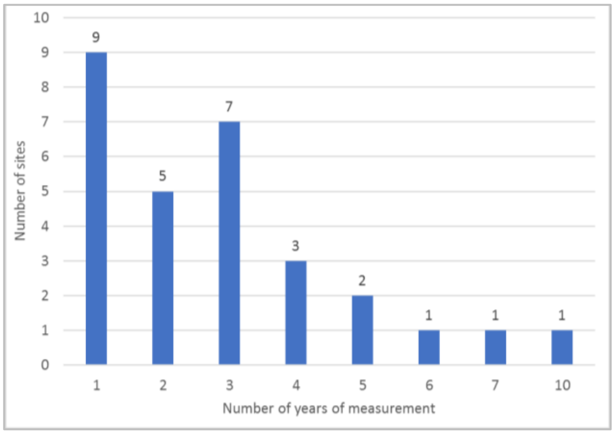
Column charts

Column or bar charts are a very simple representation of one or more numerical series.

Columns grouped together

The graph shows a simple Excel column chart with a single data series ranging from 1 to 10 (number of years measured). As can be seen, the graph shows that most of the sites have only measured at most three years.

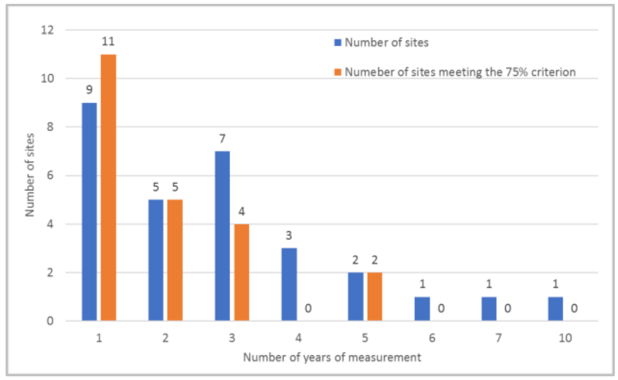
Column chart. Number of sites per number of years of measurement



Columns grouped with several series

In the following graph, one more series has been added. This last series allows us to know the number of sites that meet the completeness criterion. It is very important in these Excel charts of stacked columns not to put too many series, otherwise the chart will be very difficult to interpret.

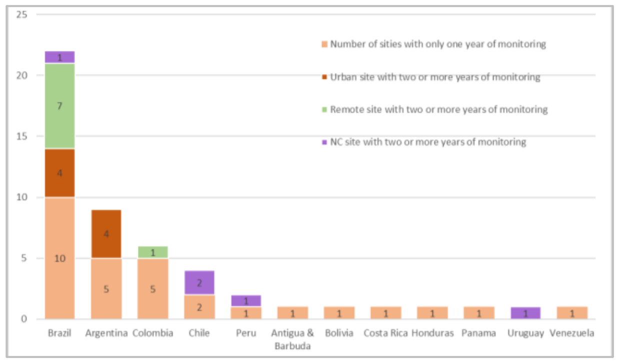
Number of monitoring sites and sites meeting the 75% criterion



Stacked columns

Stacked column charts can be a very simple way to make a quick comparison. In this case the number of sites per site type is compared for each country.

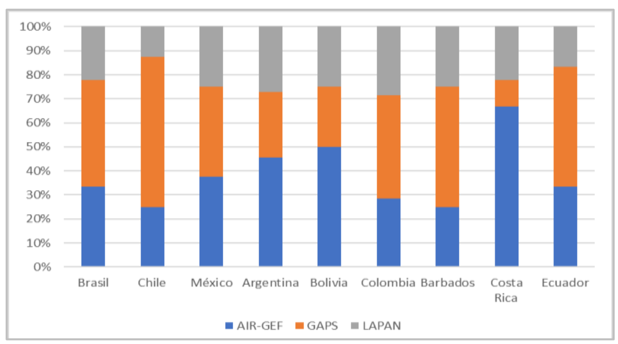
Number and type of sites per country



Stacked columns (100%)

It can also be made an Excel chart with 100% stacked columns so that you can see which series has more relative weight over another.

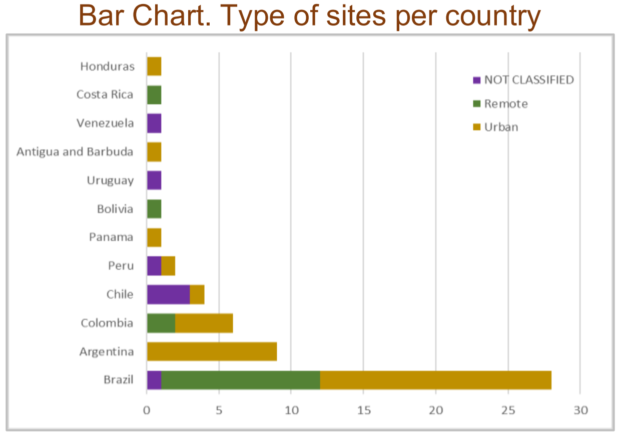
Monitoring Networks/programs per country



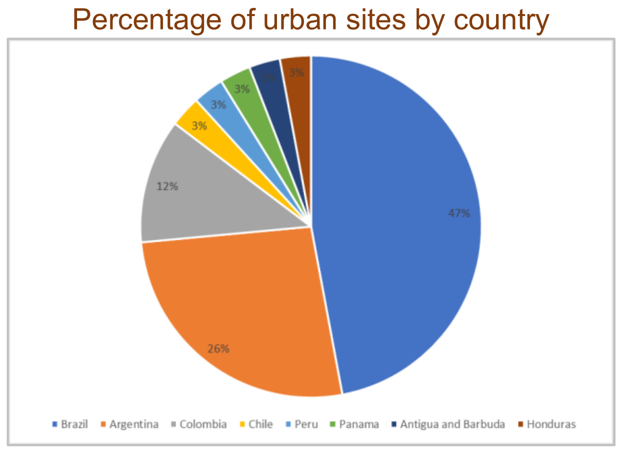
Bar chart

This chart is the same as the column chart, but with the difference that the chart is displayed horizontally.

Bar Chart. Type of sites per country

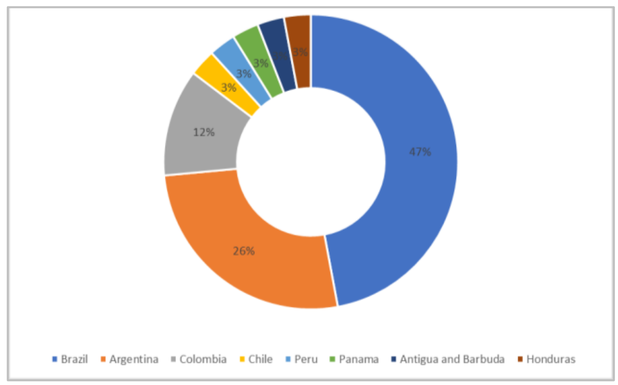


Pie chart



Pie chart

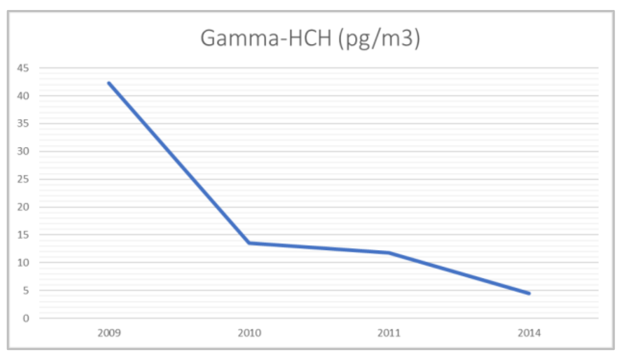
Pie charts are very commonly used because they represent in a very simple way the proportion of a series of values with respect to the total. Mastering this type of chart is essential. It can help to represent a series of very complex values. Following the example above we would have.



Ring chart

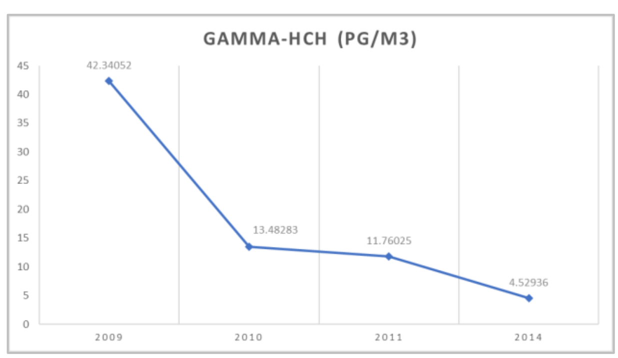
This type of chart is a variant that is becoming fashionable lately to make reports or to show indicators. It is a simple chart to make.

Line charts



Lines

It allows to identify data trends over time. This chart in Excel is very useful when in the categories we have any time reference such as days, months, years, ...

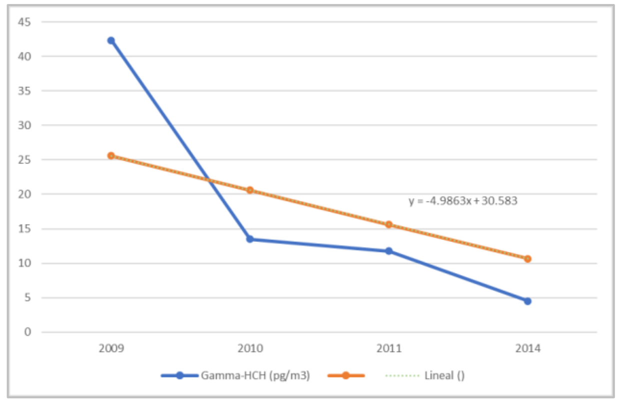


Lines with markers

You can add markers to the data with or without a label. Depending on the number of series you have, it will be convenient to have the markers, although if you only need to see the trends and not the exact values of each data, it will not be convenient to use them.

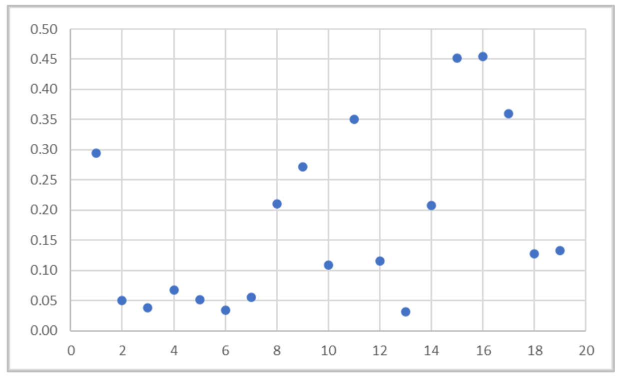
Several lines

On many occasions it is necessary to compare two or more data series and see their trends. For this purpose, the line chart is used without the markers.



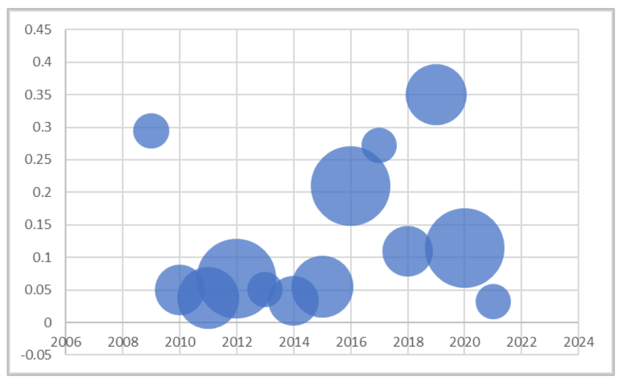
Scatter plots

Point (or scatter) plots



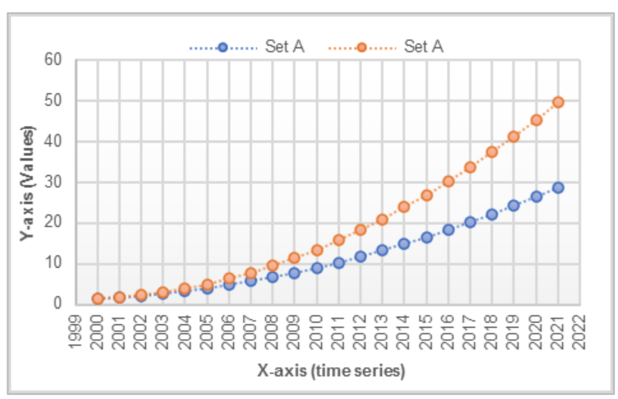
These graphs are the representation of a series of coordinates. It displays the individual values of the sample. Each point represents one observation. It is used to examine the dispersion of the data and identify possible outliers. Individual value plots are best when the sample size is less than 50.

Bubble charts/plot



A bubble plot can be used to display data relating to three quantitative variables at a time and a categorical grouping variable It is very similar to the previous chart with the exception that a third variable can be introduced. This third variable is represented by the size of the point, as shown in the image. Three variables are shown in the image: one on the x-axis, one on the y-axis, and one as the size of the bubbles.

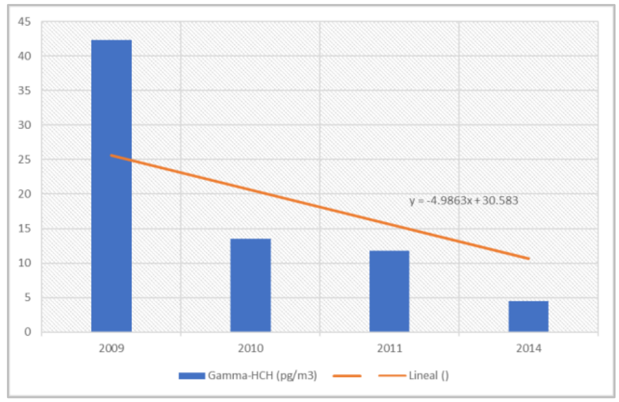
Time series plot



Time series plots are used to show how data change over time. These time series are intended to study the evolution of one or more variables over time. A time series graph shows time on the x-axis and a quantitative response variable on the y-axis. Time series plots can be used to visualize trends in counts or numerical values over time.

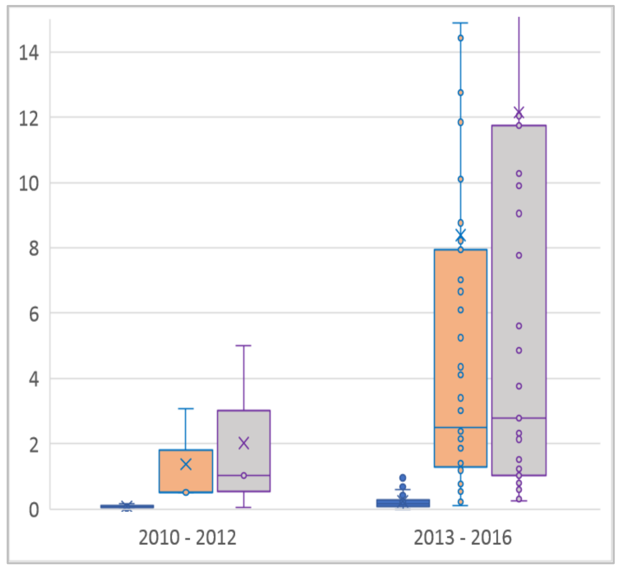
Combined chart

With these charts you can have two of the above charts in a single image. They are usually used to represent trends.



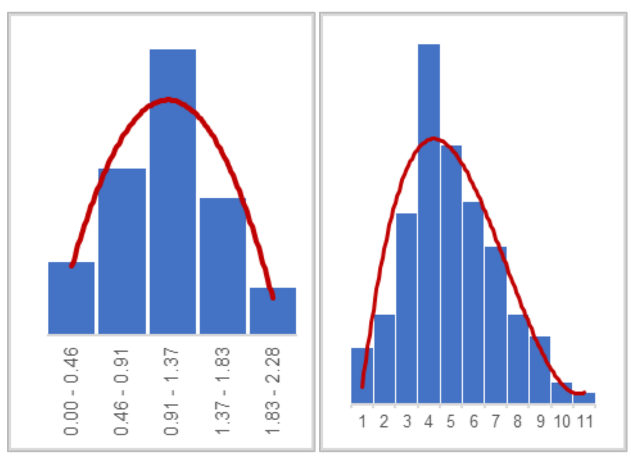
Box and whisker plot

A box-and-whisker plot provides a graphical summary of the distribution of a sample. It shows the shape, central tendency, and variability of the data. In other words, it shows the distribution of data in quartiles, highlighting the mean/median and outliers. Boxes may have vertically extending lines called "whiskers". These lines indicate variability outside the upper and lower quartiles and any points outside these lines or whiskers are considered outliers. Box and whisker plots are used primarily in statistical analysis. Boxplots are best when the sample size is greater than 20.



Histograms

A histogram divides sample values into many intervals and represents the frequency of data values in each interval with a bar. A histogram is used to assess the shape and spread of the data. Histograms are best when the sample size is greater than 20. It can also be used overlaid with a normal curve to examine the normality of the data. A normal distribution is symmetric and bell-shaped, as indicated by the curve. It is often difficult to evaluate normality with small samples. A probability plot is best for determining the distribution fit.

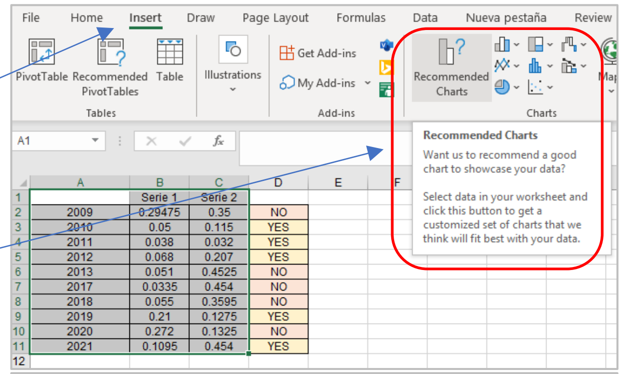


HOW TO CREATE A CHART

1) Enter the data. The first step is to enter or sort the data to generate the graph.
2) Then point out the data for the elaboration of the graph

	A	B	C
1		Serie 1	Serie 2
2	A1	0.29475	0.35
3	A2	0.05	0.115
4	A3	0.038	0.032
5	A4	0.068	0.207
6	A5	0.051	0.4525
7	A6	0.0335	0.454
8	A7	0.055	0.3595

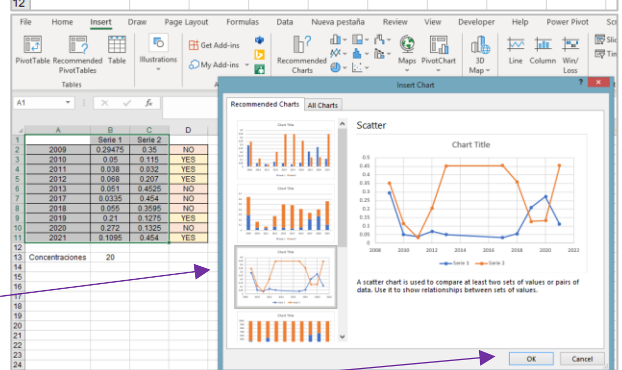
3) Select Insert > Recommended graphics.



Insert selection

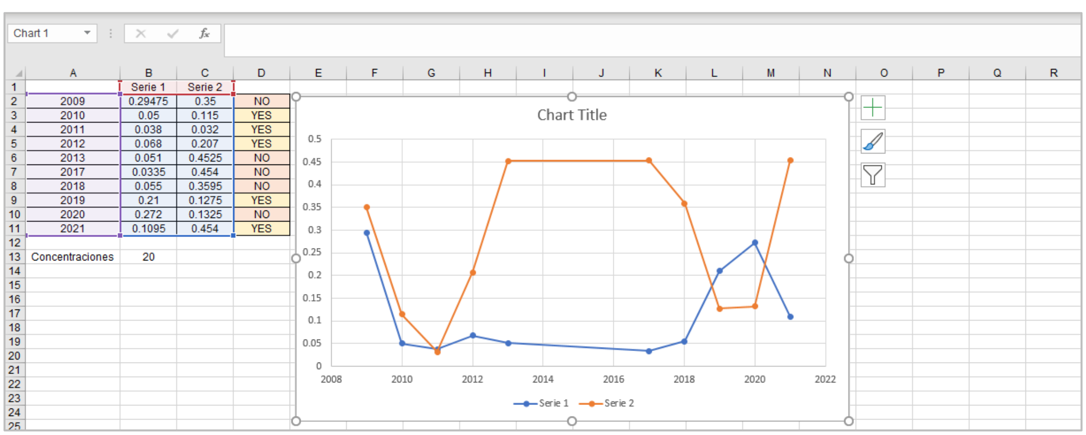
Types of de graphics

4) Select a chart in "Recommended Charts" tab to preview the chart.

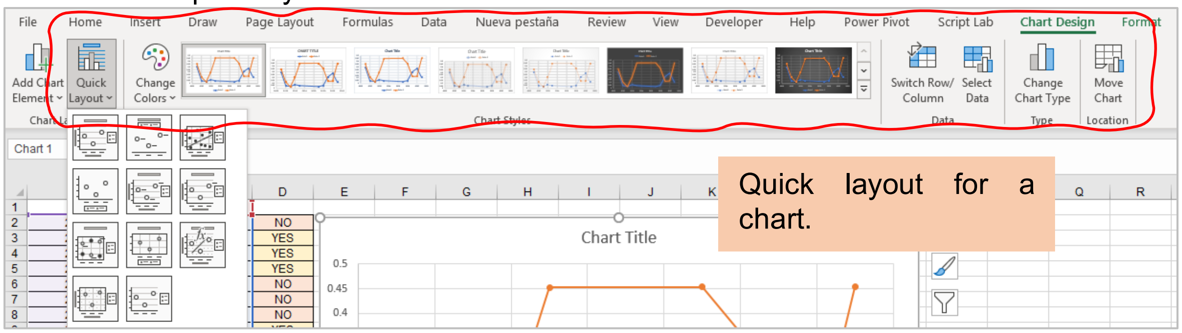


Box to select a chart

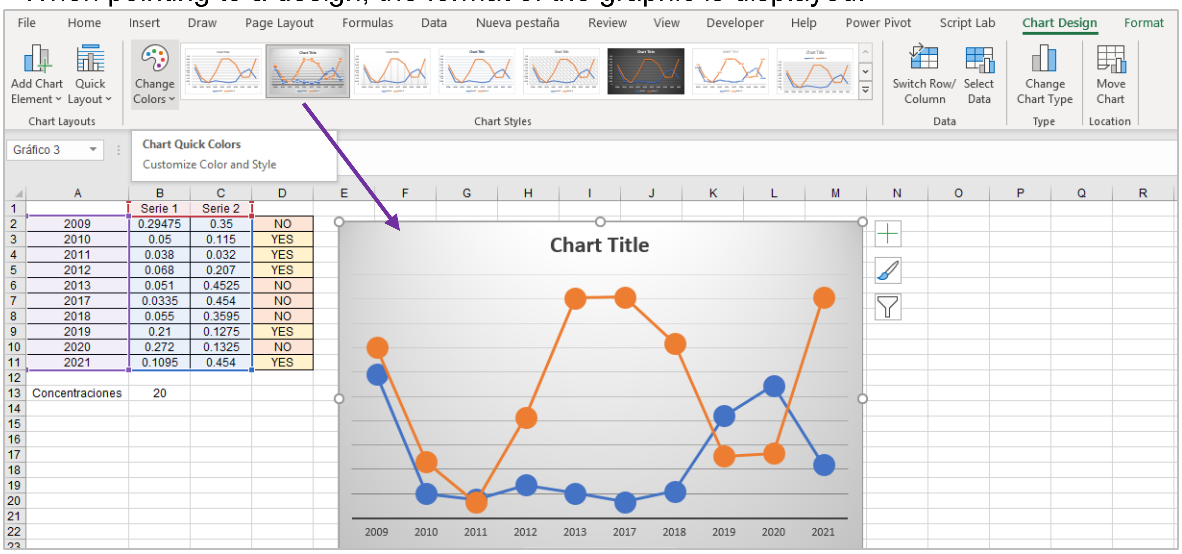
5) Finish by clicking on OK. The selected graph is generated.



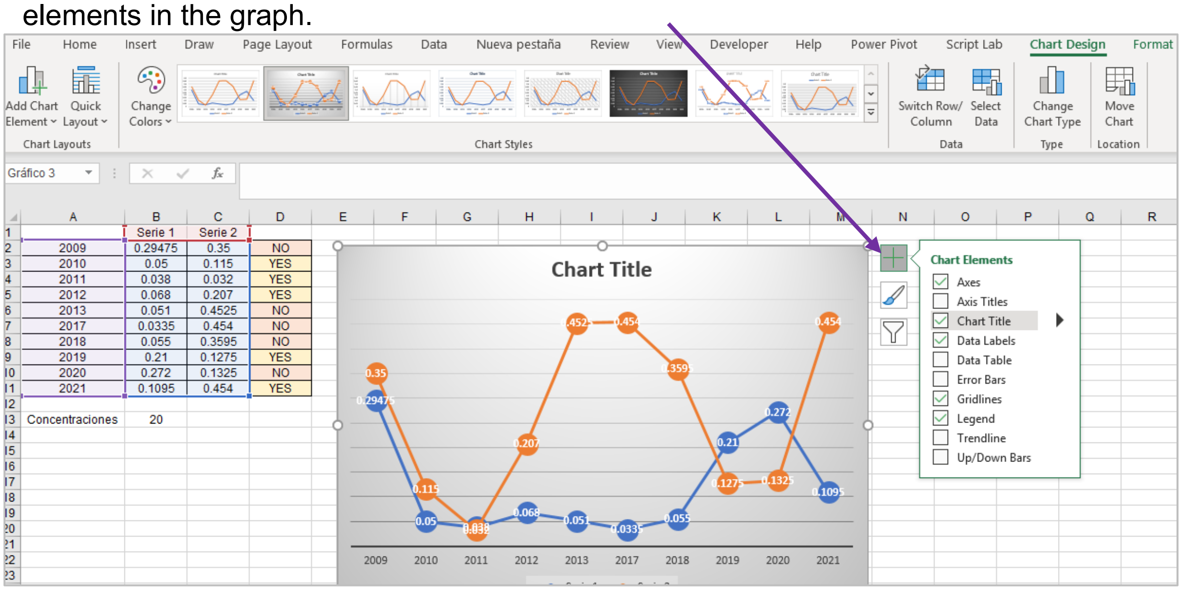
6) After generating the chart, you have the option to change the presentation format, for which you can use the quick layout box.



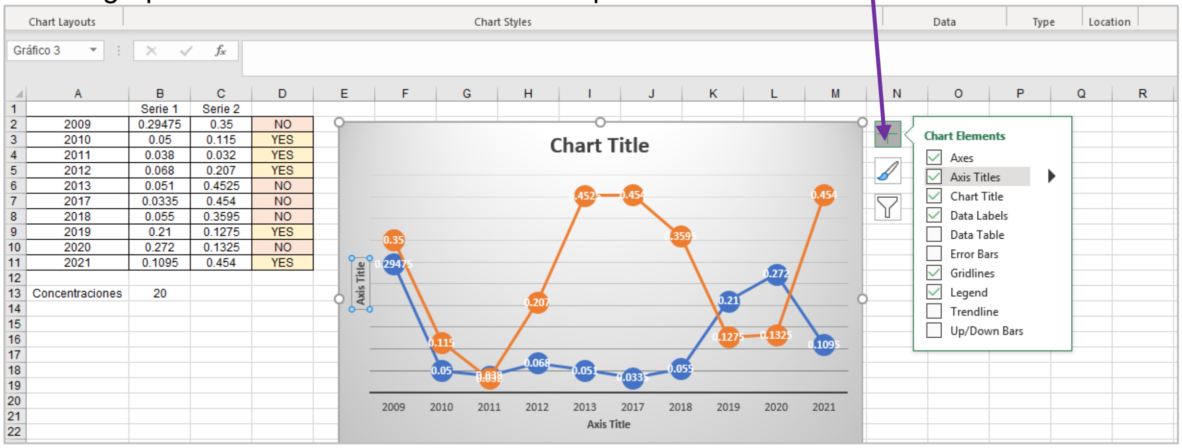
7) When pointing to a design, the format of the graphic is displayed.



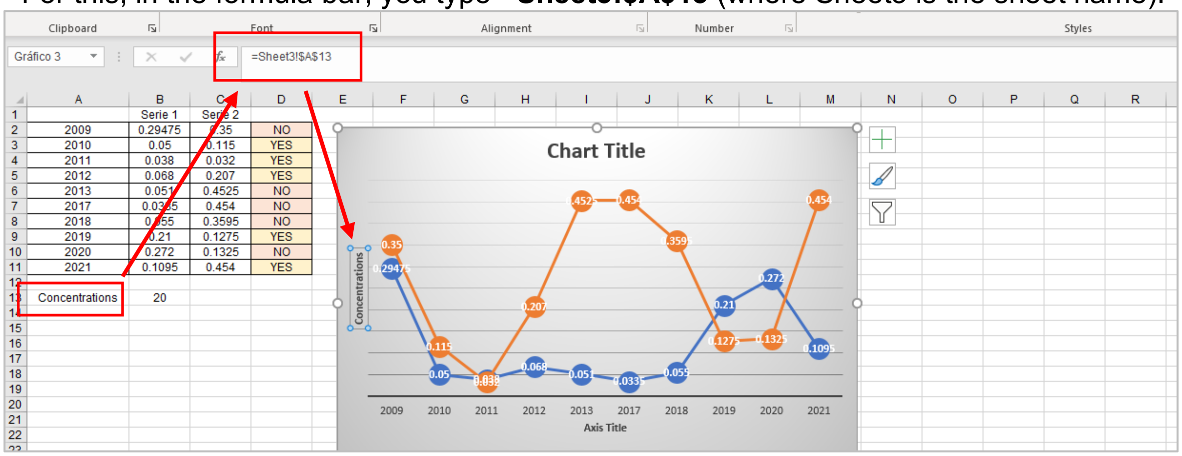
8) There are other elements that facilitate the generation of graphs, these are the icons shown to the right of the graph. Clicking on some of the icons accesses the menu to add or remove elements in the graph.



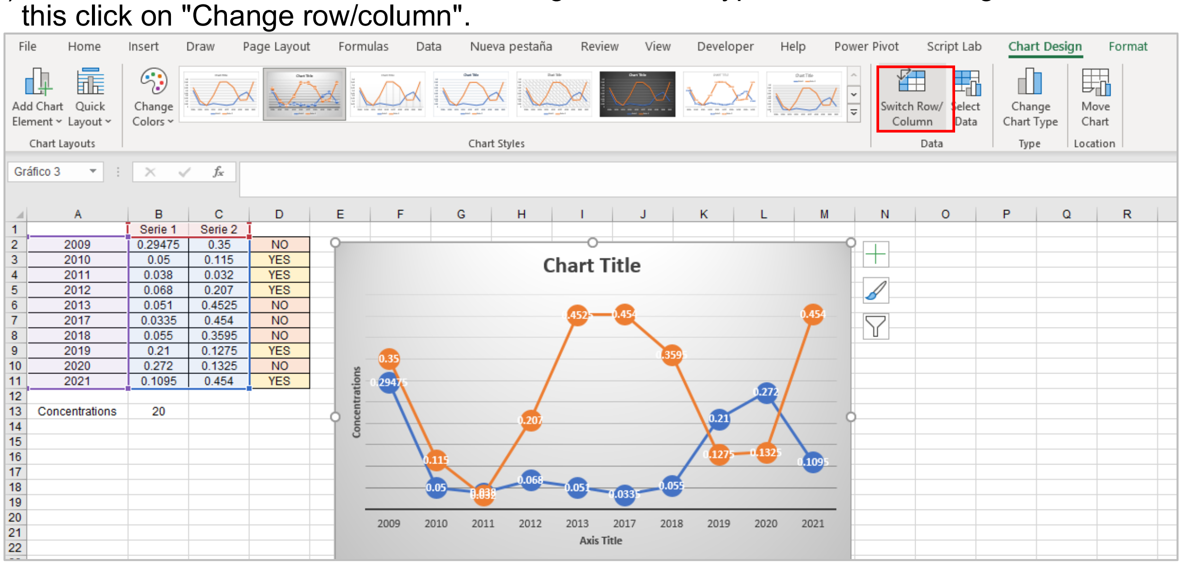
9) To add titles to the axes, select the graph and click on the button to get the menu on the right of the graph. Then activate the box with the phrase "Axis title".



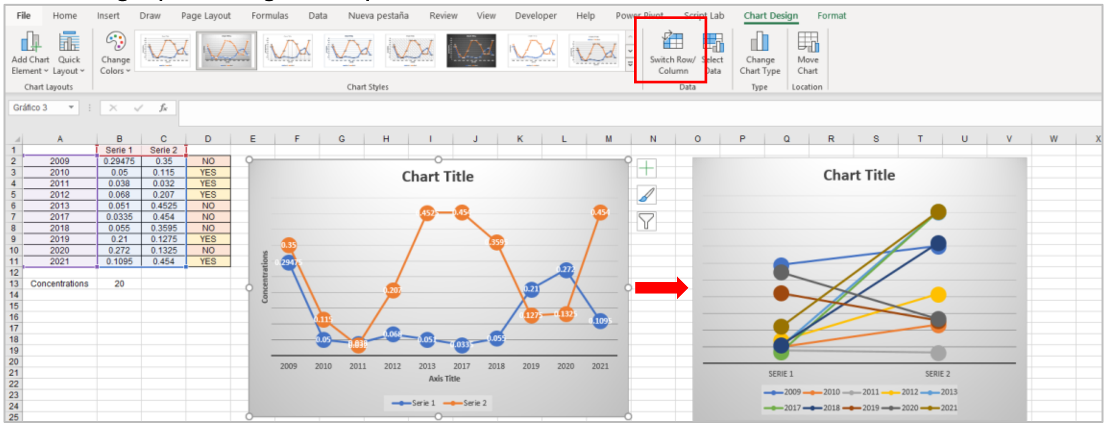
10) You now have the possibility to type the required titles. You can also reference these title names to a cell. For example, in the following chart, the title of the vertical axis (y) is written in cell A13. For this, in the formula bar, you type **=Sheet3!$A$13** (where Sheet3 is the sheet name).



11) In the menu bar there is an item to change the chart type, or also to change row to column, for this click on "Change row/column".

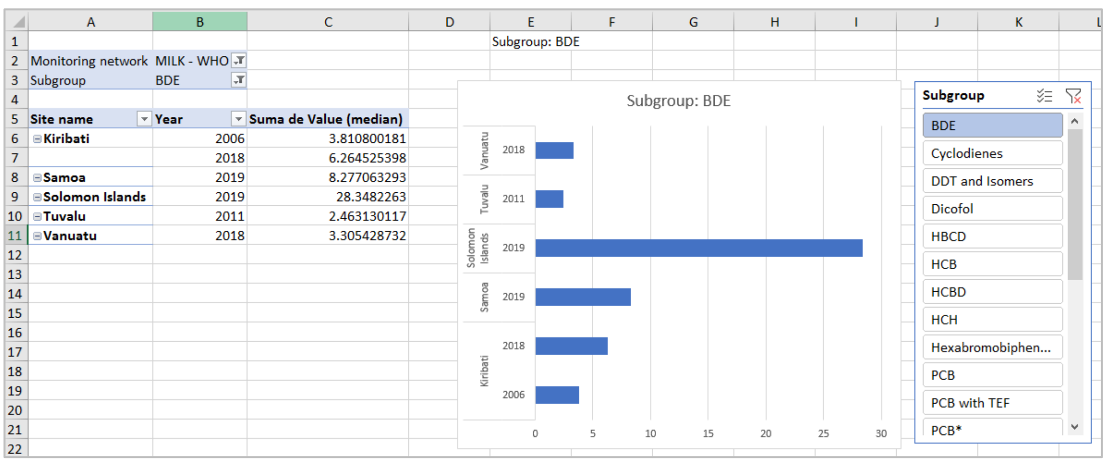


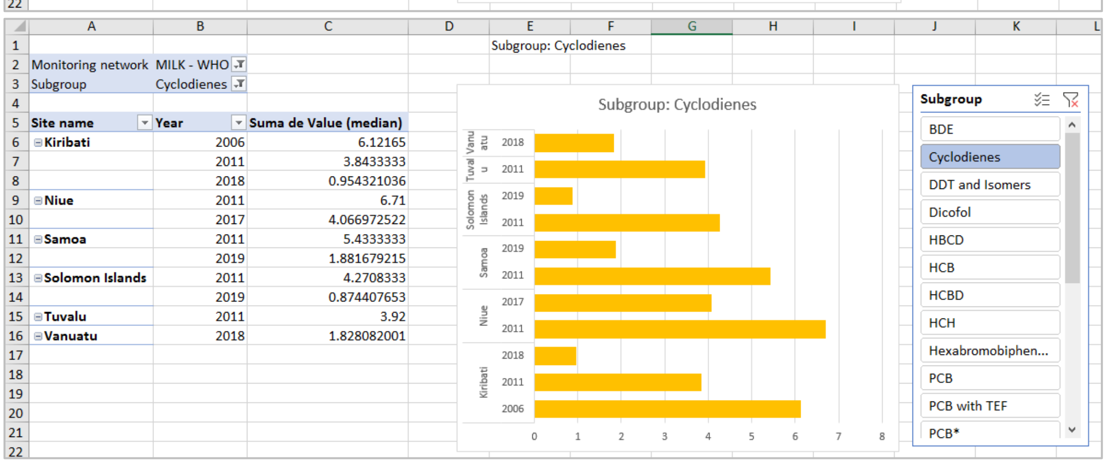
12) Thus, the graph changes shape.



13) Sometimes it is difficult to see the big picture when the raw data has not been summarized. For this, there is the **pivot table tool**, which helps to process the data quickly. It includes **pivot charts**, which are an excellent way to add data visualizations to the pivot table.

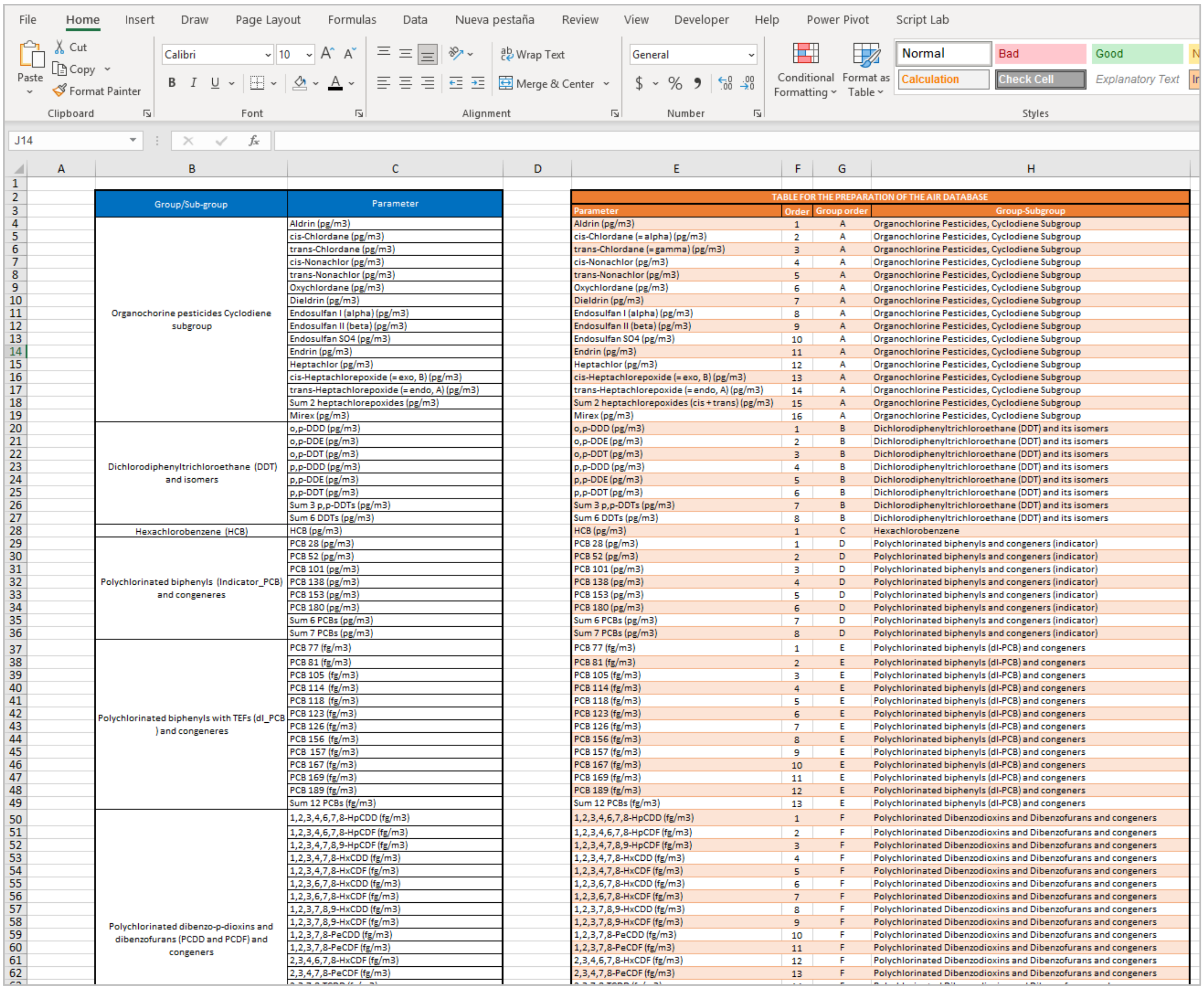
If you have already created a pivot table, you must position on the pivot table and select the desired chart. This generates the pivot chart, which is updated every time the query in the pivot table is changed.





ANNEX 8. LISTS OF COMPOUNDS

The lists of compounds analyzed for the elaboration of the databases of the three environmental matrices: air, breast milk and water are included in the zipped files of the Excel exercises and tutorials, under the name “Annex 8- List of Compounds.xlsx”.



Group/Sub-group	Parameter
Organochorine pesticides Cyclodiene subgroup	Aldrin (pg/m3)
	cis-Chlordane (pg/m3)
	trans-Chlordane (pg/m3)
	cis-Nonachlor (pg/m3)
	trans-Nonachlor (pg/m3)
	Oxychlordane (pg/m3)
	Dieldrin (pg/m3)
	Endosulfan I (alpha) (pg/m3)
	Endosulfan II (beta) (pg/m3)
	Endosulfan SO4 (pg/m3)
	Endrin (pg/m3)
	Heptachlor (pg/m3)
	cis-Heptachlorepoxide (= exo, B) (pg/m3)
	trans-Heptachlorepoxide (= endo, A) (pg/m3)
	Sum 2 heptachlorepoxides (pg/m3)
	Mirex (pg/m3)
Dichlorodiphenyltrichloroethane (DDT) and isomers	o,p-DDD (pg/m3)
	o,p-DDE (pg/m3)
	o,p-DDT (pg/m3)
	p,p-DDD (pg/m3)
	p,p-DDE (pg/m3)
	p,p-DDT (pg/m3)
	Sum 3 p,p-DDTs (pg/m3)
	Sum 6 DDTs (pg/m3)
Hexachlorobenzene (HCB)	HCB (pg/m3)
Polychlorinated biphenyls (Indicator_PCB) and congeneres	PCB 28 (pg/m3)
	PCB 52 (pg/m3)
	PCB 101 (pg/m3)
	PCB 138 (pg/m3)
	PCB 153 (pg/m3)
	PCB 180 (pg/m3)
	Sum 6 PCBs (pg/m3)
	Sum 7 PCBs (pg/m3)
Polychlorinated biphenyls with TEFs (dl_PCB) and congeneres	PCB 77 (fg/m3)
	PCB 81 (fg/m3)
	PCB 105 (fg/m3)
	PCB 114 (fg/m3)
	PCB 118 (fg/m3)
	PCB 123 (fg/m3)
	PCB 126 (fg/m3)
	PCB 156 (fg/m3)
	PCB 157 (fg/m3)
	PCB 167 (fg/m3)
	PCB 169 (fg/m3)
	PCB 189 (fg/m3)
	Sum 12 PCBs (fg/m3)
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD and PCDF) and congeners	1,2,3,4,6,7,8-HpCDD (fg/m3)
	1,2,3,4,6,7,8-HpCDF (fg/m3)
	1,2,3,4,7,8,9-HpCDF (fg/m3)
	1,2,3,4,7,8-HxCDD (fg/m3)
	1,2,3,4,7,8-HxCDF (fg/m3)
	1,2,3,6,7,8-HxCDD (fg/m3)
	1,2,3,6,7,8-HxCDF (fg/m3)
	1,2,3,7,8,9-HxCDD (fg/m3)
	1,2,3,7,8,9-HxCDF (fg/m3)
	1,2,3,7,8-PeCDD (fg/m3)
	1,2,3,7,8-PeCDF (fg/m3)
	2,3,4,6,7,8-HxCDF (fg/m3)
	2,3,4,7,8-PeCDF (fg/m3)

TABLE FOR THE PREPARATION OF THE AIR DATABASE			
Parameter	Order	Group order	Group-Subgroup
Aldrin (pg/m3)	1	A	Organochlorine Pesticides, Cyclodiene Subgroup
cis-Chlordane (= alpha) (pg/m3)	2	A	Organochlorine Pesticides, Cyclodiene Subgroup
trans-Chlordane (= gamma) (pg/m3)	3	A	Organochlorine Pesticides, Cyclodiene Subgroup
cis-Nonachlor (pg/m3)	4	A	Organochlorine Pesticides, Cyclodiene Subgroup
trans-Nonachlor (pg/m3)	5	A	Organochlorine Pesticides, Cyclodiene Subgroup
Oxychlordane (pg/m3)	6	A	Organochlorine Pesticides, Cyclodiene Subgroup
Dieldrin (pg/m3)	7	A	Organochlorine Pesticides, Cyclodiene Subgroup
Endosulfan I (alpha) (pg/m3)	8	A	Organochlorine Pesticides, Cyclodiene Subgroup
Endosulfan II (beta) (pg/m3)	9	A	Organochlorine Pesticides, Cyclodiene Subgroup
Endosulfan SO4 (pg/m3)	10	A	Organochlorine Pesticides, Cyclodiene Subgroup
Endrin (pg/m3)	11	A	Organochlorine Pesticides, Cyclodiene Subgroup
Heptachlor (pg/m3)	12	A	Organochlorine Pesticides, Cyclodiene Subgroup
cis-Heptachlorepoxide (= exo, B) (pg/m3)	13	A	Organochlorine Pesticides, Cyclodiene Subgroup
trans-Heptachlorepoxide (= endo, A) (pg/m3)	14	A	Organochlorine Pesticides, Cyclodiene Subgroup
Sum 2 heptachlorepoxides (cis + trans) (pg/m3)	15	A	Organochlorine Pesticides, Cyclodiene Subgroup
Mirex (pg/m3)	16	A	Organochlorine Pesticides, Cyclodiene Subgroup
o,p-DDD (pg/m3)	1	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
o,p-DDE (pg/m3)	2	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
o,p-DDT (pg/m3)	3	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
p,p-DDD (pg/m3)	4	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
p,p-DDE (pg/m3)	5	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
p,p-DDT (pg/m3)	6	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
Sum 3 p,p-DDTs (pg/m3)	7	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
Sum 6 DDTs (pg/m3)	8	B	Dichlorodiphenyltrichloroethane (DDT) and its isomers
HCB (pg/m3)	1	C	Hexachlorobenzene
PCB 28 (pg/m3)	1	D	Polychlorinated biphenyls and congeners (indicator)
PCB 52 (pg/m3)	2	D	Polychlorinated biphenyls and congeners (indicator)
PCB 101 (pg/m3)	3	D	Polychlorinated biphenyls and congeners (indicator)
PCB 138 (pg/m3)	4	D	Polychlorinated biphenyls and congeners (indicator)
PCB 153 (pg/m3)	5	D	Polychlorinated biphenyls and congeners (indicator)
PCB 180 (pg/m3)	6	D	Polychlorinated biphenyls and congeners (indicator)
Sum 6 PCBs (pg/m3)	7	D	Polychlorinated biphenyls and congeners (indicator)
Sum 7 PCBs (pg/m3)	8	D	Polychlorinated biphenyls and congeners (indicator)
PCB 77 (fg/m3)	1	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 81 (fg/m3)	2	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 105 (fg/m3)	3	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 114 (fg/m3)	4	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 118 (fg/m3)	5	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 123 (fg/m3)	6	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 126 (fg/m3)	7	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 156 (fg/m3)	8	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 157 (fg/m3)	9	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 167 (fg/m3)	10	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 169 (fg/m3)	11	E	Polychlorinated biphenyls (dl-PCB) and congeners
PCB 189 (fg/m3)	12	E	Polychlorinated biphenyls (dl-PCB) and congeners
Sum 12 PCBs (fg/m3)	13	E	Polychlorinated biphenyls (dl-PCB) and congeners
1,2,3,4,6,7,8-HpCDD (fg/m3)	1	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,4,6,7,8-HpCDF (fg/m3)	2	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,4,7,8,9-HpCDF (fg/m3)	3	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,4,7,8-HxCDD (fg/m3)	4	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,4,7,8-HxCDF (fg/m3)	5	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,6,7,8-HxCDD (fg/m3)	6	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,6,7,8-HxCDF (fg/m3)	7	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,7,8,9-HxCDD (fg/m3)	8	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,7,8,9-HxCDF (fg/m3)	9	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,7,8-PeCDD (fg/m3)	10	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
1,2,3,7,8-PeCDF (fg/m3)	11	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
2,3,4,6,7,8-HxCDF (fg/m3)	12	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners
2,3,4,7,8-PeCDF (fg/m3)	13	F	Polychlorinated Dibenzodioxins and Dibenzofurans and congeners

ANNEX 9. GMP GUIDANCE 2021

The latest update of the GMP Guidance 2021 can be found in the zipped files of the Excel exercises and tutorials.

UNITED NATIONS

UNEP

SC

UNEP/POPS/COP.10/INF/42

Distr.: General
21 April 2021

English only

Stockholm Convention on Persistent Organic Pollutants

Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants
Tenth meeting
Geneva (online), 26–30 July 2021*
Item 5 (i) of the provisional agenda**
Matters related to the implementation of the Convention: effectiveness evaluation

Guidance on the global monitoring plan for persistent organic pollutants

Note by the Secretariat

As is mentioned in the note by the Secretariat on the global monitoring plan for effectiveness evaluation (UNEP/POPS/COP.10/18), the updated guidance on the global monitoring plan for persistent organic pollutants prepared by the global coordination group is set out in the annex to the present note. The present note, including its annex, has not been formally edited.

* Face-to-face resumed meetings of the conferences of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants are tentatively scheduled to take place in 2022.
** UNEP/POPS/COP.10/1.

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